FORTY-FOURTH QUARTO VOLUME

From January 1, 1908, to May 29, 1908

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(Established in April, 1856)

FIFTY-THIRD YEAR

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INDEX

Forty-fourth Quarto Volume—January 1, 1908, to May 29, 1908

AUTHORS

GENERAL INDEX

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡.]*

A

B

C

D

E

GENERAL INDEX—Continued.

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡.]*

GENERAL INDEX—Continued.

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡.]*

O

P

Q

R

GENERAL INDEX—Continued.

[*Illustrated articles are indicated thus*; Editorials thus†; Contributions thus‡.*]

V

W

Y

NEW PUBLICATIONS.

INTERSTATE COMMERCE COMMISSION RULINGS.

[*See also General Index.*]

INTERSTATE COMMERCE COMMISSION RULINGS—Continued.

PERSONAL.

[*Portraits are indicated thus*.*]

OBITUARY.

[*Portraits are indicated thus*.*]

ELECTIONS AND APPOINTMENTS.

RAILROAD CONSTRUCTION.

RAILROAD CONSTRUCTION—Continued.

RAILROAD CORPORATION NEWS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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CONTENTS

VOL. XLIV., No. 1. FRIDAY, JANUARY 3, 1908.

CHANGES IN RAILROAD OWNERSHIP AND CONTROL.

The principal changes in railroad ownership or control during the year 1907 are listed briefly in another column. The list includes purchases of street railways for steam railroad lines and the steamship purchases of the year of the New York, New Haven & Hartford. The expansion of the New Haven's influence is, on the whole, the year's most striking development, particularly taken in connection with the purchases of the Connecticut Railway & Lighting Company and the Rhode Island trolleys, which took place late in December, 1906. The final outcome of the Boston & Maine purchase is still unsettled, but it is likely that Massachusetts, after having safeguarded her interests by certain legislative restrictions, will sanction the merger, which is a natural development and in the direction of the best tendencies of railroad consolidation. An entirely unique piece of financing by the New Haven was the increase and exchange of stock of the Consolidated Railway, which controlled most of the New Haven's electric lines, for stock of the New England Navigation Company which owned the Sound steamboat lines. The stock of the Consolidated Railway, tripled so as to cover the Navigation securities, was then exchanged share for share for stock of the New York, New Haven & Hartford Railroad itself, the stock of the Consolidated Railway and of the Navigation company remaining in the treasury of the merged company as free assets. At the same time a new company, the New England Steamship Company, was organized to operate the Sound lines. The purchase by the New Haven of a projected high-speed electric road in the suburban territory north of New York and of one of the few remaining small independent lines in its territory—the Poughkeepsie & Eastern—were further evidences of the unification of the system, while the purchases of steamship lines running from its territory to Philadelphia, Baltimore, Newport News, Norfolk and Savannah marked a new and bold extension of the New Haven's influence. The purchase of the Chicago & Alton by the Toledo, St. Louis & Western was another important development of the year. The Alton after having been controlled first by the Union Pacific and most recently by the Rock Island Company now goes to a road smaller and much less important than itself but with which it is to work closely in future.

The acquisition of control of the Mexican Central by the government of Mexico placed most of the railroad mileage of that country in the hands of the Federal authorities and definitely committed the government to the policy of consolidation of competing lines. A plan had been worked out and was about to be declared effective for the consolidation of the Mexican Central, the National of Mexico, the Mexican International and the Interoceanic of Mexico in one great holding corporation to be known as the National Railways of Mexico, when the financial storm broke and postponed its completion. Judging by the announced terms of this plan, the new company will have an exceeding amount of water in its stock. But apparently consolidation of competing lines and stock watering are desirable when they are carried out by a government. The Baltimore & Ohio by paying off the bonds of the Chicago Terminal Transfer gained a share in the control of this important Chicago belt line from which it leases its Chicago freight and passenger terminals. It is probable that the Baltimore & Ohio and the Burlington will control it jointly. Early in January the Northwestern Pacific was incorporated to take over various small railroads north of San Francisco and east of the Southern Pacific's San Francisco-Portland line, some of which were owned by the Southern Pacific and the rest by the Santa Fe. These two groups of these are to be connected by a through line and operated by the new company which is controlled by the two large railroads jointly.

Early in the year the Seaboard Air Line bought almost all of the stock of the Macon, Dublin & Savannah, by which it gets a better line between Atlanta, Ga., and Savannah. A 95-mile line of the Santa Fe, which will eventually probably form part of a new trans-continental cut-off for both roads, was transferred during the year to the Southern Pacific. The Central of Georgia, whose status during the last 11 years had never been made quite clear, was sold and proved to have been held since 1896 by the reorganization committee of the Richmond Terminal Railroad & Warehouse Company for the benefit of the Southern Railway. The Burlington, which has much mileage in Nebraska, took over a Great Northern line in that state, thus placing all the Hill road in Nebraska under one management. The lease of the Pere Marquette to the Cincinnati, Hamilton & Dayton was abrogated and the Pere Marquette is now in process of reorganization as a solvent independent company. The Boston & Maine, the Delaware & Hudson and the New York, New Haven & Hartford all extended their ownership of electric lines by purchase of small companies. The two Hill transcontinentals bought the Astoria & Columbia River which runs west along the south bank of the Columbia river below Portland, thus preventing it from falling in the hands of the Harriman companies and keeping for themselves the rich timber resources of its territory. The belt line of the New York Central at Chicago bought the outer mileage of the Chicago Junction Railway, thus strengthening its influence in the Chicago terminal territory. The Maine Central, by buying three small railroads in Maine, increased its territorial monopoly in that state. Most of the other purchases were unimportant, representing the taking over of small branch lines by strong companies.

THE CINCINNATI, HAMILTON & DAYTON AND THE NEW "CLOVER LEAF" SYSTEM.

There have recently been reports that the Cincinnati, Hamilton & Dayton, now in a receiver's hands, will soon become part of the new system made up of the Toledo, St. Louis & Western and the Chicago & Alton. It is interesting to observe the reasons which might bring about such a consolidation and its possible advantages.

The Alton and the Clover Leaf now connect with each other only at St. Louis. Not only is this a roundabout route for through business between Kansas City and Toledo, for which it is to be assumed they expect to compete, and also a route which involves the delays due to the frequent congestion of the St. Louis terminals and bridges, but for 117 miles westward out of St. Louis the Alton, having no line of its own, uses the Burlington tracks. Therefore a connection between the Alton and the Clover Leaf north of St. Louis is needed. The Cincinnati, Hamilton & Dayton would supply this. Its line from Hamilton, Ohio, west to Springfield, Ill., 296 miles, intersects the Clover Leaf at Metcalfe, Ill., 105 miles east of Springfield, which is on the Chicago & Alton's line to Kansas City over its own rails all the way.

It has been pointed out by the Clover Leaf interests that by building a seven-mile connecting line from Panama, Ill., on the Toledo, St. Louis & Western 50 miles northeast of St. Louis, west to the eastern end of a Chicago & Alton branch at Litchfield, the two roads could easily be connected. Even this route, however, would be roundabout for through traffic for it would be necessary to haul cars out of their east and west direction south or north either between Roodhouse and Carrollton or between Iles, which is just south of Springfield, and Carlinville. More than this, these southern lines of the Alton are not its most efficient lines, while at Springfield is the eastern end of its recently opened air-line cut-off from Iles to Murrayville on its Kansas City line.

The distance between Kansas City and Toledo by the Alton-C., H. & D.-Clover Leaf route is 686 miles as against 662 miles by the Wabash, 721 miles by the suggested Panama-Litchfield cut-off and 734 miles by the Chicago & Alton and the Clover Leaf via St. Louis. Over the Burlington and the Lake Shore via Chicago the distance between Kansas City and Toledo is 733 miles.

Between Cincinnati territory and Kansas City the advantage in distance is all with the Cincinnati, Hamilton & Dayton-Chicago & Alton route. By it the distance from Cincinnati to Kansas City is 613 miles, while from Cincinnati to Kansas City over the Big Four and the Missouri Pacific is 659 miles, and over the Pennsylvania Lines and the Missouri Pacific 668 miles. Dayton, Ohio, to Kansas City by the Pennsylvania-Missouri Pacific route is 635 miles; by the Hamilton & Dayton-Alton route 620 miles. Hamilton, Ohio, to Kansas City over the Pennsylvania Lines and the Missouri Pacific is 634 miles as against 587 miles by the Cincinnati, Hamilton & Dayton and the Alton. Then, too, the other and longer routes are all through St. Louis. They include the transfer between East St. Louis and St. Louis and handling by two, three or four different carriers.

The advantages of a combination of the Cincinnati, Hamilton & Dayton with the Clover Leaf and the Alton would be, not only the saving in distance, but what is more important to both shippers and passengers, through lines under one management. This, particularly in freight service, means quicker time and simpler methods. In all these ways the Cincinnati, Hamilton & Dayton would well round out the through routes of the present Clover Leaf-Alton system.

From the standpoint of the Cincinnati, Hamilton & Dayton such an arrangement would be important and valuable. The Hamilton-Springfield line does not now amount to much beyond Indianapolis. Such a consolidation would greatly increase the importance of all of this line and particularly of its now little used western end. The lines between Cincinnati and Toledo are and always have been profitable because this is a rich manufacturing territory. A through traffic alliance with the Alton would not only mean a great increase of traffic on the Springfield line from the west to this manufacturing territory, but would result in the routing of much westbound traffic over this line to Springfield for delivery there to the Alton. There would therefore be advantages to both parties if this reported consolidation should take place.

There remain to be considered the owners of the Cincinnati, Hamilton & Dayton, J. P. Morgan & Company who paid a high price for a bankrupt road in order to protect the general trunk line situation. Is it probable that they would be willing to turn over this property to the Clover Leaf-Alton interests? To attempt an answer to this question it is necessary to go back several years and consider the reasons which brought about the purchase of the Cincinnati, Hamilton & Dayton-Pere Marquette aggregation by the guardian spirit of the trunk line railroads. To them the bitter pill of the "Great Central Route" was that the rich traffic originated by the Cincinnati, Hamilton & Dayton in the prosperous manufacturing regions of western Ohio, which previously had been turned over to the various trunk lines at their respective junction points with this north and south line to be carried eastward over their tracks to tidewater, was instead hauled north to Detroit and there turned over to the Pere Marquette to be hauled eastward north of Lake Erie to the Buffalo gateway. The same thing was true of traffic between western Ohio territory and Chicago. In either case the Pere Marquette was a roundabout route for such traffic. As one railroad officer expressed it, it was carrying freight "round Robin Hood's barn." It was primarily to put a stop to this that the "Great Central" roads were taken over.

United with the Toledo, St. Louis & Western and the Chicago & Alton, the Cincinnati, Hamilton & Dayton would have, from the standpoint of the trunk lines, few of the same possibilities for harm that it did when working with the Pere Marquette. Eastbound traffic from Ohio points would not be affected in any way whatever by such a consolidation. It is this which is most important and which in particular made the Cincinnati, Hamilton & Dayton-Pere Marquette merger unendurable to the trunk line community of interest. Furthermore the present arrangements for westbound traffic, so far as the Chicago gateway is concerned, would not be disturbed. It is this gateway in which the trunk lines are directly interested. The Chicago-Atlantic seaboard roads would be affected only by the loss of traffic which they formerly received at Chicago from the Chicago & Alton, but this they are apparently in any case to lose as far as Toledo to the Toledo, St. Louis & Western. Thus, from a traffic standpoint—and it was the potentialities of the "Great Central Route" as a traffic disturber that brought about its purchase—there seems to be no reason of moment why the trunk lines should object to this sale of the Cincinnati, Hamilton & Dayton.

A consolidation of the Cincinnati, Hamilton & Day
Toledo, St. Louis & Western and the Chicago & Alt
advantageous to all three and would not disturb the ex
relations in trunk line territory. Accompanied by ap
prevent "Robin Hood's barn" routings, which do not
belong to the proposed combination, such for example
sible one from Dayton, Ohio, south to Hamilton, west thr
apolis, Ind., to Springfield, Ill., thence north to Chic
Alton, there seems to be no strong reason why the o
Cincinnati, Hamilton & Dayton should object to this .

It should be remembered that this is not a proph
is to come about but an examination of the facts and
of such a merger.

REVIEW OF 1907

From the standpoint of a railroad officer, the most valuable record of the commercial aspects of a year is that comprised in a collection of the annual reports of the railroads themselves and of the great industrial corporations, interpreted with understanding. The *Railroad Gazette* has made a continuous effort to present this record currently in an intelligent manner, and the illustrated round-up of the report reviews in another column will aid in fixing in memory the salient points of the year. But the 1907 covered by the annual reports begins six months earlier and ends six months later than the 1907 of the calendar—a year which is worthy of attention in review—because many important things have happened in it, and certain long-prominent tendencies have been reversed.

In less than three months' elapsed time a severe car shortage of some three years' duration has been turned into a widespread and marked surplusage; gross earnings have dipped down at a pronounced angle from the former curve of increase; expenses, after piling along nearly without interruption for a decade, have begun to waver, and a hostile and dangerous public sentiment has become mild as a dove. In twelve months' elapsed time it has become vira proportionate increase far greater than that of gross to a total of 112 per cent. above 1899, while gross earnings are 104 per cent. greater.

The variation in net earnings has been even more striking. It will be seen that there was a great increase in net between 1902 and 1903, a falling off in net in 1904, a striking gain up to 1906 and a much smaller gain up to 1907.

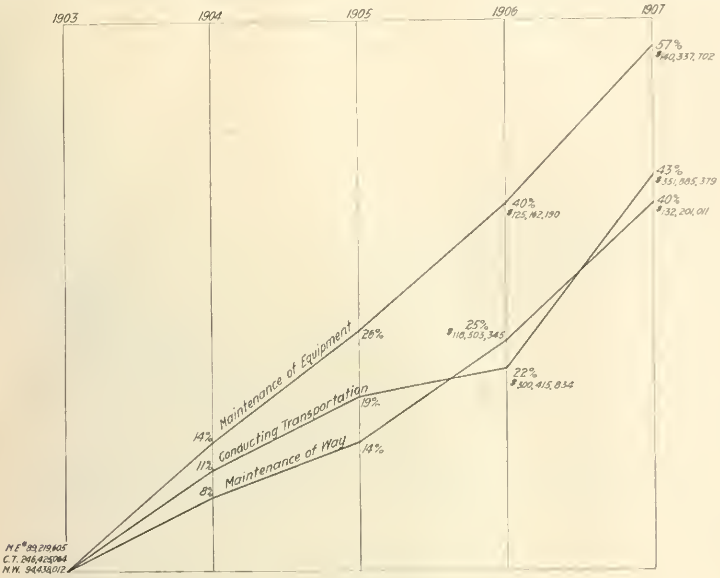


Fig. 2—Increases Per Cent. from 1903 Base. Nineteen Roads.

Figure 2, the diagram showing the per cent. increases in operating costs on the year 1903 as a base, brings out graphically some facts which are pretty well known.† The greatest increase per cent. has been in maintenance of equipment, as is naturally the case in view of the material increases in the size of equipment used. Until last year, the next greatest increase per cent. over the 1899 base was the cost of maintenance of way and structures, and this is also natural because the heavier equipment required a better roadbed. But during this past year traffic has been so enormous and costs have so constantly increased that in spite of the very liberal maintenance expenditures, the cost of conducting transportation has taken a sudden bend upward and has gone to second place on the diagram. From present indications, all three of these curves are likely to bend downward in the 1908 year, although almost five months of this 1908 year passed before traffic began suddenly to drop off. Therefore, the effect will perhaps not be fully represented in next year's figures. The significance in the extraordinary rise in the item of conducting transportation is best understood when it is realized that a large group of roads have been spending over $3,000 per locomotive a year on maintenance and renewals out of income; that several roads have charged an average of over $100 per freight car for the same purpose and that the expenditure for maintenance of way per single-track mile (counting two miles of switches and sidings as equal to one mile of main line) had been well above $1,200 on the Atchison, the Lehigh Valley and a large group of other roads, around $1,500 on the Southern Pacific and the Norfolk & Western, and over $1,000 on the Northern Pacific—to mention only a few characteristic instances of high maintenance expenditure.

Fig. 3, which we show this year for the first time, presents graphically the tendencies of one branch of increased expense. The comparison of the respective increases per cent. of taxes and of net earnings since 1899 shows that between 1899 and 1905 taxes increased each year at a rate never less than 7 per cent., or more than 9 per cent. above the base. In 1906, however, the percentage figure went up 16 per cent., and in 1907 it went up 28 per cent. The diagram shows particularly well how the curve of net earnings slacked off this year in its upward movement, while the tax curve took an incline by far the sharpest of that for any of the years shown. From all present indications, these two curves will intersect and cross each other in the current fiscal year. The upward bend of the tax curve in 1906 and 1907 tells as well as a long chapter of discussion how closely legislative attention has been di-

†The roads from which this second chart is made are as follows: Atchison, Topeka & Santa Fe; Buffalo, Rochester & Pittsburgh; Baltimore & Ohio; Chesapeake & Ohio; Chicago & Alton; Chicago & North-Western; Cleveland, Cincinnati, Chicago & St. Louis (1906 fiscal year); Chicago, Milwaukee & St. Paul; Chicago, Burlington & Quincy; Denver & Rio Grande; Great Northern; Illinois Central; Missouri, Kansas & Texas; New York, New Haven & Hartford; New York Central (year ending Dec. 31, 1906); Norfolk & Western; Chicago, Rock Island & Pacific; Southern Pacific (1906 year); Wabash.

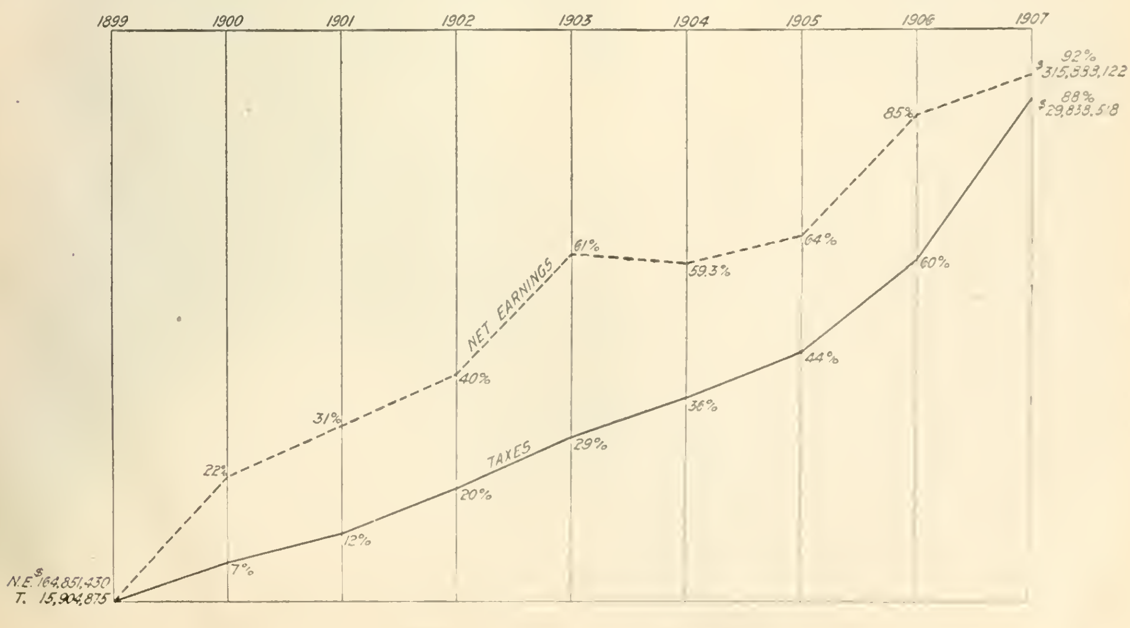


Fig. 3—Increases Per Cent. from 1899 Base. Seventeen Roads.

rected to the exaction of the greatest possible payments from railroads in the last two years. Fig. 3 and Fig. 1 are based on the same group of roads.

Figures 4, 5, 6, 7 and 8 represent graphically an exhibit of earnings compiled by the *Commercial and Financial Chronicle.* We have shown this exhibit for several years in the same form. The period represented in each diagram is the 10 months ended Oct. 31 of the calendar year shown on the right-hand wall of the diagram, and the increases per cent. are the increases over the same 10 months in the calendar year shown on the left-hand wall of each diagram. Thus, in figure 8 it is seen that in the 10 months ended Oct. 31, 1907, the operating expenses of 88 roads were 17.7 per cent. higher than the operating expenses of the same 88 roads were in the 10 months ended Oct. 31, 1906. The gross earnings of this group increased 12.9 per cent. in the same period and net earnings increased only 2.9 per cent. In only one year since 1902, when we began this form of record, has the 10 months' increase in gross earnings exceeded the increase in the operating expenses, and that was in the banner year 1906, when operating expenses increased fast enough in all conscience, but were passed by both gross and net.

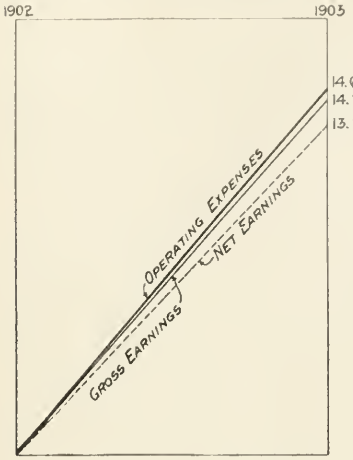


Fig. 4—Increases Per Cent., 10 Months Ending Oct. 31. 101 Roads.

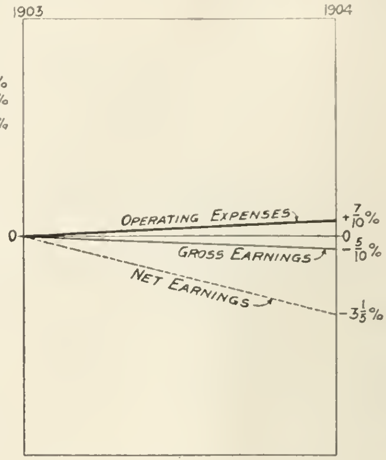


Fig. 5—Increases Per Cent., 10 Months, Ending Oct. 31. 95 Roads.

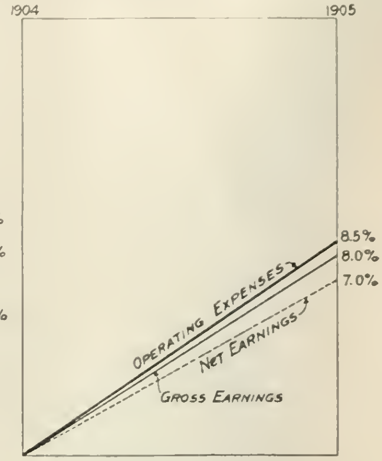


Fig. 6—Increases Per Cent., 10 Months, Ending Oct. 31. 93 Roads.

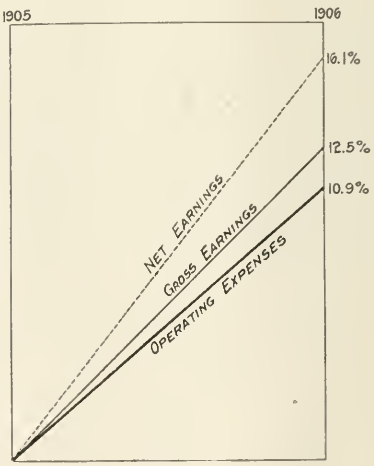


Fig. 7—Increases Per Cent., 10 Months, Ending Oct. 31. 90 Roads.

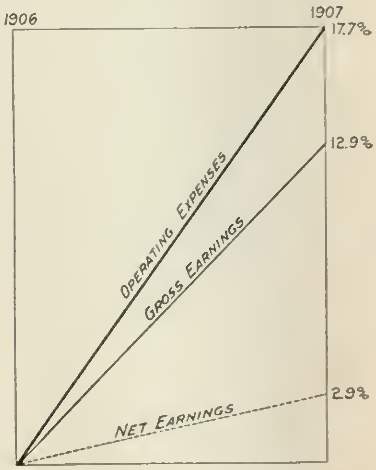


Fig. 8—Increases Per Cent., 10 Months, Ending Oct. 31. 88 Roads.

The next diagram, Fig. 9, we have compiled this year for the first time. The passenger-miles, ton-miles, number of freight cars and single-track miles are the aggregate showing of the Northern Pacific; Chicago, Burlington & Quincy, and Atchison; the car capacity, figure in tons, is that of the Northern Pacific only, since the other two roads do not give this figure. The Northern Pacific car capacity serves sufficiently well, however, to illustrate the tendency. The figure for single-track miles is arrived at by adding all the miles of first track, second track, third track and of switches and sidings operated, the idea being to show how track facilities have increased in proportion to traffic. It will be seen from this diagram that since 1899 the smallest proportionate increase has been in track capacity; the next smallest increase has been in the number of freight cars operated; passenger-miles and ton-miles, which, curiously enough, had the same total of increase, come next, a long way above the number of freight cars, while car capacity shows the highest figure of all and is approximately three times what it was eight years ago.

The curve of passenger-miles and of ton-miles, shown on this diagram, is of considerable interest. It will be seen that in the 1900 year, ton-miles increases the faster; then passenger-miles crossed them and stayed on top until June 30, 1903, when the two curves met. But the increase of passenger-miles was the steadier. Their percentage of increase was 13 points higher than that of the ton-miles in 1905 and then the curve took a slightly sharper upward bend but was, nevertheless, crossed by ton-miles in 1906. Now in 1907 the two are together again at 154 per cent. It will be seen from this chart that the rate of increase of ton-miles fluctuates more widely than does that of the passenger-miles. In the exceptionally good years, such as 1903 and 1906, ton-miles show a rate of increase about the same as that of the passenger-miles, but in the off years like 1904, passenger-miles are much less affected than are ton-miles. If we can draw conclusions for the next year from the results of the eight years past, it may be hazarded that passenger-miles will be on top (proportionate rate of increase).

Two points of interest are shown very graphically on this diagram; the conservative increase in single-track miles in proportion to traffic gains, and the great increase in the average size of the car equipment used, as indicated by the wide divergence in the curve showing car capacity and actual number of cars in service. It is also noteworthy that the curves of car capacity, of freight cars owned and of single-track miles bent upward with much greater rapidity in the 1907 year than in any other year on the chart. This is one minor point which differentiates 1907 panic conditions from those of almost all the other panics which we have had. Where there has been overproduction, in previous panic times, it has occurred in its most flagrant form a year to two years before the panic. Here we can see from the comparison of traffic increase to increase of facilities that there has been no over-production at all, and that the largest gain has occurred in the same year in which panic conditions came about, representing rather a scramble to catch up with the great ton-mile increase of 1906 than a speculative bid for the future.

Figures 10, 11, 12 and 13 are also introduced for the first time this year and are a study of individual roads rather than a compilation of general tendencies. Yet the tendencies which they show are extremely characteristic. The purpose of these diagrams is to show how general tonnage, particularly that made up of manufactures and merchandise, has increased in the last 10 or 12 years compared with the tonnage of the commodity which constitutes the road's specialty. Each one of the four roads chosen is a specialty road. The Missouri, Kansas & Texas used to depend primarily on its lumber and its grain; the Cotton Belt on cotton and lumber; the Norfolk & Western on bituminous coal; the Atchison on grain. But in the chain of golden years which received a check in 1907, the most characteristic thing about all the roads in this country has been the noteworthy increases in general, unclassified business, tending to wipe out the importance of their specialties, or at least to reduce it materially.

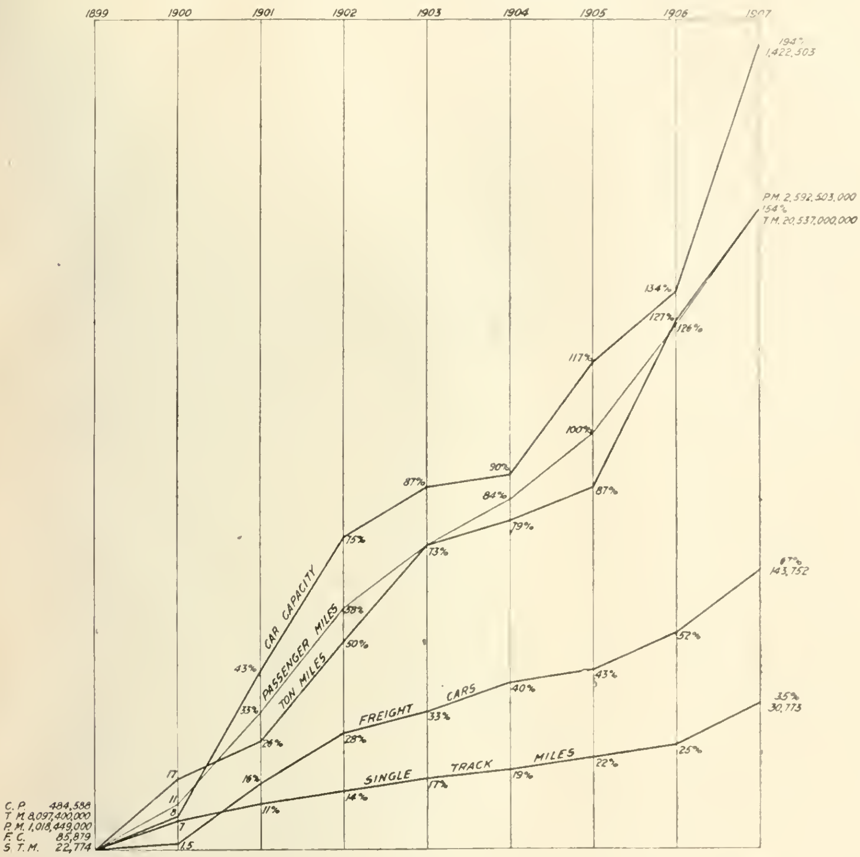


Fig. 9—Increases Per Cent. from 1899 Base. A. T. & S. F., C. B. & Q., Nor. Pac.

Note, therefore, that on the Missouri, Kansas & Texas in the 11 years ending December 30, 1907, the tonnage of manufactures and merchandise increased 268 per cent., while the tonnage of lumber increased 160 per cent., and the tonnage of grain increased only 80 per cent. The road carried some 10,000 more tons of grain in 1896 than it did of manufactures and merchandise; it carried twice as great a tonnage of manufactures and merchandise in 1907 as it did of grain—and, of course, it got a much higher proportionate ton-mile rate for it.

On the Cotton Belt, the total tonnage of the road increased 107 per cent. in 11 years, the tonnage of lumber increased 53 per cent., and the tonnage of cotton and cotton products, 105 per cent., while merchandise and miscellaneous increased 229 per cent. On the Norfolk & Western, in spite of the enormous increases in bituminous coal traffic since 1897, manufactures and merchandise went 29 points better; on the Atchison, the grain tonnage that used to determine the prosperity of the season, increased 13 per cent. between 1898 and 1907 and was not as high in 1907 as it was in 1903, the great crops of 1902 appearing, of course, as the grain tonnage for the year ended June 30, 1903. But the tonnage of merchandise, manufactures and miscellaneous articles increased 98 per cent. in the nine years.

There is one curious and rather sinister comment to be made on the showing as presented. The diagrams show conclusively that the roads in question will no longer be affected the way they used to be by a failure or a reduction in the output of their commodity, such as would be caused by a bad grain or cotton crop. But it is also apparently true that a wide and general reduction in the tonnage of manufactures and miscellaneous articles will affect these roads proportionately more than it would 10 or 15 years ago. For example, the grain roads are going to make a good showing in the current fiscal year, although not quite the highest on record. The interesting present question is, Will this showing be entirely offset by a bad record in manufactured articles? One thing is certain, that in the long run of years there will be a good many more bad crop years in this country than there will be years of general commercial depression, and the commodity diagrams show pretty clearly that the effect of these bad crop years will be greatly mitigated by the preponderance of general traffic.

One more general tendency should be presented, and it can be shown rather better by a table than by a percentage curve—the average revenue trainload. We have for similar years presented the composite of 17 roads selected as characteristic, and it will be seen that the average of these roads rose 11 tons in the last fiscal year, from a total of 399 to a total of 410. Between 1901 and 1902 the revenue trainload average increased 16 tons; between 1902 and 1903, 15 tons; in 1904 it was the same that it was in 1903. In 1905 it increased 20 tons, and in 1906, 23 tons. The increase of 11 tons this year is significant for two diametrically opposite reasons: First, because it brings the total figure so high; second, because the increase was not greater. The reason that it was not greater is because railroad managers and railroad superintendents have had so great a volume of traffic to move and have been so harassed with conditions of car shortage that they have been constrained to get their trains out as best they could and have had very little time to study out the most efficient loading of their trains, especially when this loading would necessitate any delay in train movement. Therefore, it may be said, generally speaking, that the 11-ton increase in trainload this year indicates rather an increased capacity of the motive power than general attention to the possibilities of economical operation. In a year of reduced traffic we may naturally expect this average to increase materially.

Revenue Train-Loads; Tons.

	1907.	1906.	1905.	1904	1903.	1902.	1901.
Atch., Top. & Santa Fe....	320	307	282	269	279	247	242
Baltimore & Ohio	433	420	399	401	416	406	381
Buff., Roch. & Pittsburgh..	542	525	507	439	441	424	406
Chesapeake & Ohio	596	586	557	508	493	508	511
Chicago & Alton...........	409	381	347	336	356	316	288
Chic., Burl. & Quincy.......	389	365	327	278	266	218	201
Chic., Mil. & St. Paul......	290	282	265	245	244	254	236
Erie	472	455	412	400	406	376	375
Great Northern	549	530	523	447	446	417	381
Illinois Central	364	358	319	278	288	275	255
Lehigh Valley	526	504	501	480	485	467	467
Minn., St. Paul & S. Ste. M.	334	329	309	301	305	315	314
Northern Pacific	407	400	367	339	344	346	324
St. Louis & San Francisco...	224	214	200	198	195	187	200
St. Louis Southwestern ...	279	280	267	388	384	344	318
Union Pacific	475	510	507	451	403	418	365
Wabash	360	348	293	280	302	285	283
Average for 17 roads ..	410	399	376	356	356	341	[illegible]

Turning from the general tendencies which have been presented to some of the specific things brought out in the reports of American railroads in 1907, some facts and figures can be produced which are highly significant of the period. The Atchison, after liberal maintenance in a year of splendid traffic, spent $9,791,226 out of income as a special appropriation for betterments. On the other hand, the Chicago & North Western, which for the last seven years has averaged over $4,000,000 a year as its appropriation out of income for betterments, and which in 1906 set $6,000,000 aside for this purpose, made no appropriation at all in 1907. These facts are both interesting. The Atchison was greatly desirous of carrying on some very important improvement work in the Southwest and, new funds were, to all intents and purposes, out of reach. It therefore made a notable appropriation which it was very well able to make, thereby strengthened its assets against securities already outstanding, instead of increasing obligations against assets. The Chicago and North-Western found itself in a condition of having completed the most urgent betterment work which had been on hand; also of requiring to create a large depreciation fund in accordance with the new accounting rules of the Interstate Commerce Commission.

The Buffalo, Rochester & Pittsburgh divested itself of its Rochester & Pittsburgh Coal & Iron Company holdings during the year by incorporating the Mahoning Investment Company in the state of Maine and selling to it the Coal & Iron Company's stock. Buffalo, Rochester & Pittsburgh stockholders received all but a small fraction of the Mahoning Investment stock, and the railroad profit and loss account was thus debited with about $1,000,000 in extra dividends. This transaction is interesting because it is the first instance where a railroad with a strong interest in the coal business has gotten rid of its coal holdings under the new law. The action of the Baltimore & Ohio in regard to the Consolidation Coal Company antedated the law.

The Central of Georgia has been twice sold during the year. The Southern Railway interests first of all disposed of the property to a shareholders' committee presumably in fear of the operations of the Anti-Trust law or of local hostility. Then the shareholders who bought it became involved in difficulties in the trust company failures and the property is understood to have passed to Mr. Harriman.

The Chicago, Milwaukee & St. Paul has apparently spent about 32½ million dollars on its Pacific coast extension and expects the work to be done in 1909. This is substantially all that can be learned about this project from the company's report.

The Missouri, Kansas & Texas and the Kansas City Southern made noteworthy records this year, handling not only the greatest business in their history, but a business so much greater than it ever was before that fresh attention has been directed to the future traffic possibilities of the north and south trunk lines. The Missouri, Kansas & Texas surplus in 1907 was nearly four times the surplus in 1906 and over ten times the surplus in 1905. The Kansas City Southern's gross earnings increased 20 per cent. in the 1907 year; its operating expenses decreased 3 per cent., and its net earnings increased 83 per cent., furnishing one of the very few instances in the entire country where a road was able to substantially increase net and at the same time decrease operating expenses last year. Both these roads have been rehabilitated, and the part they are to play in the future in the railroad strategy of the country is interesting and suggestive.

In the extreme Northwest an interesting situation was created this year by the new competition of the Grand Trunk, the Canadian Northern and Hill's Winnipeg-Vancouver line with the Canadian Pacific. The Canadian Pacific retaliated sharply by making traffic arrangements with the Harriman interests over the Oregon Railroad & Navigation into Portland, Ore., with the result that the great Canadian company now has a through route from Minneapolis to Portland, running most of the way on Canadian soil.

The Clover Leaf this year bought the Alton from the Rock Island, but the most sensational news and rumor of impending change has come from New England, where the New Haven road acquired a potential control of the Boston & Maine, but aroused such local hostility that it did not attempt to use it. The New England situation is now much confused, since the New Haven has the Boston & Maine to dispose of as a very important balance of power and is also in open revolt against the 50-cent per diem rate.

Space forbids a more extended review of the events of the year. The diagrams show the tendencies well; to go beyond these, except for the very high places in the curve of events, the reader must consult the detailed reviews of reports covering all the principal companies. These have been printed in the *Railroad Gazette* as fast as the reports appeared.

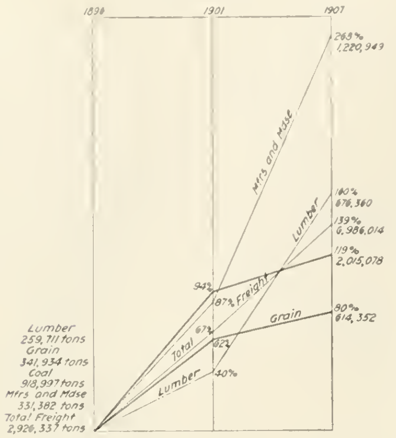


Fig. 10—Missouri, Kansas & Texas.

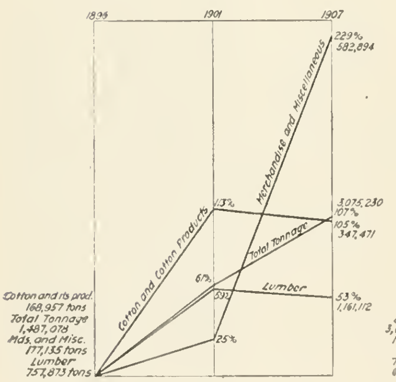


Fig. 11—Cotton Belt.

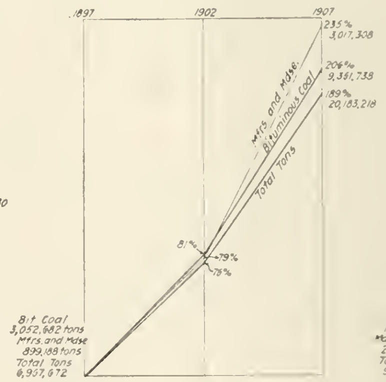


Fig. 12—Norfolk & Western.

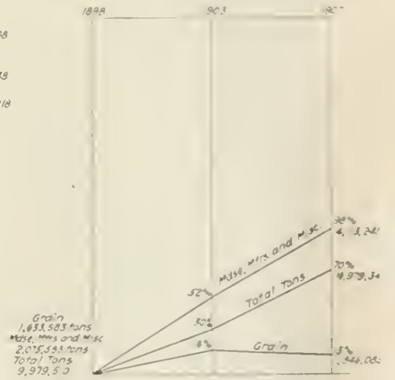


Fig. 13—Atchison, Topeka & Santa Fe.

Dividend Changes and New Railroad Capital in 1907.

The first of the following tables sums up the principal changes in the rate of railroad dividends paid during the calendar year 1907 or declared during the year for payment in 1908. The month given opposite each new dividend is usually that in which the dividend was announced or declared. The present annual rate as shown in the table is based on the latest payment or declaration in the calendar year 1907. In some cases the rate was changed by a semi-annual dividend declared early in the year and since maintained. The column showing the former rate shows either the amount paid in the calendar year 1906 or the amount paid in the previous year in which the last dividend was paid.

The record of dividend changes shows out strikingly the contually impossible to raise new railroad capital, whether by issues of bonds, stock or notes; therefore, a slackening of traffic to within limits that can be handled by existing facilities has its compensations.

When the winter of 1907 was well under way, last February, North Dakota reported such extreme scarcity of fuel, and of fodder as well, that at one time the lights were extinguished in more than 100 villages, and farmers were killing their live stock. The temperature was 48 deg. below zero at McHenry, February 5, and the town had not seen a freight train since December 18. A 300-mile branch on the Minneapolis, St. Paul & Sault Ste. Marie was closed for six weeks by snow, and all through the northwestern country genuine hardship abounded, caused by the shortage in local stocks of food and fuel and the inability of the railroads to meet the needs, in the face of the most severe winter of a generation and general car shortage. When spring came the car shortage became even worse, and the track shortage, preventing free movement of loaded trains, was equally apparent, but financial conditions were such that no comprehensive plans for bettering the situation could be put in effect. In view of subsequent events, it is very fortunate that this was the case; if the October panic had followed an abundant money market, so that the railroads most hindered and crowded could have done extensive financing to meet their needs in the spring of 1907, the long drag of recovery would probably be much extended. As it is, the depression reveals very little unsoundness throughout the country in the way of overproduction, and this is particularly true of the railroads.

The car shortage occasioned a number of investigations by commissions and by individuals, but the only useful work to alleviate the situation was done by the car efficiency committee of the American Railway Association, which published Mr. Hale's bulletins, showing graphically where there was inefficiency in shopping cars and wasted money in borrowing cars when it would be cheaper to own them. Through the information thus collected and systematized, the committee was also able to help the situation informally with its suggestions, and its work has been and promises to be of such importance that it deserves well a place in the year's record.

The characteristic of the year in finance—the change of the stock period of 1906 to a note period, because of the demoralization of the bond market, and the terrific effect on stock values occasioned even by rumor that rights to subscribe to new issues were likely to be given—came early. The Erie, in April, had to discount short-term notes like commercial paper and pay around 11 per cent. for its money; the Deepwater and Tidewater Railways had to pay some 7 per cent. for a short-time loan which bore H. H. Rogers' personal indorsement. A great many companies needed money urgently in larger sums than could be procured from earnings; they had the choice of raising it with short-time notes at a fancy rate of interest or doing without it, and even this choice was not long open. By the summer time it may be said that no money was to be had at any price a railroad could pay and preserve its self-respect unless the circumstances were most exceptional, for the outburst of notes served to depress each other's values with astonishing rapidity; most of the underwritings failed miserably, and a number of prominent banking houses are still carrying the loads thus assumed rather than sell in the present market.

Concurrent with this extreme difficulty of providing the new capital so greatly needed to handle enormous traffic, the railroads were being made the target of hostile state legislation in a way never equaled in this country since the Granger agitation in the seventies, and then only felt by a comparatively small group of roads, and there was this difference between the 1907 legislation and the Granger legislation, that in the early seventies the roads deserved, if not all, they got, at least a good part of it. They had been to all intents and purposes lawless for a long period of years and took no pains to placate an enraged public sentiment, whereas during the last few years the railroads have had to be almost as much interested in public sentiment as in gross earnings, and have made extraordinary efforts to have their actions clearly understood, believing that if they were so understood they would not be the victims of unjust legislation.

Mr. Finley, in decrying the attitude of the people traversed by his road in regarding all failures of services as wilful, hit the keynote of the discontent. Mr. Hill in showing that facilities were all inadequate to the traffic they had to carry, and that there was not money enough or labor enough in the country to make conditions right all at once, showed clearly where the principal source of difficulty lay. Yet the craze for 2-cent passenger fares, which reached fruition in Ohio the year before, spread through Arkansas, Georgia, Illinois, Indiana, Michigan, Minnesota, Missouri, Nebraska, Oklahoma, Pennsylvania, Virginia, West Virginia and Wisconsin, while Kansas required 500-mile books to be sold at the 2-cent rate. Governor Hughes was the only governor in the country who had the courage and the honesty to say that he did not propose to sign a 2-cent bill until he was convinced that the people who drew up the bill knew what they were doing. The other states passed the bills on the Widener formula of voting first and discussing afterward.

Freight rates were reduced by legislation in 11 states during the year, and reciprocal demurrage was legislated in 10 states. Hours of labor were limited in 12 states, and 11 states established or renovated their railroad commissions. In the mass of hostile legislation which was enacted it is possible by close scrutiny to discern a few safety regulations of a wholesome nature and to see where certain wrongs have been adjusted or relieved. But the record of the year is not creditable to the outworkings of democracy when applied to details. At all events, it so fell out that all these legislative enactments coincided with a period of maximum expenses—the roads found themselves obliged to pay much more than ever before for the things they bought (excluding one or two commodities), while at the same time they were required to sell their transportation for less, the reductions being mainly arbitrary ones. It was pointed out on a certain prominent line in the south that the cost of its bridge timber had more than doubled in eight years, and that its labor cost had increased from an average of $1,622 a mile in 1905 to $2,875 at the close of 1906. And it was not possible to get anything like the normal efficiency out of the labor employed. As one railroad president expressed it: "The only way you can maintain discipline is by being able to fire a man who does not do his work, and when he knows he can go across the street and get another job just as good he does not care whether you fire him or not." Estimates of the reduced efficiency varied greatly, but the sum of the matter was that the railroads were paying much more than they used to for the services of men who did much less than they used to.

But a considerable part of the legislation affecting earnings did not apply to the earnings of the June 30 fiscal year; consequently, as may be seen from the graphic diagrams on another page, the general increases in gross earnings were too great to have their benefits entirely obliterated by the high costs and rapidly increasing taxes, and a number of roads paid increased dividends. The Atchison, having raised its annual rate in 1906 from 4 to 5 per cent., put it up to 6 per cent. in 1907; the Delaware & Hudson increased from 7 to 9 per cent.; the Vandalia from 4 to 5 per cent.; the Burlington from 7 to 8 per cent., and the Kansas City Southern put its preferred stock on a 4 per cent. basis. The increase of the Pennsylvania from 6 to 7 per cent. became effective in November, 1906, and was continued throughout 1907, and the New York Central raised its rate from 5 per cent. to 6 per cent. and increased simultaneously the dividends of some of its subsidiary lines. A number of other lines which were well in position either to pay dividends or to increase a low existing rate—notably the Rock Island—preferred to put their properties in shape for more efficient operation out of income, and thus strengthened their assets.

How certain of the dividend increases are going to work out in a year of lessened traffic is still problematical, but it may be said, in general, that if American roads paid their dividends after the British plan of dividing everything above operating cost, allowing only for strict maintenance, these increases could have been made long ago, and they were all based on an abundant safety margin, viewed from the standpoint of prosperous times.

The acute panic conditions beginning in October are a vitally important part of the year's record, but need not be discussed in this review, as full comment was made on them in the *Railroad Gazette* last week. The effect of the panic on railroad business in 1908 is interestingly discussed by 42 railroad officers, whose comments will be found in another column in this week's paper. Nearly all are agreed that traffic is going to be less, but the apparent reduction that can be effected in operating costs, and the greater efficiency that can be had when railroad managers really have a chance to use their splendid transportation machines scientifically, and when employees do what they are told to do—these items have also to be considered, though they cannot well be measured. Apart from all these things, the panic and the depression may be worth what they cost and more, if they change the rule of the demagogue and political agitator for that of the legislator who realizes that the country cannot be prosperous when its railroads and industrial corporations are prohibited from earning a return that will attract capital into them.

We built 5,212 miles of railroad this year, according to a thoroughly careful preliminary estimate; an amount not very far from the average yearly addition of the last eight years, and equal to an increase of some 2⅓ per cent. in the entire mileage of the country. We also built 284,188 freight cars, 5,457 passenger cars, and 7,362 locomotives. The equipment figures include the output of Canadian companies, but not that of railroad shops. If the new mileage cost an average of $30,000 per mile it cost $156,360,000. The equipment costs can be estimated with greater accuracy, and they probably amounted to $476,000,000—three times the cost of the mileage—though in justice we should, of course, include 977 miles more for Canada, to balance its equipment. We believe, however, that the average cost of the Canadian mileage was under $30,000, and that the entire equipment built, including the output of railroad shops, did cost something like three times as much as the entire mileage did. At all events, there has never before been such a golden year for the equipment companies. Full comment on the mileage built and on the equipment ordered was made in the *Railroad Gazette* last week.

To turn from general to specific events of the year, the inauguration of electric suburban service on the New York Central, the New York, New Haven & Hartford, and the West Jersey & Seashore (1906) is worthy of special notice owing to the new conditions presented. The enormous immigration has furnished another event of the highest importance, and in connection with it should be noted that steamers are carrying full steerage loads both ways at the present time, and there is such a demand for accommodations on outbound ships that freight has been refused in many cases to make room for the steerage passengers. This condition is rather unique and not altogether harmful from an economic standpoint. Its direct influence on the steamship business tends, of course, to make operating profits very great, since steerage traffic is far and away the most profitable of all the ocean business at the present day. The influx of immigration was very necessary to the extensive construction work throughout the country during the last five or six years, and now that a very much smaller number of people can find employment it is, on the whole, desirable that they should leave the country, at least temporarily.

The new state laws of the year have already been touched on. Governor Comer, of Alabama, and his injunction-proof harassments that were enjoined before the ink of his signature was dry upon them, furnish the comedy of the situation and perhaps the solution of it as well, through his *reductio ad absurdum* of the functions of an anti-corporation official. In national legislation, the 16-hour law, the reduced telegraphers' hours, and the extension of the principle of employers' liability, furnishes perhaps the most important individual records, although the great Standard Oil Company fine (not yet paid) showed what could be done under a statute which had never before been construed in so ferocious a manner. But there are signs that the amendment of the Sherman Anti-Trust law may not be distant, and that certain forms of agreements between rival carriers are likely to be legalized, in place of the ridiculous outworkings of our national doctrine of enforced competition as now construed. Just as the Sherman law has shown the lengths to which corporation legislation cannot profitably go, in a certain direction, it may well be that the crop of 1907 laws will point out some other legislative fallacies so clearly that we shall be delivered from them for another generation.

Review of 1907 Annual Reports.

The accompanying review is intended to supplement the general statement of the characteristics of the year printed in another column, and to show by means of graphic diagrams some of the tendencies which have been particularly noteworthy.

The diagrams themselves tell the story pretty well. The first one, with 1899 as a base, shows the respective percentages of increase, year by year, of gross earnings, operating expenses and net earnings of 17 railroads.* The roads selected serve quite well as examples of the entire railroad business of the country, and the aggregate sums from which the curves were constructed are so large that the effect of peculiar local conditions is to a great extent eliminated.

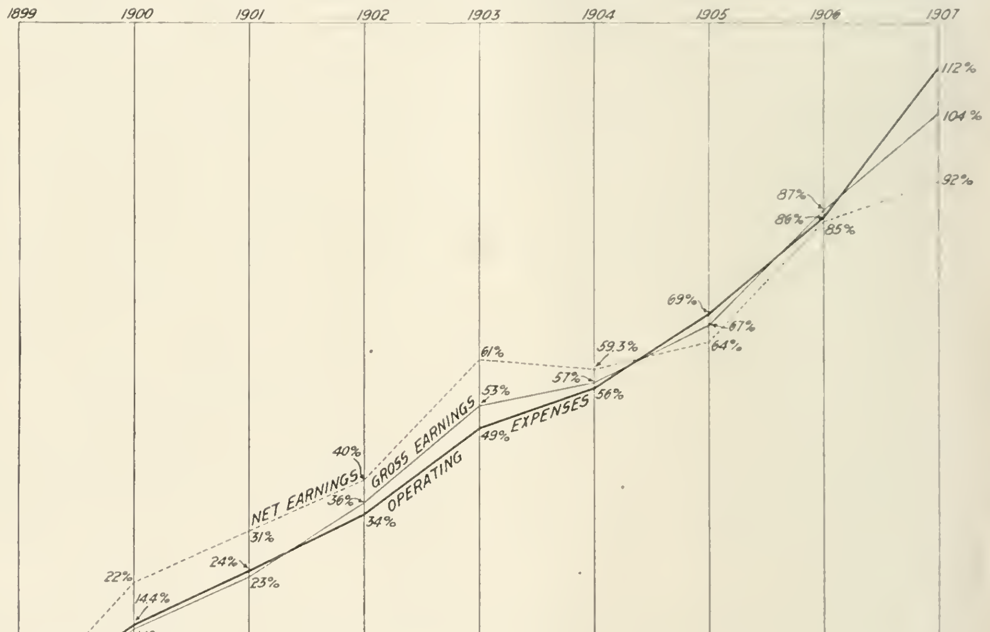


Fig. 1—Increases Per Cent. from 1899 Base. Seventeen Roads.

It will be seen that from 1899 to 1901 operating expenses increased slightly faster than gross earnings, but not very much faster. Then gross earnings received a great impetus and the expense account did not eat up the advantage thus gained until after the temporary depression in 1904. In 1905 operating expenses had increased 69 per cent. above the 1899 base and gross earnings had increased only 67 per cent. In 1906 gross earnings again increased faster than operating expenses but in 1907 operating expenses show

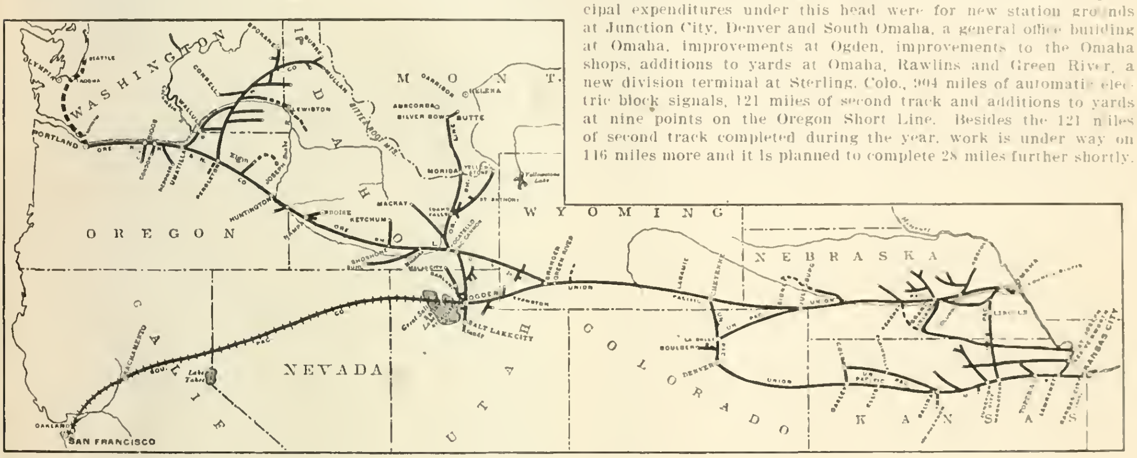
*These roads are as follows: Atchison, Topeka & Santa Fe; Baltimore & Ohio; Chesapeake & Ohio; Chicago, Burlington & Quincy; Chicago & North Western; Chicago, Milwaukee & St. Paul; Cleveland, Cincinnati, Chicago & St. Louis; Erie; Great Northern; Illinois Central; Louisville & Nashville; New York, New Haven & Hartford; Norfolk & Western; Northern Pacific; Philadelphia & Reading; Southern; Wabash.

increase of 7 per cent. in the locomotive mileage. Repairs and renewals of passenger cars cost $1,092 against $1,079 in 1906. There was an increase of 7 per cent. in the mileage of passenger cars. Repairs and renewals of freight cars cost $131 against $123 in 1906. There was an increase of 5 per cent. in the mileage run by cars in freight trains.

Conducting transportation costs increased $4,100,000, or 25 per cent. The increase of $1,171,000, or 29 per cent., in cost of locomotive fuel has already been mentioned. Locomotive service, not including fuel, increased 19 per cent., train service 17 per cent. and station and terminal service $16\frac{1}{2}$ per cent. As a result of the increase of the per diem from 25 cents to 50 cents a day, and of the serious detention of cars caused by traffic congestion during the year "mileage and switching payments" almost doubled. One small contributary to the increase in cost of conducting transportation was a decrease of 7 per cent. in the average train load. The congestion of traffic was responsible for this and the Union Pacific's experience in this particular was the same as that of most other roads during the great floods of traffic throughout most of the last fiscal year. Smaller trains were run in order to relieve the congestion and move the increased traffic as fast as possible. There was a very special reason which reduced the train load of the main line of the Union Pacific east of Cheyenne, Wyo. Instead of using Wyoming coal on this line eastern coal was used so as to send a greater amount of Wyoming coal to the territory west of Cheyenne, where there were serious shortages of fuel in many localities during the winter. As long as Wyoming coal was shipped eastward the fullest loading was secured on eastbound traffic because of the favorable grades. The change in direction of these shipments greatly reduced the traffic for eastbound cars and in consequence the average train load and car load. The loaded car load on the Union Pacific proper decreased 3 per cent., while on the Oregon Short Line and the Oregon Railroad & Navigation in each case it showed a slight increase. The train load on the Union Pacific proper was 456 tons against 494 tons in 1906; on the Oregon Short Line 530 tons against 558 tons in 1906, and on the Oregon Railroad & Navigation 477 tons against 502 tons in 1906. The average for all lines was 475 tons against 510 tons in the earlier year. The greater cost of moving the traffic can be summed up most briefly and concisely when approached from the locomotive mileage. Per locomotive mile, the cost in expense of moving and getting the traffic was 65.6 cents against 57.5 cents in 1906. General expenses increased 22 per cent.

There was a falling off in the freight density. In 1907 there were 1,185,367 tons of freight (including company freight) carried one mile per mile of road, against 1,203,174 tons in 1906. This was doubtless due in part to the increase of 241 miles, or 4 per cent., in average mileage operated. In 1905 the Union Pacific began a new policy of branch line development, whose effects were first noticeably shown last year. These lines, most in unoccupied sections of Oregon and Idaho, naturally had thin traffic compared to the heavy density of the Union Pacific's through main line. The rate received per ton of freight per mile is not given in the report but works out at 9.62 mills. This compares with 7.69 mills on the Great Northern last year. The Great Northern's figure is low because so large a proportion of its tonnage is grain. The Union Pacific's rate is high because it has so large a proportion of high grade tonnage.

During the year there were large improvements to the property. Besides the expenditures included in operating expenses, separate accounts are now kept for betterments and for additions, in order to distinguish between betterments upon the existing roadway, structures, equipment and facilities, and additions to the existing property which do not take the place of anything previously existing. The expenditures for betterments during the year amounted to nearly $2,000,000 and were principally for over two miles of steel bridges and trestles, replacing timber trestling and embankments and lighter steel structures on the Union Pacific proper, betterments to station buildings at six points on the Oregon Short Line and over one mile either of new steel bridges or of pile and timber trestles filled in on the Oregon Railroad & Navigation Company's lines, as well as a new brick car shop 492 ft. long by 342 ft. wide at Omaha. There was $561,000 spent on changes of line and revision of grades, of which four on the Union Pacific proper, one on the Oregon Short Line and five on the Oregon Railroad & Navigation were finished during the year or were still in progress at its close. Two of these, on the Union Pacific, reduced the maximum grade from 95 to 63 ft. per mile and by building 17 miles saved 14 miles in distance and 1,163 deg. of curvature. A line change on the Oregon Railroad & Navigation at Summit, Ore., open for business on May 15, 1907, reduced the maximum grade from 66 ft. to 11 ft. to the mile and another, 17 miles long, will save 1,455 deg. of curvature. The expenditures for additions amounted to over $6,000,000. Against this sum was credited $1,260,000 proceeds from land sales, making a net balance of $4,800,000 to be charged to capital account. The principal expenditures under this head were for new station grounds at Junction City, Denver and South Omaha, a general office building at Omaha, improvements at Ogden, improvements to the Omaha shops, additions to yards at Omaha, Rawlins and Green River, a new division terminal at Sterling, Colo., 904 miles of automatic electric block signals, 121 miles of second track and additions to yards at nine points on the Oregon Short Line. Besides the 121 miles of second track completed during the year, work is under way on 116 miles more and it is planned to complete 28 miles further shortly.



Union Pacific System.

The Southern Pacific connection from Ogden to San Francisco is shown.

All second track is laid with 90-lb. rail. When the mileage on which work is under way is finished, 267 miles of the 817 miles from Council Bluffs to Green River will be double-tracked. It is probable that the construction of second track will be steadily carried on until the whole line is so equipped, making the Union Pacific the first double-track through line west of the Missouri river. The new block signals form another notable improvement. On the Union Pacific automatic block signals have been put in on 803 miles of main track and 224 miles of second track, and their installation is progressing on 150 miles of main and 194 miles of second track. On the Oregon Short Line there are automatic signals on 45 miles of track, and they are being put in on 258 miles more. On the Oregon Railroad & Navigation automatic signals between Durkee and La Grande, 78 miles, and between Troutdale and Pendleton, 160 miles, are approaching completion. Already the Union Pacific is far and away the best protected railroad west of the Missouri river.

Of the lines under construction the most important are the Lane cut-off, from South Omaha west to Lane, 32 miles, a very expensive piece of work undertaken for the purpose of avoiding a loop on the present main line and a new cut-off from Onaga, Kan., northwest to Marysville, on the St. Joseph & Grand Island, which, in connection with a branch to be built by the St. Joseph & Grand Island from Hastings, Neb., west to Kearney, on the main line of the Union Pacific, with trackage rights over the St. Joseph & Grand Island, will shorten the distance for through trains between Kansas City, Mo., and Cheyenne, Wyo., by 98 miles and give a much more favorable line than over the old Kansas Pacific line via Denver. The branch from the main line up the North Platte river to Northport, Neb., 115 miles, is under way, and 54 miles have been finished. The Yellowstone Park Railroad is about finished to the boundary of Yellowstone Park near its northwest corner.

Dating from July 1, 1907, a new issue of $75,000,000 _-year convertible 4 per cent. bonds was sold. The balance sheet shows how important at that time was the need for larger working capital. Cash and demand loans stood at $8,570,000 on June 30, 1907, as against $55,968,000 one year earlier. At the same time there was a current liability of $69,000,000 in loans and bills payable by the Union Pacific, against no corresponding item whatever in the earlier year.

The cash funds which were on hand at the end of the fiscal year in 1906 were used to pay for the investments in stocks of various railroad companies whose purchase was made public in the testimony at the Interstate Commerce Commission investigation in the first week of 1907. "Stocks and bonds owned" stood on the balance sheet at $209,400,000 on June 30, 1907, against $96,800,000 a year earlier. This increase was due both to the investment purchases and to the funding of advances to the San Pedro, Los Angeles & Salt Lake in first mortgage 4 per cent. bonds and stock of that company.

Mr. Harriman treats of the investment operations of the company in considerable detail. Without attempting to follow the intricacies of these various operations, the situation may be summed up as follows: The original investment in Northern Securities stock cost $79,500,000, or, including Great Northern stock later acquired at par under subscription rights, $83,200,000. There have been sold at an average price of $304 for Great Northern, $209 for Northern Pacific, and $77 for Great Northern ore certificates, stocks of these various companies for which $117,900,000 was received. There is here shown a net profit in money of $34,700,000, plus the stocks of these companies on hand June 30, 1907, whose market value on the preceding day was $22,400,000, so that the total profit of these operations was over $50,000,000. There was invested during the last fiscal year $131,700,000 in stocks of various railroad companies not connected with the Union Pacific System, on which an income of 4.46 per cent. is being received, against an income of 2.79 per cent. which was being received on the Hill stocks at the average prices at which they were sold. Since the re-investments were made there has been a shrinkage in their market value as of June 29, 1907, of $23,100,000, but the shrinkage on the market value of the Hill stocks which had been sold on the same date would have been $55,500,000, so that not only was the income return to the Union Pacific largely increased by the reinvestments, but the loss through shrinkage of market values as of June 29, 1907, was $32,400,000 less than it otherwise would have been.

Mr. Harriman also shows a table based on the market prices on December 5, 1907, the date of the report, and also, incidentally, the day on which the stock market was higher than on any day for some weeks before or since, showing the market value of all investment stocks owned on that day as compared with their cost. The market value on that day was $228,400,000 and the cost $227,400,000, so that on this showing the market value was $1,000,000 more than the cost. If some day a week earlier or a week later had been chosen, the market value and the cost would probably have been about even. This calculation, however, takes no account of the $34,700,000 profits from the sale of the Hill stocks in excess of the cost of the same, which must be considered as a profit from the whole transaction. Looking at the whole series of operations together, there is no doubt that the Union Pacific has largely profited from its experiment in banking operations. It is equally evident that under certain market conditions it would have lost equally, and furthermore, that through these large purchases during the last fiscal year its working capital was seriously reduced, while its current obligations were tremendously increased. It must always be remembered, of course, that the original investment was made with the idea of safeguarding its territory, but the lesson of the whole striking series of transactions is plain that a railroad should not engage in speculative investment operations.

The following table, arranged according to our usual method, shows the income results for the last two years ended June 30:

	1907.	1906.
Mileage worked	5,645	5,404
Passenger earnings	$14,912,508	$13,236,055
Freight earnings	54,859,302	48,992,015
Gross earnings	75,651,105	66,879,142
Maint. way and structures	10,066,868	9,900,409*
Maint. of equipment	7,853,933	7,118,940†
Conducting transportation	20,276,530	16,203,783
Operating expenses	40,155,523	34,824,076
Net earnings	35,495,582	32,055,066
Other income	11,587,018‡	10,329,816
Net earnings and other income	47,082,600	42,384,882
Fixed charges and taxes	10,905,679	10,620,207
Net income	36,176,921	31,764,674
Dividends	23,530,036	19,552,424
Improvement appropriations	2,271,011§	4,504,556‖
Year's surplus	10,375,874	7,727,694

*This includes $1,691,610 charged as reserve for future maintenance, renewals, etc. No similar charge in 1907.

†This includes $515,000 charged as reserve for the future maintenance, renewals, etc. No similar charge in 1907.

‡Does not include dividends amounting to $2,015,963 declared since June 30, 1907, for account of the year ended on that date on stock of the Atchison, Topeka & Santa Fe; the Baltimore & Ohio, and the Illinois Central, but does include $1,125,000 paid July 1, 1907, and $1,350,000 paid Oct. 1, 1907, by the Southern Pacific. Similarly "Other Income" for the year ended June 30, 1906, includes $2,250,000 paid by the Southern Pacific on Oct. 1, 1906.

§Includes $312,009 reserved for depreciation of equipment.

‖ Includes $304,556 reserved for depreciation of equipment.

Railroad Officers on the 1908 Outlook.

The following compilation of answers to our circular letter of inquiry is published in the same form as in previous years. We have agreed in each case to protect the identity of the writer, and are therefore obliged to classify answers geographically, and, in some cases, to omit a line or two that would furnish a direct clue. We received 42 detailed answers to our inquiry, covering every part of this country, including Canada and Mexico. Of these letters, 16 are clearly and definitely optimistic, 14 indicate their belief that a more or less protracted period of mild depression is ahead; 12 anticipate severe depression. We will let them speak for themselves.

QUESTION 1.—HOW DOES THE GENERAL RAILROAD OUTLOOK FOR 1908 APPEAR TO YOU COMPARED WITH THE OUTLOOK A YEAR AGO AT THIS TIME? IS BUSINESS GOING TO REMAIN GOOD IN YOUR TERRITORY, OR DO YOU ANTICIPATE A MILD OR A SEVERE PERIOD OF DEPRESSION?

Central West and Trunk Lines.

The general railroad outlook for 1908 does not look favorable to me compared with the outlook a year ago at this time. With quite a number of our steel plants already closed down and with the prospects at the present time of more closing down in the near future, it hardly seems reasonable to expect that the business will remain as good in this territory as it has been during the past few years. Under ordinary circumstances, business suffers more or less depression during the Presidential year, and my notion is that there will be a severe period of depression in 1908, because of the continued agitation against corporate interests that has been manifested by the present administration.

There is such a general lack of confidence among the people of the United States, and I might say abroad, because of the legislative enactments, both national and state, against railroad properties and other corporate interests, and with the fear of more such legislation, which has been planned, that it is impracticable for railroads or other corporate interests to get the use of money for further development of their properties, many of which have been spending money freely during the past few years, with the expectation of continued prosperity, so that to-day many of these properties have assumed fixed charges which they would not have undertaken in the face of a depression which now seems inevitable, but which they would have had no difficulty whatever in carrying if the prosperity of the country had been permitted to continue.

As an offset to this disadvantage might be cited the high value of the grain crop of the country. While not so large in volume as in 1906, yet the market value in dollars and cents exceeds that of any other year in the history of the country, but the same difficulty is met with in marketing the crops as in various railroad improvements—the absolute inability to secure from banks the money with which to move the crops. —*Vice President.*

The outlook is not nearly so good as it was a year ago at this time. There is a much less volume of business offering, and, in my opinion, there will be a very considerable decrease in the gross earnings for several months —*President.*

The railroad outlook does not appear to be any better than a year ago, and I fear a further falling off in business.

—*President.*

The general outlook for 1908 compared with the previous year is bad. Business will not remain good in this territory. The shrinkage will be quite large, I think. I anticipate a severe period of depression. —*President.*

In my opinion, there will be a more or less marked period of depression during the entire calendar year for reasons so obvious as to require no portrayal. —*President.*

Railroad outlook for 1908 in this territory indicates a gradual recession in manufacturing, but gradual resumption in grain movements as the financial situation improves.

—*General Manager.*

The railroad outlook for 1908 is not as good as it was a year ago at this time. I anticipate a period of mild depression.

—*President.*

We anticipate a decrease in volume of traffic, but more economy in handling same with a possible slight reduction in cost of labor, material and supplies, which should show better comparative net results. —*Vice-President.*

In regard to the general railroad outlook for 1908, would say, we believe there will be considerable curtailment along both of our lines, which will cover a period of two years, although it will not begin to show much falling off prior to the end of the fiscal year June 30, 1908. We note that lumber operations along our lines will be curtailed by probably 50 per cent., beginning with this year.

—*President.*

The business on our lines has been somewhat reduced, but in this respect we do not differ from any of our neighbors, so far as I am aware. I am inclined to believe that we have reached the limit of the downward tendency in this direction, and while I do trasts of the year 1907. In the early part of the year there were dividend increases. After the stock market panic in March a few dividends were reduced or paid in some other form than in cash. Toward the end of the year there were some decreased payments. At the same time there were extra dividends on two of the western subsidiaries of the New York Central in order to provide funds for payment of the full dividend on stock of the parent company. Of the roads which paid their dividends in something else than money, the Erie paid in 4 per cent. interest bearing scrip, the Atlantic Coast Line in 4 per cent. certificates of indebtedness and the Missouri Pacific in stock. In this connection the recent action of the Western Union in declaring its regular dividend payable in stock may be mentioned. One class of the dividend increases marked the beginning of payments by roads on stocks which had never before received any return. Such cases were the dividends on the preferred stock of the Kansas City Southern and the Toledo, St. Louis & Western and the dividend on the second preferred stock of the Colorado & Southern.

The second table includes the more important new authorizations, issues, sales or listings of railroad stocks, notes and bonds during the year. An arbitrary minimum of $500,000 has been used in making up the list. A similar list published in the *Railroad Gazette* a year ago, with a $1,000,000 minimum, showed a total authorization of new securities amounting to about $2,600,000,000. The total this year is much smaller; it amounts to only about $1,800,000,000. There have, however, been a great number of issues of securities during the year. The dates shown in the table are, in the case of bonds or notes, usually the day on which they are dated and in the case of other issues, the date or month of issue. New authorizations, no part of which was issued, have the date of authorization. The column showing the amount of refunding covered is necessarily not exactly accurate, but shows in general the proportion of the new authorizations or issues which takes the place of securities previously outstanding. Similarly the amount issued or sold is not always announced by the companies, so that this showing cannot be entirely accurate. This is particularly true of security issues of a controlled or leased company held by the parent corporation.

The striking feature of the year's financing has been the great output of short term notes, which amount, including extensions of bonds, to over $375,000,000. The expansion of the New York, New Haven & Hartford is also clearly reflected in the table. The railroad financing of the year 1906 was done largely by stocks, the proportion of mortgage bonds being very small. The typical development of the year 1907 was the fact that neither stock nor bonds could be sold, and that the railroads had to turn to note issues to finance their absolutely necessary requirements, paying for these funds higher rates than had obtained for many years. Judging by the precedents of the Union Pacific in the case of first mortgage bond issues covering two of its new lines under construction, both of which are to be an important part of its through line, and of the New Haven in making its recent large convertible debenture issue, well secured railroad bonds bearing 6 per cent. interest will for some time be common.

Name of Company	Amount paid in 1907	Present annual rate.	Paid or declared	Amount paid in 1906.
Atlantic Coast Line com.	6	6	Jan. 10, 1908	6
Atchison, Topeka & Santa Fe com.	6	6	June and Dec.	4½
Boston, Revere Beach & Lynn	5	6	July	4
Belt R. R. & Stock Yard of Indianapolis com.	11[2]	12[2]	July	8
Belvidere Delaware stock	10	10	March	5
Central of Georgia, second preference income	3.729	3.729	August	5
Central of Georgia, third preference income	..	..	August	2
Chicago, Burlington & Quincy	13¼[3]	8	October	7
Chicago Great Western debenture	4	..[4]	January, 1908	4
Chicago Great Western preferred A	2½	..[5]	October	5
Chicago, Rock Island & Pacific Ry.	5¼[6]	7	October	6
Cleveland, Akron & Columbus	3½	4	September	3
Colorado & Southern 2d pref.	4	4	April and Oct.	..
Cornwall & Lebanon	8	8	Jan. and July	6
Delaware & Hudson	9	9	Mar., June, Sept. & Nov.	7
Erie 1st and 2d pref.	4	4[7]	August	4
Grand Trunk third preference	3	3	April	2
Great Northern	1½[8]	1½	Nov	½ of 1[9]
Great Northern ore certificates	1	1	September	..
Hocking Valley com	3½	4	July	3
Interborough Metropolitan pref	3¾	.	October	2½
Kansas City Southern pref.	5[10]	4	July and Oct.	
Lake Erie & Western pref.	3	2[12]	January 1908	3
Lake Shore & Michigan Southern	12	16[13]	January, 1908	8
Maine Central	7¼	8	October	7
Michigan Central	6	10[11]	January, 1908	4
Missouri Pacific	5	5[14]	January, 1908	5
Nashville, Chattanooga & St. Louis	6	6	January	5
New York, Chic. & St. L. 2d pref.	4	4	March	3
Pennsylvania Company	7	8	December	6
Southern pref.	4	3	October	5
Southern Pacific com	5¼[15]	6	October	2½
St. Joseph, South Bend & Southern	2½[16]	2	October	2
Toledo, St. Louis & Western pref.	4	4	April and Oct.	
Wabash debenture A	6	6	July	6[17]
Wabash debenture B	1[18]	4[19]	January 1908	

[1]Certificates of indebtedness.
[2]Six per cent. regular and 2 per cent. extra in 1906; 3 per cent. regular and 2 per cent. extra January, 1907; 3 per cent. regular and 3 per cent. extra July, 1907.
[3]In October, 2 per cent. quarterly and 6 per cent. extra, the latter not to be continued.
[4]Payment postponed.
[5]October dividend passed.
[6]January, 1 per cent.; April, 1½ per cent.; July, 1 per cent.; October 1¾ per cent.
[7]October semi annual in scrip.
[8]Paid by the Lake Superior Co.
[9]In 1901.
[10]Two quarterly payments at 5 per cent. annual rate; company organized in 1906.
[11]July, 4 per cent. from earnings of fiscal year; October 1 per cent. quar.
[12]January, 1908, 1 per cent.; heretofore, 2 per cent. in January and 1 per cent. in July.
[13]January, 1908, dividend is regular semi annual and 2 per cent. extra.
[14]January, 1908, semi annual div. in stock.
[15]April, 1½; July, 1¼; October, 1½.
[16]Regular semi annual and ½ of 1 per cent. extra.
[17]In 1904; none since.
[18]July, 1907.
[19]Two per cent. semi annual declared for payment in 1908.

Name of Road	Amount authorized.	Kind of security.	Amount issued, listed or sold.	Amount of refunding covered	Date.
Alabama Great Southern	$1,750,000	1st mortgage, 20-year, 5 per cent. bonds[1]	$1,750,000	$1,750,000	Jan. 1, 1908
Atchison, Topeka & Santa Fe	98,000,000	Common stock	.....	98,000,000[2]	Jan. 30
" " "	98,000,000	10 year, 5 per cent. convertible bonds	26,056,000	....	June 1, 1907
Atlanta, Birmingham & Atlantic	....	5 per cent., 30-year, 1st mortgage bonds	5,000,000	.....	June
" " "	10,648,600	Additional common and preferred stock	....	.....	June 5
" " "	1,720,000	10 year, 5 per cent. equipment trust notes	1,720,000		July 1
" " "	....	Alabama Terminal R. R. Bonds	2,400,000	....	....
" " "	4,000,000	Georgia Terminal 20-year, first mortgage 5 per cent. bonds	3,000,000	....	....
Atlantic Coast Line	1,500,000	4 per cent. equipment trust notes	1,500,000	....	March 1
" " "	5,000,000	5 per cent. three year notes	5,000,000	....	March 1
" " "	1,500,000	40-year 1st mortgage, 4½ per cent. bonds of the Washington & Vandemere	100,000	....	Feb. 1
Bangor & Aroostook	....	Northern Maine Seaport Railroad first mortgage, 5 per cent., 30-year bonds	800,000		March
" "	1,000,000	Medford extension first mortgage, 5 per cent., 30-year bonds	1,000,000	....	Mar[illegible]
" "	900,000	5 per cent., 10 year equipment trust notes	900,000		April 1
" "	....	Capital stock	792,000		June
Birmingham Terminal Company	3,000,000	50 year, first mortgage, 4 per cent. bonds	1,500,000		March 1
Boston & Maine	3,000,000	One-year, 5 per cent. notes	3,000,000		January March
" "	2,000,000	4 per cent., 20-year bonds of the Fitchburg	2,000,000	1,500,000	April 1
" "	2,900,000	Bonds of the Fitchburg		2,000,000	Sept. 25
" "	1,000,000	One year 6 per cent. notes	4,000,000	....	Oct. 1
" "	6,000,000	Bonds	....	3,700,000	Oct. 6
Buffalo & Susquehanna	....	First refunding mortgage 4 per cent., 50-year bonds	2,408,000	....	March
" "	540,000	10 year, 5 per cent. equipment trust notes	540,000	....	April 1
" "	1,200,000	10-year, 5 per cent. equipment trust notes	1,200,000	....	Aug. 1
Buffalo, Rochester & Pittsburgh	1,000,000	One-year, 6 per cent. notes	1,000,000	....	March 11
" " " "	3,000,000	20-year, 4½ per cent. equipment trust notes	2,100,000	....	April 1
" " " "	35,000,000	50 year, consolidated mortgage 4½ per cent. bonds	1,000,000	18,145,000	May 1
Canadian Northern	1,500,000	Imperial Rolling Stock 1st mortgage 10-year, 4½ per cent. bonds	1,500,000	....	June 1
Canadian Northern Ontario	....	3½ per cent., 30-year debenture stock	3,850,000[3]	....	April
Canadian Pacific	....	4 per cent. preference stock	5,000,000	....	February
" "	....	4 per cent. consolidated debenture stock	12,000,000		March and August
" "	8,000,000	4 per cent. debenture stock			Oct.
" "	....	Ordinary stock	24,336,000		Dec. 30

[1]First mortgage 6 per cent. bonds extended.
[2]Issued to retire convertible bonds.
[3]Issued in pounds sterling.

Name of Road	Amount authorized.	Kind of security	Amount issued, listed or sold	Amount of existing covered.	Date
Central of Georgia	....	Consolidated mortgage 5 per cent. bonds	1,000,000		August
Central Ontario	1,200,000	Bonds			May 18
" "	2,890,000	Common stock			May 18
Chattanooga Station Company	....	50-year, 4 per cent., 1st mortgage bonds	850,000		Jan. 1
Chesapeake & Ohio	2,250,000	5 per cent. equipment trust notes	2,250,000		Jan. 1
" "	2,250,000	5 per cent. equipment trust notes	2,250,000		[illegible]
" "	....	General mortgage 4½ per cent., 100-year bonds	1,000,000		March
" "	....	Potts Creek branch first mortgage 40-year, 4 per cent. bonds	600,000		April
" "	1,200,000	One-year notes	1,200,000	1,200,000[4]	June 28
" "	10,000,000	General equipment and improvement 10-year, 5 per cent. bonds	6,500,000		Aug. 1
" "	5,000,000	Three-year collateral trust 6 per cent. notes	5,000,000		July 1
" "	1,500,000	1st mortgage, 30-year, 4 per cent. bonds of the Rawley & Southwestern	—		May
Chicago & Alton	6,000,000	Five-year, 5 per cent. collateral trust notes	6,000,000	5,000,000	Jan. 1
Chicago & Eastern Illinois	....	General consolidated and first mortgage, 50-year, 5 per cent. bonds	8,085,000	8,085,000	June
" " "	....	General consolidated and first mortgage 5 per cent. bonds	3,206,000	3,206,000	December
Chicago & North Western	....	Common stock	24,491,6[illegible]	. .	March 18
Chicago & Western Indiana	8,000,000	Three-year, 5 per cent. collateral trust notes	8,000,000		Feb. 1
Chicago Great Western	....	4 per cent. cumulative debenture stock	2,000,000		March 6
Chicago Junction	2,000,000	1st mortgage, 20-year, 5 per cent. bonds	2,000,000		May 1
Chicago, Lake Shore & Eastern[6]	2,510,000	Additional capital stock	2,510,000	2,510,000	April
Chicago, Rock Island & Pacific Railway	6,500,000	4½ per cent. equipment trust notes	6,500,000		Feb. 1
" " " " "	....	1st and refunding mortgage, 30-year, 4 per cent. bonds	10,000,000	7,500,000	May
Chicago Southern (So. Ind.)	2,500,000	Syndicate subscription	2,500,000		April 15
Cincinnati, Bluffton & Chicago	....	30-year, 1st mortgage, 5 per cent. bonds	300,000		February
Cincinnati, Hamilton & Dayton	1,023,660	Receiver's certificates	1,023,660	1,023,660[7]	June 24
Cincinnati, New Orleans & Texas Pacific	500,000	Three-year 6 per cent. notes	500,000		Dec. 2
Cleveland & Pittsburgh (Penn. Co.)	....	Special guaranteed betterment stock	436,250	. .	October
Cleveland, Cincinnati, Chicago & St. Louis	5,000,000	Four-year, 5 per cent. notes	5,000,000		June 1
" " " " "	....	General mortgage 4 per cent. bonds	1,079,000	79,000	July
Coal & Coke	10,000,000	5 per cent. preferred stock	8,881,300	6,300,000	October
Colorado & Southern	....	30-year, 4½ per cent. refunding mortgage bonds	10,000,000	8,651,648	Jan. 1
" "	1,026,000	10-year, 5 per cent. equipment notes	1,026,000	. .	April 1
Colo. So. N. O. & Pac. (St. L. & S. F.)	1,600,000	10-year, 5 per cent. equipment notes	1,600,000	.....	Feb. 1
Connecticut Railway & Lighting Co. (N. Y., N. H. & H.)	....	Preferred stock	8,142,900	.....	October
Connecticut Railway & Lighting Co. (N. Y., N. H. & H.)	....	Common stock	8,977,200	......	October
Connecticut Railway & Lighting Co. (N. Y., N. H. & H.)	....	1st and refunding mortgage, 4½ per cent., 50-year bonds	1,578,000	16,000	October
Delaware & Eastern	6,000,000	First mortgage bonds	6,000,000	....	June 29
" "	3,800,000	Capital stock	3,800,000	....	June 29
Delaware & Hudson	10,000,000	15-year, 4½ per cent. equipment trust notes	10,000,000	....	July 1
Denver & Interurban (Colo. & So.)	1,250,000	30-year, 6 per cent. bonds	....	......	Jan. 2
Denver & Rio Grande	1,500,000	10 per cent. equipment trust notes	1,500,000	....	July 1
" "	....	50-year mortgage and collateral 4 per cent. bonds of the Rio Grande Western	638,000	....	October
Erie	500,000	6 per cent. six months' notes	500,000	....	Sept. 1
"	580,000	10-year, 4½ per cent. equipment notes	580,000	......	Feb. 2
"	5,500,000	One-year notes, discounted at 7 per cent.	5,500,000	5,000,000	April 8
"	3,000,000	Erie & Jersey three-year, 6 per cent. collateral trust notes	3,000,000	....	June
"	2,000,000	Loan secured by 1st mortgage bonds of the Genesee River	2,000,000	....	June
"	6,000,000	1st mortgage bonds of the Genesee River	....	....	June
"	580,000	10-year, 5 per cent. equipment trust notes	580,000	....	July 1
"	5,000,000	One-year notes	....	....	May
"	3,000,000	1st mortgage, 50-year, 4 per cent. bonds of the Erie & Jersey	3,000,000	....	June
Florida East Coast	3,500,000	Three-year, 6 per cent. notes	3,500,000	....	Aug. 1
Georgia Coast & Piedmont	3,500,000	40-year consolidated mortgage 5 per cent. bonds	2,570,000	640,000	October
Grand Trunk Pacific	....	Prior lien 4 per cent. debenture stock	4,850,000[8]†	....	February
Great Northern	....	Stock	60,000,000[9]	.....	April 2
Gulf Terminal Company, Mobile, Ala. (Southern)	700,000	50-year, 4 per cent. 1st mortgage bonds	600,000	......	Jan. 1
Hocking Valley	1,418,000	4 per cent. equipment trust notes	1,418,000	....	Feb. 1 and Feb. 15
Houston Belt & Terminal	5,000,000	30-year, 1st mortgage, 5 per cent. bonds	....	....	July 1
Indiana Harbor Belt Railway	25,000,000	50-year, general mortgage, 5 per cent. bonds	....	....	November
Interborough-Metropolitan	3,000,000†	Six months' 6 per cent. notes	3,000,000†	....	May
" "	15,000,000	Three-year, 5 per cent. collateral trust notes	......	8,000,000†	June
" " "	2,100,000	Extension of 70 per cent. of the $3,000,000 six months' notes	2,100,000	2,100,000	November
Interborough Rapid Transit	10,000,000	Three-year 5 per cent. notes	10,000,000	....	March 1
Kanawha & Michigan	2,500,000	2d mortgage 5 per cent. bonds	2,078,000	1,095,000	November
Kansas City, Mexico & Orient	....	4 per cent., 1st mortgage, 50-year bonds	[illegible]	....	February
" " " "	850,000	7 per cent. collateral trust notes of the Mexico & Orient Townsite Co	850,000	....	August
Lake Shore & Michigan Southern	15,000,000	Three-year 5 per cent. notes	15,000,000	....	Jan. 25
Laramie, Hahn's Peak & Pacific	1,800,000	25-year, 1st refunding mortgage, 6 per cent. bonds	1,560,000	240,000	Oct. 1, offered Dec.
Lehigh Valley	21,000,000	10-year, 4½ per cent. equipment trust notes	2,000,000	......	Sept. 1
" "	2,343,000	Additional capital stock of the L. V. R. R. of New York	343,000	....	Authorized June
Louisville & Nashville	6,500,000	5 per cent. three-year notes	6,500,000	......	March 1
McCloud River	1,200,000	30-year, 5 per cent., 1st mortgage bonds	....	....	October
Maine Central	1,500,000	4-year 5 per cent. notes of the Somerset Railway	1,500,000	.....	June 1
Michigan Central	10,000,000	Three-year 5 per cent. notes	10,000,000	....	Jan. 25.
" "	3,000,000	First mortgage 50-year bonds, Joliet & Northern Indiana	1,500,000	800,000	July 10
" "	14,000,000	First mortgage, five-year, 6 per cent. bonds of the Canada Southern	14,000,000	14,000,000[11]	November
Midland Valley	3,500,000†	First mortgage 5 per cent. bonds	3,500,000†	5,000,000[12]	Dec. 1
Minneapolis, St. Paul & Sault Ste. Marie	14,000,000	Common stock	2,800,000	....	Sept. 17
" " " " "	7,000,000	Preferred stock	1,400,000	......	Sept. 17
" " " " "	....	4 per cent. consolidated mortgage bonds	3,500,000	....	....
Missouri Pacific	693,000	10-year, 5 per cent. equipment notes of the M. P. Equipment Association	693,000	....	April
" "	3,350,000	10-year, 5 per cent. equipment notes	3,350,000	....	May
Mobile & Ohio	1,291,000	Seven-year 5 per cent. equipment notes	1,291,000	.....	April

[4]Extension of old notes.
[5]Deposited as security for $5,000,000 notes dated July 1.
[6]Owned by United States Steel Corporation.
[7]Extended for one year from July 1, 1907.
[9]Under subscription; $34,616,212 paid up on June 30, 1907.
†About.

[11]Extension of first mortgage 5 per cent. bonds due January 1, 1908.
[12]Notes of the Cherokee Construction Company; new notes of the construction company also given in exchange to the extent of 30 per cent. old notes.
[13]Extension of notes due October 1, 1907.
[14]Guaranteed by the Southern and the St. Louis & San Francisco.

Name of Road.	Amount authorized.	Kind of security.	Amount issued, listed or sold.	Amount of refunding covered.	Date
National Railroad of Mexico	10,000,000	Two-year 5 per cent. notes	10,000,000	10,000,000	Oct. 1
New Orleans, Mobile & Chicago††	30,000,000	1st mortgage, 50-year, 5 per cent.	12,030,000	8,061,400	Dec. 30
" " " "	5,000,000	6 per cent. preferred stock	2,015,000	....	Dec. 30
" " " "	25,000,000	Common stock	10,075,000	8,073,800	Dec. 30
New Orleans Terminal	2,500,000	Two year 6 per cent. collateral trust notes[14]	2,500,000		April 10
New York, New Haven & Hartford	13,900,000	Two to five-year 5 per cent. notes	13,900,000		January
" " " "	27,985,000	4 per cent., 15 year debentures French currency	27,985,000	....	April 1
" " " "	1,000,000	Debenture bonds of the Worcester Consolidated Street Railway	...	...	Oct. 9
" " " "	19,911,000	50-year 4 per cent. debentures of the Providence Securities Co.	19,911,000		May 1
" " " "	30,000,000	Capital stock	30,000,000*		May 31
" " " "	30,000,000	Capital stock	11,000,000	.....	June
" " " "	39,029,600	Capital stock	39,029,600	39,029,600**	December
" " " "	39,029,600	6 per cent. convertible debentures	..	.....	Jan. 15, 1908
" " " "	....	4 per cent. bonds of 1955, of Boston & New York Air Line	1,000,000	......	August
New York, Ontario & Western	....	4 per cent. general mortgage bonds	1,300,000	..	June
Norfolk & Southern[16]	25,000,000	First and refunding mortgage 5 per cent. bonds	....	......	Oct. 23
" "	2,750,000	Three-year 6 per cent. collateral notes	2,750,000	....	Oct. 1
Norfolk & Western	....	10-25-year convertible 4 per cent. bonds	14,576,000	......	June 1
Northern Pacific	....	Prior lien 4 per cent. 100-year bonds	1,023,000	....	April
Northwestern Pacific	35,000,000	First and refunding mortgage, 50 year, 4½ per cent. bonds	10,000,000	6,676,000	March 1
Pennsylvania Company	50,000,000	Three-year 5 per cent. collateral improvement notes	50,000,000	50,000,000[17]	March 15
Pennsylvania Railroad	....	Stock	1,691,400	564,800[18]	January
" " "	....	Stock	4,185,200	4,185,200[19]	February
" " "	100,000,000	Stock	......	.....	March 12
" " "	40,000,000	Bonds or notes	....	....	March 12
" " "	60,000,000	Three-year 5 per cent. notes	60,000,000	50,000,000[20]	March 15
" " "	....	Stock	2,295,600	765,200[21]	August
" " "	40,000,000	Stock of the Pennsylvania Tunnel & **Terminal Co.**[22]	25,000,000[23]	25,000,000	June
" " "	5,000,000	Bonds or otherwise of the Philadelphia, Baltimore & Washington	5,000,000	....	July 31
Peoria Railway Terminal	1,500,000	30-year, 1st mortgage, 4 per cent. bonds	697,000	697,000	Jan. 1
Pere Marquette[24]	5,000,000	Five-year 6 per cent. notes	5,000,000	2,038,260[25]	Dec. 9
" "	13,800,000	4 per cent. preferred stock	13,800,000	12,000,000	Dec. 9
Philadelphia & Reading	1,500,000	1st mortgage 4 per cent. bonds of the New York Short Line	1,500,000	......	Feb. 1
Philippine Railway	15,000,000	1st mortgage, 30-year, 4 per cent. bonds	15,000,000	....	July
Pittsburgh & Lake Erie	20,000,000	Stock	....	..	Feb. 28
Pittsburgh, Cincinnati, Chic. & St. Louis	....	Common stock	3,868,800	644,800	December
Pittsburgh, Fort Wayne & Chicago	....	Additional guaranteed special stock	1,431,900	....	June
Reading Company	....	General mortgage, 100-year, 4 per cent. bonds	1,500,000	.. ....	January
" "	5,000,000	4½ per cent. equipment trust notes	....	......	May
Richmond-Washington Company	....	Collateral trust 40-year 4 per cent. bonds	1,000,000	....	April
Rock Island-Frisco Terminal	5,000,000	20-year, 1st mortgage, 5 per cent. bonds[26]	3,000,000	....	Jan. 1
St. Louis & San Francisco	3,300,000	10-year 5 per cent. car notes	3,300,000	....	Jan. 1
" " " "	5,074,000	10-year 5 per cent. equipment notes	5,074,000	....	Aug. 1
" " " "	115,000,000	15-20-year general lien bonds	....	62,816,000	Aug. 27
" " " "	100,000,000	Common stock[27]	....	..	Aug. 27
St. Louis, Brownsville & Mexico	3,000,000	Three-year 5 per cent. notes	1,600,000	.	Nov. 1
St. Louis, Iron Mountain & Southern	3,660,000	10-year 5 per cent. equipment trust notes	3,660,000	. . .	June 1
" " " "	....	River and Gulf division, 1st mortgage, 30-year, 4 per cent. bonds	3,890,000	....	March, July and Aug.
St. Louis Southwestern	....	30-year consolidated mortgage bonds	1,326,000	....	May
Seaboard Air Line	18,000,000	Collateral trust and general mortgage, 5 per cent., 30-year bonds	7,308,000	....	Feb. 1
" "	4,655,000	Collateral trust and general lien four year 5 per cent. bonds	4,665,000	4,665,000[28]	March 1
" "	1,300,000	10-year 5 per cent. equipment trust notes	1,300,000	......	May 1
" "	1,840,000	40-year, 1st mortgage, 5 per cent. bonds of the Macon, Dublin & Savannah	1,240,000	1,880,000	Jan. 3
Southern	15,000,000	Three-year 5 per cent. debenture notes	15,000,000	....	Feb. 1
"	....	First consolidated mortgage, 100-year, 5 per cent. bonds	3,315,000	637,000	February and Nov.
"	2,500,000	1st mortgage, 50-year, 4 per cent. bonds of the Carolina & Tennessee Southern	492,000	....	May
"	2,000,000	7 per cent. preferred stock	35,612,800	....	June 15
Southern Pacific	....	50-year 4 per cent. bonds of the Tennessee & Carolina Southern	938,000	......	May 10
Tampa & Jacksonville	5,000,000	First consolidated mortgage, 30-year, 5 per cent. bonds	485,000	150,000	April
Terminal Railroad Association of St. Louis	....	General mortgage refunding 4 per cent. bonds	1,000,000	745,000	December
Texas & Pacific	3,100,000	10-year 5 per cent. equipment trust notes	3,100,000	.. ..	June 1
Toledo, St. Louis & Western	12,000,000	10-year bonds, series "A" 4 per cent., and series "B" 2 per cent. and 4 per cent.[29] ....Series "A"	6,380,000		
		Series "B"	5,047,000	. ....	Aug. 1
Tonopah & Goldfield (Bullfrog Goldfield)	1,250,000	1st mortgage, 15-year, 6 per cent. bonds of the Bullfrog-Goldfield	1,250,000	. ....	.. ..
Trinity & Brazos Valley	500,000	10-year 5 per cent. equipment notes[30]	500,000	. ..	April 1
Union Pacific	6,000,000	50-year 6 per cent. bonds of the Topeka & Northwestern	6,000,000	....	June 1
" "	100,000,000	Additional common stock	.. ..	42,857,143[31]	June 15
" "	75,000,000	20-year 4 per cent. convertible bonds	73,762,000	... .	July 1
" "	3,000,000	50-year 6 per cent. bonds of the South Omaha & Western	3,000,000	.. .. .	June
Virginian Railway	10,000,000	Two-year 6 per cent. participation certificates[32]	10,000,000	....	Feb. 15
" "	33,500,000	50-year, 1st mortgage, 5 per cent. bonds	....	....	May 1
" "	10,000,000	50 year 5 per cent. bonds of the Virginia Terminal Railway	500,000	......	May
Wabash	6,160,000	Two-year 5 per cent. collateral notes	6,160,000	6,160,000	May 10
"	931,000	Seven-year 5 per cent. equipment notes	931,000	. ....	September
Washington Terminal	....	40-year, 3½ per cent., 1st mortgage bonds	10,000,000[34]	. ....	June
" "	....	40-year, 3½ per cent., 1st mortgage bonds	2,000,000[35]	....	Aug. 1
" "	1,575,000	Two-year 5 per cent notes	1,575,000	.. ...	Aug. 1
Yosemite Valley	....	1st mortgage, 30-year, 5 per cent. bonds	3,000,000	. .. .	June

[15]Exchanged for Consolidated Railway stock.
*Exchanged for Boston & Maine stock.
**Held to be exchanged for 6 per cent. convertible bonds.
††Successor of the Mobile, Jackson & Kansas City and the Gulf & Chicago.
[16]Stockholders also voted to issue common and preferred stock and an equipment trust.
[17]Refunded 4½ per cent. notes due November 1.
[18]In exchange for Cumberland Valley common, first and second preferred, at rate of 3 to 1.
[19]In exchange for Philadelphia & Erie stock.
[20]Notes maturing November 1.
[21]In exchange for Bald Eagle Valley stock.
[22]Successor of the P., N. J. & N. Y. and the P., N. Y. & L. I.
[23]Owned by the Pennsylvania Company.
[24]Reorganized company.
[25]Receivers' certificates.
[26]Guaranteed by C. R. I. & P. and the St. L. & S. F.
[27]To comply with Missouri law governing relative proportion of authorized bonds and stock.
[28]Extension of similar bonds due March 1, 1907.
[29]Paid for Chicago & Alton stock.
[30]Guaranteed by the Colorado & Southern and the Chicago, Rock Island & Pacific.
[31]For exchange for new convertible bonds.
[32]Issued by the Tidewater Construction Company, secured on $20,000,000 Tidewater Railway bonds and $10,000,000 stock exchange collateral.
[34]Sold in 1905 to a syndicate. Listed June, 1907.
[35]Collateral for notes.

Union Pacific.

As usual, the Union Pacific report is one of the most striking and important of the railroad statements of the year. This is especially so this year because President Harriman describes at length the financial operations of the company, particularly the investment operations of the past year. The part of the report signed by him covers 20 pages as against 13 pages a year ago. The whole is a story of growth, progress and wealth so remarkable that it cannot be easily understood or realized.

The year ended June 30, 1907, was the tenth since the reorganization of the company. The changes which have come about in the ten years are little short of marvelous. With only about 300 miles more operated than in 1898, gross receipts from all sources have increased from $33,000,000 to $87,000,000, or nearly 164 per cent. Surplus after fixed charges has increased from $9,000,000 to $36,000,000, a gain of 300 per cent. Dividend payments have risen from $1,800,000 to $23,500,000, an increase of 1,205 per cent., while the surplus after dividends is nearly double. One of the most striking features in the development is the decrease in fixed charges. During each of the last three years, which have been the three years of the most remarkable gains in traffic during the decade, the fixed charges decreased, so that instead of being $12,100,000 as in 1901, they amounted to only $8,700,000 last year. Compared with 1898, fixed charges have not quite doubled.

It is no secret how these remarkable results were accomplished. The present management has always devoted great energy to the improvement of the property. If little new mileage has been added, the efficiency of the old lines has been so increased that the result in capacity for handling traffic amounts to the creation of about 7,500 new miles of railroad. The expenditures for changes in line, for grade reductions, for second track, for larger and better shops, terminals, etc., for new lines, and for other betterments and additions have amounted to over $130,000,000, of which $33,500,000 were for grade reductions, second tracks, shops, terminals, etc.; $32,700,000 for new lines, including ownership in the San Pedro, Los Angeles & Salt Lake; $26,100,000 for new equipment; $11,800,000 for changes in line, and $26,200,000 for new lines in course of construction and terminal properties. All of these expenditures (except possibly part of the last item) were made previously to July 1, 1907.

The past year's record has been a very satisfactory one. Gross railroad earnings rose from $66,879,112 in 1906 to $75,651,105 in 1907, an increase of $8,771,963, or 13 per cent. The 1906 earnings were $8,122,216 larger than in 1905, so that the large increase of that year was continued at the same rate in 1907. More satisfactory still, in a year when operating expenses were greatly on the increase, net earnings rose just as fast as in the year 1906. The 1907 net earnings were $35,165,837, or $10\frac{3}{4}$ per cent. larger than in the year before, while in 1906 net earnings were $32,020,372, or $10\frac{1}{2}$ per cent. larger than in 1905. This was accomplished, to be sure, by a reduction of the proportion of operating expenses which were for maintenance, compared with the part used in operation, the latter heading including both conducting transportation and general expenses, but, as examination of the unit maintenance charges later will show, the Union Pacific's expenditures for keeping up its property are still exceedingly liberal. The decrease of $77,000 in fixed charges was canceled by an increase of nearly $300,000 in tax payments, so that net income from transportation operations was $3,155,000 larger than in the previous year. From this net income from transportation operations, amounting to $21,600,000, $15,700,000 was paid out in dividends, or 4 per cent. on the preferred stock and 6 per cent. on the common stock of the Union Pacific, as well as 4 per cent. on the trifling amount of preferred stock of the Oregon Railroad & Navigation Company still remaining in the hands of the public. The surplus from transportation operations after payment of the dividends which are charged to the railroad, as distinguished from the banking side of the Union Pacific, was $8,900,000, an increase of $3,100,000 over 1906.

The remaining 4 per cent. of the 10 per cent. paid on Union Pacific common stock is charged against income other than from transportation operations. The most important source is investments, from which the Union Pacific received $11,563,105 last year. The Southern Pacific contributed $5,985,000, or nearly half of this large total, and the properties listed below contributed the following amounts.

Baltimore & Ohio	$1,111,151
Great Northern	770,718
New York Central	770,113
Illinois Central	661,869
Northern Pacific	625,196
Chicago & Alton	415,774
The Pacific Express Company	381,000
Atchison, Topeka & Santa Fe	240,000
Chicago, Milwaukee & St. Paul	231,150
Chicago & North-Western	202,415

Dividends declared since June 30, 1907, for the year ended on that date, by the Atchison, the Baltimore & Ohio, and the Illinois Central, amounting to $2,015,963, are not included in this total, but there is included $1,125,000 paid July 1, 1907, and $1,350,000 paid October 1, 1907, by the Southern Pacific. The total income from stocks, $11,563,105, compares with $7,237,917 received in the same way in 1906. The item, "Balance of rentals from steamships and property and other income," under this head is less than half as much as in 1906, principally because of disasters in the summer of 1906 to both of the ocean steamships owned by the Union Pacific and rented to the Pacific Mail Steamship Company. The "Manchuria" went aground on the Hawaiian Islands and was so damaged that she was unable to resume service until August 8, 1907. The "Mongolia" went aground on Midway Island, but was temporarily repaired and continued in service. On completion of repairs to the "Manchuria" the "Mongolia" was put in dry-dock for permanent repairs, and resumed service again Nov. 12, 1907. Under the terms of the marine insurance, only a small part of the cost of repairs will be borne by the owners. The loss in earning power, however, is a final one. The total income other than from transportation operations was $12,000,000, but there was deducted from this nearly $500,000 for interest, so that the net income from these sources amounted to $11,600,000. Out of this there was paid $7,800,000, being 4 per cent. on the outstanding Union Pacific common stock, leaving a surplus after dividends from investments of $3,800,000, against $6,400,000 in 1906. This decrease was due to the fact that only one semi-annual dividend of 2 per cent. was paid in the previous year.

Adding $8,900,000, the surplus after railroad dividends, and $3,800,000, the surplus after investment dividends, the total surplus after dividends from both transportation operations and other operations, is found to be $12,646,885, which is about the same figure as in the previous year. From this, about $2,000,000 was appropriated for betterments, against $2,700,000 for betterments and $500,000 for betterments and additions of branch lines, and $1,000,000 for new equipment appropriated in 1906. There was, therefore, less than half as much appropriated for this purpose last year as in 1906. If the same amounts had been spent in these ways the year's surplus from all operations would have been the same as in the earlier year. As it was, the year's surplus was $2,700,000 larger than in 1906.

There were important increases in every department of earnings. Passenger earnings increased 13 per cent., mail and express earnings 27 per cent., and freight earnings 12 per cent., while the number of revenue passengers carried one mile and the ton mileage of revenue freight was 7 per cent. larger. No total of commodities carried is included in the report so that it is not possible to trace the growth and fluctuations of the different classes of traffic, but it is fair to assume that the increased earnings came from larger tonnage of almost every important commodity. As the most direct line between the Missouri river and San Francisco, the Union Pacific secures a great amount of high grade traffic, the movement of which was undoubtedly exceptionally heavy during most of the year.

As against the increase of 13 per cent. in gross earnings, operating expenses as shown increased 15 per cent. The increase in the normal cost of operation was, however, really nearly 23 per cent., for the 1906 expenses were charged with over $2,200,000 which was credited to a reserve fund for future maintenance and renewals "for which there was no necessity this year." There were a large number of unfavorable causes which account for this increase of nearly one-fourth in the normal cost of operation. Most of the wage schedules were higher and the greater part of these increases went in effect in the fall of 1906. Material cost more, particularly fuel, whose cost increased from $4,000,000 to $5,200,000 in 1907, an increase of 30 per cent. The movement of traffic was exceptionally heavy during a large part of the year so that it exceeded the limit of economical handling. During the summer of 1906 operations were embarrassed by the accumulation of cars and of traffic following the San Francisco fire. Later there occurred in the Pacific coast states unusually heavy rains, followed by disastrous floods, heavy snowstorms and extremely cold weather. Many miles of track and a number of bridges were washed away, the movement of traffic was seriously interrupted for over four months and as a result there was a traffic congestion over a large part of the system.

There were 129 less miles of new rails laid than in 1906 and 60,000 fewer cross ties, equal to 31 miles of continuous track; 52 miles less of tie plates and 195 less of continuous rail joints put in track. On the other hand 8 per cent. of the mileage of first and second track was on June 30, 1907, laid with 90-lb. rail, against 4 per cent. a year earlier. Maintenance of way cost $1,782 per mile, against $1,832 in 1906, including the reserve for future maintenance, etc. Not including this, the 1906 figure for straight maintenance per mile of road was $1,519.

Maintenance of equipment expenses increased $1,250,000, or 18 per cent. over the straight maintenance of equipment expense of the previous year. The 1906 maintenance of equipment account, however, was charged with $515,000 as a reserve for future maintenance, renewals, etc., so that the 1907 total was an increase of 11 per cent. over the total shown in 1906. Repairs and renewals of locomotives cost $2,933 against $3,068 in 1906. There was an not expect any rapid recovery, I believe the business of the country will slowly improve from now on. We have been for some time past engaged in adjusting our expenses to meet the changed conditions of business, and have been reducing our forces and hours of labor to correspond as nearly as may be to the reduced amount of business done. We have practically finished all of the work which we had under way, and it is not likely that we will engage in any further construction or purchase any new equipment until business conditions generally improve. As we have practically sufficient facilities for handling the business we are now doing very comfortably.

The fact that the wage schedules are, as a rule, a subject of contract with our employees does not permit a general reduction along that line until the expiration of the present agreements. There will probably be some shrinkage in gross earnings during the coming year, and in view of the wage agreements referred to, it is not likely that the operating expenses can be reduced in the same proportion as the gross earnings are likely to decline.

On the other hand, the business that is done will probably be done with greater ease, with less straining of facilities and little congestion, and consequently with less expense, as such conditions as have prevailed for the last two or three years always make rail road operations unduly expensive. —*President.*

East.

The general railroad outlook for 1908 appears to be quite unsatisfactory as compared with the indications a year ago at this time. The present financial stringency has spread itself over the whole country and is not, as many people suppose, simply a Wall street panic. The first effect of this stringency is a reduction in the output of nearly all the large manufacturing industries in this section, and there is consequently a proportionate decrease in the traffic offered for transportation by the railroads. It may therefore be expected that, for a time at least, railroad earnings will show considerable decreases as compared with last year.

—*President.*

In our territory we anticipate a mild period of depression.
—*Vice-President.*

The outlook for 1908, in general, is very gloomy, but is not seriously bad in our territory. This railroad depends upon the increase in population, and as this is the natural channel for the overflow from New York City, we expect our business for 1908 will be better than for 1907. —*President*

We anticipate the general business will be the same as during 1907. —*General Manager.*

My road serves a territory of large resources in timber, water powers, storage basins and soil. The kinds of timber peculiar to the section have been pretty heavily broken into elsewhere until, probably, no other such area of them exists in the country, so near to the Atlantic seaboard. Most of the log floating streams, rivers and lakes, with which northern Maine abounds, are used to float lumber tonnage to the railroad.

The soil of populated A. county is of a character which produces an exceptionally fine quality of potatoes. Not alone is their reputation high for table use, but they are understood to be [illegible]r than any others obtainable for seed, especially in the southern [illegible]s, the West Indies, Bermuda, etc. Since 1870, when about 40,000 [illegible]shels were shipped out of the country, the acreage has been steadily increased until, from the crop of 1906, the company has moved something over 13,000,000 bushels. Probably over 16,000,000 bushels were moved by all routes, and several million bushels used in starch manufacture.

The acreage in 1907 was larger than in 1906. An unprecedentedly cold and wet year and heavy October frosts prevented a successful outcome. The quantity of potatoes to be shipped is variously estimated at 50 to 75 per cent. only of the quantity from crop of 1906. The large shipments will be delayed until seed demand comes on because prices are expected to favor. The large shipments from crop of 1906 were from the field. Our September to November, inclusive, earnings have been seriously affected by the conditions as stated.

Not much can be done toward moving forest products to the railroad, after the time for rivers and streams to be closed with ice, until they are frozen solidly enough for teams, and until also there is depth of snow enough for woods roads. Last year extreme cold and plenty of snow came early, not far from the middle of November. At this writing heavy ice has not made. There is no snow.

The company's prospects cannot fairly be considered along with those of railroads in general. The resources, and the request for all that can be supplied from them, would appear to insure the same steady gains in traffic offerings, by years, now and in the future, as in the past. It is a question whether seasons of depression do not encourage extra exertion with the hoe and the axe in a territory where the population understands the use of both, and where opportunity to profitably use them is at its door. —*President.*

South.

I anticipate severe depression until after the Presidential election. —*President.*

All improvements absolutely stopped; confidence shattered by national and state legislation; tonnage growing lighter every week Look for hard times in 1908 —*President.*

The general railroad outlook at the moment is very bad our earnings held up fairly well until 10 days ago, but during the last 10 days have fallen off to an alarming extent The car movement shows a decrease in pay loads the last week in November of something over five thousand. Unless this crisis proves an exception to former ones through which I have passed, we have entered upon a long period of depression —*President.*

In this section the outlook for 1908 is very discouraging. The adverse legislation in some of the southern states, and the great drop in the price of pig iron and the closing of a number of iron furnaces has depleted the railroad tonnage to a very large extent The money matters are being handled in an excellent manner. Pig iron is a great barometer in this country and the products of the forest sympathize with the prices of iron. I do not look for better times here for a year —*General Manager*

I do not believe that we have yet passed through the full period of depression, which seems to be the inevitable result of general antagonistic legislation against railroad property.

—*General Manager.*

I anticipate a mild period of depression
—*General Manager.*

Twenty per cent below normal. —*General Manager*

Mild state of depression for some months.
—*Chairman of Board*

The outlook for 1908 is not materially worse than a year ago for the conditions at that time were not encouraging owing to the fact that the previous boom in the lumber business upon which we largely depend for our earnings, collapsed prior to January 1, 1907. —*General Manager*

I consider business will remain good in this territory
—*General Manager.*

The territory of our lines is peculiar, much of the area being water The products are of food, agriculture and the forest The first two classes being in unlimited demand are nearly stable, the third, together with other industrial and commercial articles, fluctuates.

Subject to the next crop conditions, there is no present reason why the regular annual increase of food and agricultural shipments should not continue in 1908. There may be some decrease of manufacturing output, but altogether we expect increase of gross earnings per mile of road, resulting in some measure, from our new lines and a more compact system

Our earnings for 1907 were increased by the Jamestown Exposition, and it is difficult to say to what extent, if at all they were affected by rate legislation. In Virginia, the Railroad Commission did not apply to us the rulings imposed on other companies because of our physical situation. In North Carolina much of our mileage was exempted from the reduced passenger rate because of existing or recent construction. We do not expect further hostile legislation. The local popular feeling in our territory is not now and never has been generally antagonistic; our relations with the public have been reciprocal, fostered possibly, by the feeling of security by the public in the abundance of competition by water and other lines. —*Vice-President*

Southwest

The general railroad outlook is bad compared with the outlook a year ago; business is not going to remain as good in our territory, and I anticipate a period of depression, perhaps not severe
—*Vice-President.*

The general railroad outlook for 1908 is not at all favorable. Business in the territory served by our rails will undoubtedly show a severe period of depreciation Just at present our traffic has fallen off very materially, and with the present financial stringency I look for a greater falling off We are moving some lumber and other forest products, but very little cotton.

—*Vice-President.*

We do not think that the railroad outlook for 1908 compares at all favorably with the outlook a year ago. From the standpoint of to-day, we look for a material decrease in business in 1908 as compared with 1907, although we do not think the depression will be so severely felt in our territory—Texas and Louisiana—as in mining and manufacturing districts of the North and East, our line depending more largely upon agricultural results. Our lines are located in a growing and developing territory. Increased acreage will be brought into cultivation, and if we are favored with good crops, especially with a good cotton crop, our earnings may not be materially affected. —*Vice-President.*

The railroad outlook at present in this section seems to be about 50 per cent of what it was last year. We are anticipating a mild period of depression. —President.

I do not anticipate general business will be as good for 1908 as for the past year. In the southwestern states, Oklahoma and Texas especially, we expect a moderate depression.
—Vice-President.

West.

The general railroad outlook for the year 1908 compared with the outlook a year ago is distinctly depressing, business will not be good and I anticipate a severe period of depression. After the crops of next season there will be the usual amount of transportation of food products as well as supplies for the use of those who produce them, but no new enterprises of any kind are likely to be started during the year 1908, or at least until the Presidential question is settled, and I shall be happy if our gross receipts for the calendar year 1908 do not decrease by 20 per cent.
—President.

I do not think the railroad outlook is as favorable as it was a year ago at this time. The crops are good, the farmers are prosperous, so that there cannot be what may be termed "hard times," but I think there will unquestionably be a serious reduction in volume of freight carried by the railroads, as the general cessation of construction work and curtailment of orders for equipment, made necessary by the damage done to their credit by political agitation, has already forced them—and will continue to force them—to adopt vigorous policies of retrenchment. We must not forget that the material required for construction of motive power, rolling stock and new lines was a very potent factor in the general tonnage movement of the early part of the year 1907. —Vice-President.

The general railroad outlook for the coming year is not as good as it was a year ago. Farmers in our territory have harvested fair crops the past season which, in connection with the high prices obtained therefor, barring the present period of financial uncertainty, will result in a fair local business. We do not anticipate a severe period of depression, although the present financial situation and the uncertainty always attending a Presidential election year will put a stop to a large extent to enterprises which, under normal conditions, would bring a considerable tonnage to our line.
—President.

Pacific.

General outlook for business for 1908 at the present time is not very favorable. Believe present depression and tightness in money market is going to result in quite a decrease in our business.
—General Manager.

We do not look for any serious reduction of business on our lines. —Vice-President.

The general railroad outlook for 1908 as compared with a year ago is bright so far as the general conditions and crops are concerned. I anticipate, however, a mild depression due entirely to the money stringency, which I do not think will extend very far into 1908. —Vice-President.

Canada.

While the crops this year have not been as large as the years immediately preceding, they are still above the average, and the demand from foreign countries and high prices existing will net the farmers quite as much money as their larger output of preceding years, although there will not be as much grain for the railroads to haul. While, therefore, there will be some decrease in earnings in this direction and some general falling off as the result of the financial situation, I look for a fair business for the year 1908.
—Vice-President.

The traffic in 1908 will be just about the same as it was last year. —General Manager.

Mexico.

General railroading outlook good for 1908.
—Superintendent.

Outlook for 1908 same as for 1907. No changes to report.
—General Manager.

QUESTION 2.—RETRENCHMENT. ARE YOU PLANNING TO RETRENCH EXTENSIVELY, OR ARE YOU ALREADY DOING SO? IF SO, HAVE YOU BEEN ABLE TO REDUCE ANY WAGE SCALES RECENTLY ADVANCED, OR DOES THE RETRENCHMENT LIE IN SHORTENING FORCES, IN STOPPING NEW CONSTRUCTION WORK AND IN REDUCING EQUIPMENT ORDERS?

Central West and Trunk Lines.

We have reduced our expenses to the minimum in all departments, but owing to the fact that our wages are pretty generally controlled through agreements with labor organizations, we have been unable to return to the old scale of wages. We have reduced the number of working hours at our shops, have stopped all new construction work, and have placed no orders for equipment for next year. —Vice-President.

We are reducing the force wherever possible. Have not been able to make any reduction in wages. —President.

We are retrenching in every direction. We do not expect to be able to reduce wages at the present time, but have reduced the working hours of the men and have made material reductions in the number of men employed. Our new construction work has practically all been stopped, and we have no equipment orders on the market. —President.

We are already doing as much as we can in the way of retrenchment. We have not been able to reduce any wages.
—President.

With the first of the year we shall retrench in every possible direction. Some reductions have been made in certain classes of employees, but no general reduction in the wage scale has been attempted, the retrenchment consisting principally of reducing forces, stopping new work and a general lessening of the stroke in construction. —President.

We have already commenced radical retrenchment, consisting of reducing forces and stopping new work. We have made no attempt to reduce wages, increase in which has more than equalled our increase in earnings for the past six months, and with falling off of earnings to less than a year ago this very appreciably affects our net earnings. —General Manager.

We are already making such retrenchment as possible. We have not reduced any wage scale as yet, our retrenchment lies in shortening hours of labor and in reducing forces, stopping new construction work and in reducing equipment orders.
—President.

No attempt at general retrenchment but an especial effort towards more economical service in all departments. We are taking advantage of the labor supply to increase construction forces on the 210 miles we have under contract with the hope of completing same during 1908. —Vice-President.

We have already stopped all new construction work and are curtailing very materially on what we have under way, and are placing no orders for equipment for the coming season. Our wage scale has not been reduced since advanced in November, 1906.
—President.

East.

The roadway is in good condition throughout. It is usual at this season to reduce track, masonry, fence, etc., forces. We are now able to reduce, and are reducing them more than ever. Considerable passenger train mileage is to be canceled, and some minor stations will be temporarily closed. Upon conferences with leading patrons, to be affected, they have approved. We will have no incomplete construction 10 days hence. Wage scale has not been reduced. —President.

We, in common with other railroads, are endeavoring to retrench so as to bring operating expenses into a right relation with operating income, but up to the present time we have not attempted to consider the rearrangement of wage schedules. Thus far our efforts are being directed to a reduction in train service corresponding with reductions in income, and in discontinuing all kinds of construction work, including equipment orders, that can be postponed. —President.

We are retrenching and expect to further retrench in shortening hours of work, and in abandoning new construction work. At this time we do not see our way clear to reduce wage scales recently advanced. —Vice-President.

The general situation has made it necessary for us to retrench in all improvement work. We do not believe it will be necessary to reduce wage schedules recently advanced, but we are retrenching in every direction possible. —President.

We are not planning to retrench extensively, neither have we already done so. —General Manager.

South.

We have not been able to reduce wage schedules yet on account of the strength of the unions, but believe that the next three months will see a change in this. —President.

Retrenching in all ways possible. —President.

We have endeavored to retrench in every way possible for many months past. We have not reduced wages, but have reduced force; however, it seems to me that a reduction in wages is inevitable unless business largely improves very soon. We are endeavoring to keep our roadway and equipment in good order, but have suspended all work that can be dispensed with. We do not anticipate purchasing any new equipment during the present fiscal year.
—President.

Owing to the falling off in tonnage we are already retrenching, taking off trains and reducing the number of men in the shops and on the track. We tried retrenching by reducing hours to keep as many men as possible and give them some kind of a living.
—General Manager.

We are retrenching extensively. All new construction has been stopped, and no new equipment is likely to be ordered in the near future. —General Manager.

We are going ahead, but with not quite as much vigor as formerly. It has been found possible to reduce track labor from $1.50 to $1.25 per day. —*General Manager.*

We are retrenching by stopping new work and by shortening forces, but have not reduced any wage scale. —*General Manager.*

All works of improvement not imperatively necessary have been suspended. Orders for supplies, etc., have been curtailed. There has been no reduction in wages. —*Chairman of Board.*

We found it advisable to make retrenchment in expenses before the end of the last fiscal year, and have made still further retrenchment since the recent financial troubles, but it has not yet been practicable to make any material reduction in wages. We are not doing any construction work, nor have we made any additions to our equipment since June last. —*General Manager.*

Not retrenching. Are reinforcing the old lines and preparing to construct the new lines. —*General Manager.*

Some construction work is suspended, and operating expenditures will be governed by considerations of safety and prudent economy. The property has been well kept up, and could very well live on its own fat for a considerable period, but it is not intended to deprive it of adequate repair. Beyond retrenchment in reducing forces and purchases, there is no road open to us toward lower operating cost. Wage scales have not been cut, and they are about 5 per cent. higher now than a year ago. —*Vice-President.*

Southwest.

We are planning to retrench wherever possible. Have not been able to reduce any wage schedules. We are following a general plan for revision of alignment and grades with permanent construction and relaying heavy steel from Texico to Woodward, Oklahoma, in my territory, but have cut out some extensive improvements, such as the completion of lap sidings, with an interlocking tower at the lap, and have stopped the construction of all new lines. We had no intention of buying new equipment; however, the Texas Railroad Commission has issued orders for the heavy purchases of cars and engines. —*Vice-President.*

We have already made extensive retrenchments. Wage scales remain about the same. We have no new construction work or equipment orders outstanding. —*President.*

We are gradually retrenching as far as we can consistently without crippling our service. We have no new construction to speak of under way, and are not arranging for any new construction for the coming year, as we have recently largely increased our equipment, and will not place orders for any new equipment for 1908. We have made no reduction in wage scales recently advanced, but we believe that it will be necessary for all lines and industries in our territory to make material reductions in the near future. —*Vice-President.*

We are retrenching where possible, but have been unable to reduce wage schedules. Have laid off surplus force where practicable, and have stopped all new construction work, and are withholding orders for additional equipment. At this writing we have a surplus of equipment on our rails, and are turning back to connecting lines a considerable number of empty cars. —*Vice-President.*

We have already begun to retrench in our expenses, by stopping improvements and reducing forces in the shops. —*Vice-President.*

West.

We have pursued the customary policy of retrenchment to meet existing conditions as far as possible. We have not as yet reduced any wage scales recently advanced, but decrease in business has enabled us to reduce train mileage and make considerable saving in other directions. Our plans for construction work next year were not very extensive, and, based on the present outlook, they will be to a considerable extent carried out. We added quite largely to our equipment, both cars and power, during the past year, and it may not be necessary to make further additions to take care of the business of 1908. —*President.*

Our lines are retrenching and are deferring all construction work and improvements of every description that can be deferred without injury to the property. There has been some fall in the scale of wages of laborers, but in no other classes, and retrenchment simply lies in shortening hours and in reducing forces. —*Vice-President.*

We are retrenching in every possible way by stopping new construction and improvements—in fact, spending no money whatever which we can avoid without deterioration in that which we now have, and except where work previously commenced is so far advanced as to make its completion essential. There will be no equipment orders whatever during the year 1908. It will probably not be possible to reduce the wage scales for skilled labor. —*President.*

Pacific.

We are not planning any extensive retrenchment. Owing to common labor being very plentiful we have reduced the wages of some of our section men. We have stopped some unimportant new construction work, but are continuing all construction and maintenance work necessary to keep the property up to its standard. —*Vice-President.*

We have made no retrenchments any more than usual at this time of year. We are, however, intending to reduce wages in certain lines of labor about January 1. —*Vice-President.*

All construction work has been discontinued and we do not think it will be resumed until early spring, when, in all probability, work already started will be pushed to completion. We have only ordered a part of the equipment which we had figured on buying for 1908. —*General Manager.*

In the matter of retrenchment, we shall probably limit our new works to the completion of those begun the previous year, and not undertake anything further until times are better. What retrenchments are made in our labor force will be rather in the direction of reduced force or shortening of hours than any change in the wage scale. As to new equipment, we have ordered about the same average amount as preceding years. —*Vice-President.*

Mexico.

Retrenchment, such as good business principles demand during the present financial condition, any excess in operating expenses will be reduced according to present conditions only. —*Superintendent.*

Question 3.—Are you making any other efforts to check the prevalent large increases in operating expenses?

Central West.

We have been doing everything possible to check the large increase in operating expenses, but with the increased prices for both labor and materials of all kinds, the only way that reductions can be made is by entirely cutting out all work that can possibly be dispensed with. —*Vice-President.*

There are no efforts we can make to check the increase in operating expenses, except as above specified, and in reducing our train service wherever practicable. —*President.*

Every effort possible. —*President.*

Every possible effort is being made to prevent an undue ratio of operating expenses to earnings. —*President.*

Until the earnings very materially fall off, will not put in force economies that will affect the efficiency of our service. —*General Manager.*

We are reducing our forces in every department to check a probable large increase in expenses, so far as we can without affecting the safety of our patrons and without permitting the property to deteriorate, either as to its physical condition or its equipment. —*President.*

Only by an effort to a better education of our men as to cost of service, and their mutual interest with the company in the general operating results. —*Vice-President.*

It is possible we might take measures to reduce our operating expenses by 5 per cent. to 10 per cent. the coming year. —*President.*

General economies are being studied and applied as fast and as fast as is deemed wise. —*President.*

We are endeavoring to check the increase in operating expenses that have prevailed during the last two years. —*President.*

No. —*Vice-President.*

We are making every effort to check the large increase in operating expenses by reducing train service and in other ways cutting out all luxuries and extraordinary expenditures. —*President.*

We are not making any special effort to check the increases in operating expenses. —*General Manager.*

South.

We are making every possible effort to check the prevalent large increases in operating expenses, and with a good deal of success for many months past, in the items of car loading, engine loading and per diem as affected by the movement of foreign cars on our line. —*President.*

We are making every effort to check increases in the operating expenses, but the new legislation, particularly in Georgia and Alabama, makes it difficult to reduce. —*General Manager.*

We are making every effort possible to check the large increase

in operating expenses. This is a difficult matter to accomplish on account of the labor situation and increased cost of all material entering into the maintenance and operation of railroads.
General Manager.

We are making every effort to prevent any further increase in operating expenses consistent with the requirements of our State Corporation Commission, which does not permit us to decrease train service, which is the most effectual way to economize.
—General Manager.

Am making every effort to keep operating expenses down, and am watching car movements very closely, for, in this section, the handling of foreign cars is the weakest point.
General Manager.

Southwest

We are making strong effort to check increases in operating expenses by not increasing the salary of any man, and buying only such new material as is imperative. *Vice-President.*

There is very little opportunity to reduce operating expenses except by a decrease in rates of pay and in cost of all supplies and material used. *—Vice President*

We are making an effort to check the increase in operating expenses by a reduction in force. It is our intention to maintain cars, engines, etc., at least equal to their present standard. This will result in our maintenance expense showing some increases, as a great number of our cars are now coming home to us.
—Vice-President.

We are making efforts in every direction to check prevalent large increases in operating expenses. *Vice-President.*

West.

To check the large increases in operating expenses, renewed effort has been made to increase car and train loading by reducing in many cases the speed of trains to promote it.
Vice President

We feel that the high water mark has been reached and passed in the matter of large increases in operating expenses, and, except as accompanied by adverse legislation, look for reductions rather than increases. *President.*

Pacific.

We have in a few cases curtailed expenses in our stations by slightly reducing the help. *—Vice-President.*

We are reducing operating expenses as much as is consistent with efficient operation. We expect to cut down wages, which have been abnormally high, in some departments about January 1.
—Vice-President.

We are making a special effort to keep operating expenses down to the very lowest possible point. *—General Manager.*

QUESTION 4.—DO YOU ANTICIPATE ANY SHRINKAGE IN GROSS EARNINGS FOR 1908?

Central West.

With many industries shut down and the remainder working with reduced forces, it could hardly be expected that the gross earnings for 1908 will equal those of 1907.
—Vice-President.

I anticipate a shrinkage in gross earnings for 1908.
—President.

Yes. *—President.*

A considerable shrinkage in gross earnings is inevitable. The grain crop is below the average, the demand for building materials is less, and the combined effect will prevent an increase in gross earnings. *President.*

We anticipate material shrinkage in gross earnings for 1908.
General Manager.

I anticipate a shrinkage in gross earnings for 1908.
President

No. *Vice President.*

The A. B. gross receipts will probably not be decreased by the year ending June 30, 1908, but will be considerably less the following year. The C. D. gross earnings are likely to be increased in 1908 over 1907, due to new traffic arrangements made by which we secure additional tonnage from other sources than heretofore.
President

East.

We are hopeful for increased gross earnings in 1908. Everything now points to a handsome increase. *President*

We do anticipate a considerable shrinkage in gross earnings, for the present at least, but whether that will continue through the year 1908 will depend wholly upon whether the business of the country revives. A railroad is not a producer. It is simply a carrier of what other people produce, and therefore its income is wholly dependent upon the prosperity of its customers.
President

We anticipate some shrinkage in gross earnings.
—Vice-President.

We do not anticipate any shrinkage in gross earnings for 1908 compared with 1907, but we do not anticipate that the earnings will be as great as they would be if the financial depression had not appeared. *—President.*

We do not anticipate any shrinkage in gross earnings for 1908.
—General Manager.

South.

Fifteen to 20 per cent. reduction. *—President.*

I fear that shrinkage in gross earnings for 1908 is inevitable.
—President

We anticipate great shrinkage in gross earnings for 1908 for all the railroads in the South. *—General Manager.*

Shrinkage in gross earnings for the year 1908 seems inevitable.
—General Manager

Twenty per cent. reduction. *—General Manager.*

We hope to earn something more than this year.
—Chairman of Board.

We have reasonable ground to hope that the shrinkage in gross earnings, which the larger roads in this section seem to anticipate, will miss us, or touch us lightly. *—General Manager*

No. *—General Manager.*

Southwest.

I anticipate a considerable shrinkage in gross earnings for 1908, possibly 10 per cent. *—Vice-President.*

We anticipate about 50 per cent. shrinkage in gross earnings for 1908. *—President.*

In our territory, where our gross earnings are so largely affected by the result of our crops, we would not feel justified in making an estimate on gross earnings for the year 1908 as compared with the year 1907. *—Vice President.*

Gross earnings for 1908 will undoubtedly show a considerable decrease over 1907. *—Vice President.*

I anticipate a very considerable shrinkage in gross earnings in 1908 compared with 1907. *—Vice President.*

West.

As we think the tonnage carried by the roads will be reduced in 1908, there must necessarily be a shrinkage in gross earnings.
—Vice-President

It seems reasonable to anticipate a reduction of from 10 to 15 per cent. in the gross earnings for the ensuing year.
—President

Pacific.

I do not anticipate any shrinkage in the gross earnings for 1908.
—Vice-President.

We do not anticipate any large shrinkage in gross earnings. Up to the present they are considerably in excess of last year.
—Vice-President.

Expect quite a decrease in gross earnings for 1908, the extent of which, however, will depend entirely on 1908 grain and fruit crops. *—General Manager.*

QUESTION 5.—IF GROSS EARNINGS ARE LESS, DO YOU THINK OPERATING EXPENSES ON YOUR ROAD CAN BE SO REDUCED THAT THERE WILL BE LITTLE, IF ANY, LOSS IN NET?

Central West.

With the increase in wages in all lines of service and the increased prices of all materials, it would be impracticable to show the same net, even if the gross earnings were equal.
—Vice-President

I do not see how operating expenses can be reduced so as to meet this condition; the net must suffer a loss. *—President.*

Expenses cannot be reduced to an extent that will enable us not to show quite a loss in net. *—President.*

I do not think it possible to maintain the present ratio of net earnings for the ensuing year. *—President.*

With present rate of wages operating expenses cannot be so reduced that there will be little if any loss in net.
—General Manager.

I do not think the operating expenses can be so reduced so there will be little or no loss in net; on the contrary I anticipate a loss in net. *—President.*

Do not think any material reduction in operating expenses likely. *—Vice-President.*

We expect our net earnings for 1908 will be about equal to 1907.
—President.

East.

We believe there will be a good gain in net.
—President.

It is impossible to determine now whether the reductions in operating expenses can be made large enough to meet the losses in net for the reason that we cannot yet approximate what those losses will be. —*President.*

We think operating expenses can be reduced to very nearly offset shrinkage in gross earnings. —*Vice-President.*

Under the present plans, the operating expenses of this road will be reduced so that there will be no loss in net earnings. —*President.*

South.

We think loss in net is inevitable. —*President.*

We cannot keep off shrinkage of net revenue. —*President.*

I do not believe that operating expenses can be reduced so as to cover the loss in gross earnings without a sharp cut in wages. —*President.*

Cannot reduce operating expenses to make up for the loss in tonnage. —*General Manager.*

I do not believe that operating expenses can be reduced proportionately to reduction in gross earnings. —*General Manager.*

No. —*General Manager.*

With a shrinkage in gross earnings, it is hardly to be expected that our net earnings from operation could be maintained. —*General Manager.*

I expect to increase net earnings. —*General Manager.*

We cannot now forecast the maintenance of net earnings for the calendar year 1908. Were there no other factors—and the others are plainly indicated above—the unknown crop of the year—vegetables, cotton, corn and peanuts—forestalls any estimate of value. —*Vice-President.*

Southwest.

It will be impossible to reduce operating expenses to prevent considerable loss in net. —*Vice-President.*

We will try to hold our own in regard to operating expenses. —*President.*

With a heavy reduction in gross earnings, under present cost of labor, supplies and material, it is doubtful that there would not be some reduction in net earnings, even under the most watchful care and supervision. —*Vice-President.*

Under the present high wage schedules it will be impossible to reduce operating expenses to a point that will permit the net to remain stationary, and I look for a considerable decrease in the net. —*Vice-President.*

I don't think operating expenses are going to be so reduced that there will be little loss in net earnings, unless the trunk lines that fix the very large compensation paid to enginemen, trainmen, machinists and other shop men by contract, revise their contracts and make lower schedule of wages to apply during the depression. —*Vice-President.*

West.

It will probably be impossible to offset this entire shrinkage by a reduction in operating expenses, but probably two-thirds of the decrease can be so offset. —*President.*

I do not think operating expenses can be so reduced that there will be anything but a serious loss in net. By serious I mean that while we will in all probability earn a safe margin above our dividend payments we shall make a very unfavorable showing as compared with last year. —*President.*

It is difficult to forecast the effect on net earnings. There have been no material increases in rates, while state commission. have been reducing them quite generally. The 16-hour law affecting train service and the eight-hour law affecting telegraph operators the effect of both of which will mean large increases in operating expenses, have yet to be felt, as they take effect in March, 1908. The problem before operating officers of maintaining net earnings at the same figure as last year is, therefore, one presenting many difficulties. —*Vice-President.*

Pacific.

In case of a slight decrease in gross earnings I think operating expenses can be correspondingly decreased so as to leave no loss in net earnings. —*Vice-President.*

Do not think that operating expenses can be reduced except that wages of labor will probably be more reasonable. —*Vice-President.*

We expect to keep operating expenses down to a point which will avoid showing decrease in net earnings. —*General Manager.*

Canada.

I think that a lesser volume of traffic with the labor situation more amenable to control than has been the case in late years, should enable us to prevent much of a loss in net. —*Vice-President.*

Mexico.

Expect increase in tonnage during 1908 over 1907, with increased net earnings. —*Superintendent.*

QUESTION 6.—HAVE YOUR EXPENDITURES FOR MAINTENANCE AND BETTERMENTS BEEN ON SO LIBERAL A SCALE DURING THE PAST FEW YEARS THAT THE PROPERTY CAN GET ALONG FOR A YEAR OR SO WITH LESS EXPENDITURE, IF NECESSARY? HOW MUCH DO YOU EXPECT TO SPEND ON EXTRAORDINARY BETTERMENTS IN 1908, AS COMPARED WITH 1907?

Central West and Trunk Lines.

Our expenditures for maintenance and betterments have been fairly liberal during the past two or three years and can be reduced during the next year without injury to the property. Labor cost is about 15 per cent. more than it was a year ago. —*President.*

The property can get along for a year or more with less expenditure on maintenance of way owing to the present condition of the property. I do not expect that we will make any extraordinary betterments in 1908 beyond those compelled by law or ordinances, such as our work on track elevation at Joliet and the completion of some track elevation work in Chicago. —*President.*

Yes. I do not anticipate spending very much for extraordinary betterments. —*President.*

No expenditures for extraordinary improvements are to be made in 1908 beyond keeping the roadway and equipment in proper shape. —*President.*

Expenditures for maintenance and betterments during past few years have not been on so liberal scale that the property can get along for a year or more with any less. We will not spend as much on "extraordinary" betterments the coming year we did the past year. —*General Manager.*

Our expenditures for maintenance and betterments have been on such a scale during the past few years that we probably can yet along for a year or so with less expenditures, if necessary. I am not prepared at this writing to state what our expenditures on extraordinary betterments in 1908 will be, as compared with 1907. —*President.*

Yes, if absolutely necessary, but doubt the wisdom of the policy except under compulsion. —*Vice-President.*

Our expenditures for maintenance and betterments will be very much less in 1908 as compared with 1907, due to the extraordinary expenditures made during the past 18 months. —*President.*

The general physical condition of the property is such that we could probably get along for a year, if necessary, with very small maintenance expenses, but I do not think it will be necessary to allow it to depreciate in any way from its present good condition. Probably expenditures for extraordinary betterments will be less than during the year just passed. —*President.*

East.

Expenditures for maintenance, betterments and equipment have been very liberal since the company began to operate the railroad. The necessity for coming expenditure on those lines is to be insignificant, for some years, save to meet increasing traffic demands upon the property. Not 10 per cent. of the outgo in 1907, against the items named, need be expended in 1908. —*President.*

Our expenditures for maintenance and betterments have been so large during the past three years that the property will not suffer from retrenchment in these matters during the coming year. —*President.*

Expenditures for maintenance and betterments have been so liberal that this road can get along for some years with less expenditure. During the year ended June 30, 1907, the company spent $933,898 for additions and betterments. Since June 30, and to December 31, 1907, we will have spent about $400,000 more. Jan. 1, 1908, to June 30, 1908, we do not expect to spend anything; in other words our expenditures for extraordinary betterments will be practically nothing. —*Vice-President.*

Our expenditures for maintenance and betterments have been on a very liberal scale during the past few years, and the property is in very good condition, and we will get along for a year or two with less expenditures. —*President.*

This property can be maintained without any excessive expenditures for maintenance and betterments for a year or two. We expect to spend a similar amount on extraordinary betterments in 1908 as we did in 1907. —*General Manager.*

South.

We will not spend any more than enough to keep the property in safe condition. —*President.*

Our expenditures for maintenance and betterments have been on a liberal scale during the past few years and the property can get along for a year or so with reduced expenditures if necessary. I am having the data compiled, with reference to the extraordinary betterments in 1908 as compared with 1907 [illegible] information is not yet in hand. There will be a sharp reduction.

—President.

Our expenditures and improvements for betterments have been considerable and the property is in good condition and can be run with a considerably less force. Cannot advise you what we will spend for betterments in 1908.

—General Manager.

Our expenditures for maintenance and betterments have been on so liberal a scale for the last two years that we can get along for the next two years with small expenditure without serious deterioration to the property. The amount to be spent on extraordinary betterments for the year 1908 will not amount to more than 25 per cent. of the amount expended during the year 1907.

—General Manager.

No.

—General Manager.

Cannot give figures; will spend as little as possible.

—Chairman of the Board.

If necessary we can get along with less expenditure for maintenance and betterments than heretofore. We have expended little for betterments in 1907, and will expend little or nothing in that direction for 1908.

—General Manager.

It is expected that this year's expenditures will be larger than those of last year to bring condition of property to normal.

—General Manager.

Southwest.

Expenditures for maintenance and betterments have been immense, but the work is now only about 60 per cent. complete, so that we will not get much benefit from it in 1908. We expect to complete the betterment work between Texico and Woodward, Okla., 265 miles, in 1908, with possibly the exception of the ballast. The work consists in reduction of grade from 1 per cent. to six-tenths, of alinements of 6 deg. curves to two; permanent bridge work, and replacing 52-lb. and 56-lb. rail with 75-lb.

—Vice-President.

We shall keep expenditures for betterment and maintenance at a minimum.

—President.

Our property has been well maintained, from the standpoint of maintenance and betterments, and our expenses in this direction, if conditions required, could be reduced next year as compared with the current year.

—Vice-President.

Expenditures for betterments, maintenance, etc., have been on a liberal scale for some years past, and we are in shape to get along for a year or so with less expenditure for maintenance of track and equipment, if necessary, although our entire efforts will be directed toward keeping up our present standard as regards maintenance. Expenditures for extraordinary betterments during 1908 will be nil.

—Vice-President.

Our expenditures in betterments has been liberal during the past few years, and the property can get along for a year or more with less expenditure in that direction, except that before the panic struck us I contracted a $10,000 expenditure in the direction of strengthening several metal bridges that were erected when the railroad was built in 1880 and 1881. Our expenditures for equipment and betterments in 1907 aggregated $232,520; 1908 expenditures will be limited to the $10,000 above referred to.

—Vice-President.

West.

The condition of the property is such that, if necessary, it could be maintained satisfactorily for a year or more with less expenditure than in the past, but we do not anticipate a situation which will make this necessary.

—President.

Our expenditures for maintenance and betterments have been on an extremely liberal scale during the past few years, so that we think our property can get along with less expenditures for maintenance than have heretofore been made. The amount to be spent on betterments in 1908 will depend largely on financial conditions.

—Vice-President.

Our expenditures for maintenance and betterments during the last 10 years have been such that the property can be maintained at a minimum of expense. There will be no expenditures for extraordinary betterments.

—President.

Pacific.

Our property being comparatively new, we could very easily get along for a year or so with less expenditure for maintenance if necessary, but we do not anticipate that this will be necessary. I have no doubt we will spend on extraordinary betterments in 1908 as much as we did in 1907.

—Vice-President.

We have kept our track and equipment in first class condition and could, if necessary, considerably reduce maintenance expenses for a year or two. We do not expect to make any extraordinary betterments during 1908.

—Vice-President.

As for the last two or three years our expenditures for improvements and betterments have been on such a liberal scale we can get along for some time without any extraordinary expenses, if necessary to do so.

—General Manager.

Canada.

We do not expect to curtail any of our regular expenditures for maintenance of the property.

—Vice-President.

Mexico.

Expenditures for maintenance for 1907 have been in view of putting road in first class condition for anticipated increase of business.

—Superintendent.

QUESTION 7.—HOW DO YOUR LABOR COSTS COMPARE WITH THOSE OF LAST DECEMBER? HOW DO COSTS OF MATERIALS COMPARE?

Central West and Trunk Lines.

The increase in wage schedules plus the increase fc. overtime rules that have had to be conceded will run from 10 per cent. to 15 per cent. more than for the same period of last year, and the cost of material will run from 10 per cent. to 25 per cent. more.

—Vice-President.

Labor costs are considerably higher than last December, and also material.

—President.

An increase of about 7 per cent. in labor. Material about the same as last year.

—President.

There is as yet no decrease in current costs as compared with those of one year ago.

—President.

Labor and material costs, as compared to a year ago, equal about 10 per cent. increase.

—General Manager.

There is no material change in the cost of labor or material as compared with a year ago December.

—President.

Labor increased approximately 15 per cent., materials from 10 per cent. to 25 per cent.

—Vice-President.

Our labor costs are about the same as a year ago—December, 1906. The cost of material would average a trifle less than last December.

—President.

In a general way I should say that our labor costs are perhaps 10 to 12 per cent. higher than they were a year ago, but in the materials which enter most prominently into railroad operations the increase has been little, if any, during the past year.

—President.

East.

Moderate concessions have been made to labor within the year, but not to the extent where less numbers of employees cannot receive present wage and, on account of the betterments, perform December, 1906, work.

—President.

Labor with us is from 5 to 10 per cent. higher during December, 1907, as compared with December, 1906. With the exception of lumber and coal prices show a decided tendency towards a decrease over December, 1906.

—Vice-President.

Our labor costs, compared with last year, show an increase of 10 per cent.; costs of materials show an increase of 15 per cent.

—President.

There has been an increase of 10 per cent. in the cost of labor and 10 to 15 per cent. in the cost of materials.

—General Manager.

South.

In material about 10 per cent. and labor not over 5 per cent.; so far about 5 per cent. reduction in force.

—President.

Our labor cost compared with last December is probably 10 per cent. higher.

—President.

We have reduced price of labor, particularly on track. Have not noticed any less prices on metal materials yet, but they will come down soon.

—General Manager.

The rate paid our labor is about 7 per cent. greater than last December. Cost of material about 12 per cent. more.

—General Manager.

Considerably greater.

—President.

Both are larger.

—Chairman of Board.

The cost of both labor and materials is higher than in December, 1906.

—General Manager.

Labor about the same. Material is a little higher, but we purchase little.

—General Manager.

Southwest.

Cost of labor and material about [illegible] per cent. higher than last year.

—Vice-President.

Cost of labor is the same. Cost of materials about 10 per cent. less.

—President.

The cost of labor as compared with last December shows an increase of from 5 to 15 per cent.; the increased cost of material is even greater.

—Vice-President.

Labor costs as compared with December, 1906, show an increase of approximately 10 per cent. Costs of material show about the

same ratio of advance, although I look for a reduction in the cost of materials and supplies, commencing the first of the year.
—*Vice-President.*

Labor and materials have advanced greatly since last December. I haven't the figures at hand to give the per cent. of increase, but it is quite large. —*Vice-President.*

West.

There has been an increase of about 5 per cent. in the average wages of skilled labor since December, 1906. —*President.*

Labor costs in all departments, except track labor—which is about the same as last December; are very much higher. Costs of materials generally are higher, except lumber which has recently been somewhat reduced. Rail and track trimmings unchanged.

It is difficult to say what our labor costs are compared with those of last December, but there will be an increase of not less than 12 per cent. for the same amount of work. The cost of material has undergone a slight decline, but only in unimportant items. Steel and ties remain at the maximum prices. —*President.*

Pacific.

We are paying our skilled labor more this year than a year ago, but our unskilled labor a trifle less. Material, principally lumber, is less than last year. —*Vice-President.*

Labor and material are as yet about the same as last year.
—*Vice-President.*

We cut the rate for ordinary labor used in track work in the middle of November about 25 per cent. Rates for other labor practically the same as in December, 1906.

Cost of material is a little in excess of what it was this time last year. —*General Manager.*

Canada.

Labor is 10 per cent. or 15 per cent. higher than last December. Material about the same. —*Vice-President.*

Mexico.

Labor is cheaper and more plentiful at present time.
—*Superintendent.*

QUESTION 8.—HAVE YOUR EARNINGS, FREIGHT OR PASSENGER, BEEN MATERIALLY REDUCED BY STATE LEGISLATION THIS YEAR, AND DO YOU EXPECT A REDUCTION IN 1908 ON THIS ACCOUNT?

Central West and Trunk Lines.

The only reduction that we have suffered by legislative enactment is the 2-cent passenger fare law in Ohio and Pennsylvania, and as our passenger traffic was extremely thin, there was really no net money in the 3 cent fare which formerly prevailed. This enactment simply increased our burden just this much, as it is absolutely impracticable for us to haul passengers at a profit over our lines under a rate of 2 cents per mile. —*Vice-President.*

Our passenger earnings have been very much reduced on account of the 2-cent per mile passenger fare, which became effective Sept. 28. As a large portion of our mileage runs through a sparsely settled district of Michigan, reduced rates will not increase the travel.
—*President.*

Earnings, both freight and passenger, have been materially reduced by state legislation, and this undoubtedly will be reflected in the returns for 1908. —*President.*

Yes. —*President.*

There is a marked increase, over half a million, in taxes, and a consequent material reduction in net earnings. —*President.*

Passenger and freight earnings have not been materially reduced by state legislation, except that we believe the 2-cent law in Ohio, Indiana and Illinois has resulted in reducing our earnings, but with material growth in passenger business the loss has been largely overcome—this, we believe, not entirely due to cheaper fares.
—*General Manager.*

Our earnings on freight and passengers have been materially reduced by state legislation, and I anticipate a reduction in 1908 on this account. —*President.*

Slightly. Anticipate further reduction in 1908.
—*Vice-President.*

We do not expect that our earnings will be materially affected the coming year by any state legislation —*President.*

There is no question that our earnings have been reduced to some extent by state legislation during the year, but not to any such extent, proportionately, as our compensation for carrying the mails. In connection with the action of Congress, which resulted in decreasing our earnings by about 10 per cent., the Postmaster-General, on the day of adjournment of Congress, made a further reduction of about 15 per cent., so that the compensation for the carriage of mails within the last year has been cut about 25 per cent.
—*President.*

East.

Earnings have not been affected by state legislation.
—*President.*

There has been no legislation in the states within which we operate that will affect our rates, and we have no [illegible] that any legislation will be made during the coming year that will change present conditions. —*President.*

Earnings have not been materially reduced by legislation [illegible] we do not anticipate any change in this respect.
—*Vice-President.*

Our passenger earnings have not been materially reduced by direct legislation, but indirectly we made some concessions which stopped some direct legislation which would have seriously affected us. We do not expect a reduction in 1908 on this account.
—*President.*

Earnings, freight or passenger, have not been reduced by state legislation during 1907. —*General Manager.*

South.

Greatly hurt. —*President.*

By being a small line no direct reductions, only loss by indirect competition with large line reductions. —*President.*

Our passenger earnings have been irregular in Georgia since the $2\frac{1}{2}$-cent rate was put into effect, but there is no doubt, as shown by analysis, that we shall show not only reduced earnings compared with last year, to say nothing of the normal increase which we have shown from year to year. —*President.*

Our earnings of both passenger and freight have been materially reduced by state legislation this year, and there will be the same conditions in 1908, as the new laws of Alabama and Georgia reduce freight rates. —*General Manager.*

Our earnings have been materially reduced by state legislation this year. We do not expect a reduction in 1908 on this account; at least we hope that such will not be the case.
—*General Manager.*

Yes. —*President.*

Too soon to tell. State legislation has only affected passenger rates. —*Chairman of Board.*

We are operating 85 miles of road in West Virginia through the mountains in a district where a traveler would formerly gladly pay from 25 to 50 cents per mile if he could escape going that way. Our railroad, built at an average cost of $100,000 per mile and dependent entirely upon a sparse local business is only allowed to charge [illegible] cents per mile. —*General Manager.*

There has been no legislation to reduce either passenger or freight rates during 1907, but our passenger fares have been reduced one-eighth by the State Corporation Commission, which is much less than the general reduction in this state.
—*General Manager.*

The Georgia Railroad Commission has treated these small roads very leniently. Earnings have not suffered therefrom, and it is not thought they will in 1908. —*General Manager.*

Southwest.

There has been reduction in passenger earnings from 3 to 2 cents in Oklahoma and some slight reduction in Texas, due to Railroad Commission order, and considerable reduction in New Mexico due to interstate rulings. —*Vice-President.*

Freight and passenger earnings have been materially reduced this year, but I cannot say that it was wholly due to legislation. We hope for better things in 1908. —*President.*

Our freight and passenger earnings have not been materially affected by state legislation this year. The 2-cent passenger rate bill before the last Texas legislature was defeated and our legislature only convenes biennially. Therefore, we are not looking for any material change, brought about by state legislation or by further reduction in freight rates by the Railroad Commission, during the year 1908. —*Vice-President.*

Earnings, both freight and passenger, have been materially reduced by state legislation, and the year 1908 will undoubtedly show still further reductions, although it is only fair to say that many of the reductions made during 1907 did not become effective until the year was half gone. —*Vice-President.*

Our gross earnings have not been reduced by state legislation during this year, nor do I expect a reduction from that cause during 1908, but our expenses are being largely increased by acts of the thirtieth Texas legislature. —*Vice-President.*

West.

Earnings, both freight and passenger, have been materially reduced by state legislation, and a similar reduction will continue in the future. This reduction has been offset to a large extent the past year by exceedingly favorable business conditions generally, hence the reduction will be relatively of more moment in 1908 than in 1907. —*President.*

Earnings, both freight and passenger, have been materially reduced by the action of state legislatures and commissions, and as these laws will be operative through 1908 the reduction for that year will be greater than in 1907, as they were operative only a part of the year. —*Vice-President.*

Our passenger earnings have undergone a serious reduction by state legislation, and efforts are being made by several state commissions to make reductions in freight rates. —*President*

Pacific.

I do not believe our earnings, either freight or passenger, have been materially reduced by state legislation this year, nor do I anticipate any reduction from that cause the coming year. —*Vice-President*

Our freight and passenger earnings have not been reduced by state legislation. —*Vice-President.*

Do not think freight or passenger earnings will be affected to any great extent by state legislation this year. —*General Manager*

No material reduction that we can point to as the result of state legislation. —*Vice-President.*

QUESTION 9.—HOW MUCH HIGHER WILL YOUR TAXES BE IN 1908 THAN THEY WERE IN 1907?

Central West and Trunk Lines.

We could only approximate what the increase in taxes might be. There is a movement on foot, however, to force the railroads of this section to pay considerably higher taxes, but just what it will amount to we cannot foretell. —*Vice-President*

Do not anticipate any increase in taxes. —*President*

In hope there will be no material increase. —*President.*

Our taxes will be about the same as 1907. Our valuation for taxation purposes was increased during the years 1905 and 1906 39 per cent. —*President.*

It is impossible to forecast what the legislatures now convening in the several states may do in the way of further unfavorable corporate legislation. The impression is gaining ground that they will do less in the way of further oppression of railroad corporations this session than last. —*President.*

Taxes have increased about $3\frac{1}{2}$ per cent. on our gross earnings the past year. —*General Manager.*

Our taxes will be, approximately, $80,000 higher in 1908 than they were in 1907. —*President.*

Uncertain. —*Vice-President.*

About the same. —*President.*

East.

This year's taxes will not appreciably differ from those of last year. —*President.*

Railroad taxes in the states in which we operate are levied under laws which have not been changed, and I do not, therefore, anticipate any material increase in the total of our taxes during the coming year. —*President.*

Our taxes were increased during the year ended June 30, 1907, and show an increase of 92.25 per cent. over year ended June 30, 1906. We expect a slight increase for year ending June 30, 1908. —*Vice-President*

Our taxes in 1908 will be 15 per cent. higher than they were in 1907. —*President.*

Taxes in 1908 will be the same as they were in 1907. —*General Manager.*

South.

Do not look for any change. Increase of 1907 over 1906 about 20 per cent. —*President*

Our taxes in 1908 will probably be $125,000 in excess of 1907. —*President*

We have not yet had any intimation regarding taxes that will be in 1908, but suppose that they will be again raised. —*General Manager.*

Our taxes will be about 10 per cent. higher for 1908 than they were in 1907. —*General Manager*

Ten per cent. higher. —*President*

A little higher, not a great deal. —*Chairman of the Board.*

Taxes for 1908 will depend upon the assessments to be made by the State Corporation Commission on the first of September next and the county and municipal rates of taxation for 1908, but we do not anticipate any material increase in the taxes over those just paid for 1907. —*General Manager*

There are no new bases of assessment in either of our states that will increase our taxes in 1908. Our gross taxes will be materially increased in that year by the creation of additional property in the new lines. —*Vice-President*

About the same. —*General Manager*

Southwest.

It is impossible to estimate the taxes exactly in 1908, but we expect them to be about 5 to 8 per cent. higher than in 1907. —*Vice-President*

Should be about the same. —*President*

The new tax bills passed by the last Texas legislature increased our taxes about $150,000 for the year 1907. We do not expect an increase in the year 1908. —*Vice-President.*

I look for an increase in taxes. The tendency for some years past has been toward a gradual increase, both in the assessed valuation and the rate of taxation. —*Vice-President.*

Our taxes in 1908 will be nearly double the amount paid in 1907. —*Vice-President.*

West.

Taxes in 1908 will probably be higher than in 1907. The tendency is universal to increase taxes, and every month of the present fiscal year is showing a large increase over the corresponding month of last year, the average being about 10 per cent.

In some states we are still being taxed on the basis of gross earnings, and as it is impossible to state to what extent our gross earnings will be reduced we cannot give an intelligent estimate of the total of the taxes for 1908 as compared with 1907. —*President*

Pacific.

Somewhat higher. —*Vice-President*

About double what they were in 1907. —*Vice-President*

We estimate that our taxes for 1908 will exceed those for 1907 to the extent of about $50,000. —*General Manager*

Canada.

Taxes about the same as last year. —*Vice-President.*

QUESTION 10.—IS LOCAL POPULAR FEELING IN YOUR TERRITORY AS MUCH OR MORE ANTI-RAILROAD AND ANTI-CORPORATION THAN IT WAS LAST DECEMBER? DO YOU SEE ANY SIGNS OF REACTION TOWARD A KINDLIER FEELING?

Central West and Trunk Lines.

Local popular feeling seems to be undergoing a change in our territory, as the inability of the railroads to go ahead with their improvements, because of lack of money, has had a reflex action upon the industries served by these roads, many of which have been compelled to close down, forcing large numbers of workmen out of employment, and the people are beginning to ask themselves whether the railroads and other large corporations really deserve the extreme punishment that has been inflicted upon them during recent years. —*Vice-President.*

I believe it is the consensus of opinion locally that anti-railroad legislation has probably gone a little too far. We have no session of the legislature this coming winter. —*President.*

I do not think the local popular feeling against the railroads is as great now as it was last December. —*President.*

No let up as yet. —*President.*

Local popular feeling on line of road seems less antagonistic than a year ago, but railroad commissioners in all states are exercising very inquisitive jurisdiction over the railroads, making it more expensive on that account to operate. —*General Manager.*

The local popular feeling in this territory is not as much anti-railroad or anti-corporation as it was last December. I see decided signs of reaction toward kinder feeling. —*President.*

Can see but little change. —*Vice-President.*

The local popular feeling in this territory does not seem to be as strongly anti-railroad or anti-corporation as it has been previously. —*President*

I am somewhat inclined to believe that there is a more kindly popular feeling manifesting itself in our territory, or perhaps it would be better to say a less bitter feeling, than existed a year ago, and this is evidenced to a large extent by the tendency on the part of the local press to give the railroads an opportunity to be heard in various questions that arise. I believe this feeling will continue to grow, but its growth must depend very largely upon the different railroad managements and the attitude which they assume in meeting and conferring more than they have heretofore done with the leaders of public opinion in the various communities. —*President*

East.

Popular feeling in our territory never was so cordially kind toward us. —*President*

There has not been in this section as much local popular feeling against railroads and other corporations as in other parts of the country, although there has been more of this feeling than was pleasant to encounter. I think, however, there is a slight improvement in this particular. —*President.*

Local popular feeling in our territory seems to be more kindly than in the past. —*Vice-President.*

We think the local popular feeling in our territory is more kindly than it was a year ago, taking all things into consideration. —*President.*

The anti-railroad and anti-corporation feeling in this territory is about the same as it was last December Do not see any signs of reaction toward a kindlier feeling. —*General Manager.*

South.

Prejudice subsiding to some extent. —*President.*

There is every indication of a large change in public sentiment with reference to the railroad question in this territory. The general impression seems to be that measures against railroads have been too drastic and have been pushed too far. —*President.*

The local popular feeling here is not as much averse to railroads and corporations as it was a year ago. I believe the people see that mistakes have been made by the legislatures and that it will have the effect of lessening this prejudice in another year. —*General Manager.*

The local feeling in our territory is much less of an anti-railroad and anti-corporation character than it was last December. There are also signs of a reaction. —*General Manager.*

Feeling is more kindly. —*President.*

The feeling is better. —*President.*

Popular feeling has become more anti-railroad during the past year, and there are no material signs of a reaction as yet. —*General Manager.*

The pendency of litigation in the rate cases in North Carolina must necessarily curb any immediate further radical tendency. —*Vice-President.*

The feeling, never very bad in this section, is now better. —*General Manager.*

Southwest.

We think we can see a revulsion of feeling in our territory and a kindlier feeling toward railroads and corporations than last year, at least among business men. A great many business men are beginning to see that their interests are very closely linked with the prosperity of railroads. In evidence of this is the action of the lumber men and grain men in Texas, in making an effort to reduce the severity of reciprocal demurrage rules proposed by legislation and the Texas Commission. There is not much of a change in Oklahoma, although political conditions there have absolutely tied up further construction, and it is expected the feeling will change there. —*Vice-President.*

We feel that there has been a slight reaction in regard to the kindlier feeling. —*President.*

We feel that the popular feeling in our territory is gradually becoming more conservative toward railroad and other corporations, and that the bitter feeling that has been worked up against all corporations has now passed the "high-water mark," and we can see signs of reaction. In our opinion, the kindlier feeling is gradually developing. —*Vice-President.*

There is a tendency toward a kindlier feeling on the part of the public in regard to corporations, largely due to the present financial conditions. The fact that the government, national and state, have been making war on corporations, has caused a general fear of panic, and thinking people to stop and reason. If the practically universal onslaught by the various state legislatures and candidates for office continues against railroad corporations, it will undoubtedly eventually apply to all property interests. The heavy fine against the Standard Oil Company, and the various suits brought by the attorneys-general of the many states against the different corporations, under the various anti-trust laws, has caused some reaction in feeling, and the people to see the effects of political agitation. —*Vice-President.*

I think popular feeling in our territory is not quite so radical against corporations as it was a year ago, and I think I see decided signs of reaction; in other words, we are not "held up" quite so often as we were a year ago, except by men who handle live stock, who continue to handle the railroads through the courts in such a way as to make the business unremunerative regardless of the market. In former years shippers of live stock were apparently satisfied if they secured from the railroads, in the way of claims, an amount to cover the freight charges, but at the present time they are exacting not only a rebate of the charges, but in a good many instances demand payment to almost the full value of the animals being handled. —*Vice-President.*

West.

There has been a marked recession of the anti-railroad disposition in the territory served by this company. While it still exists in many quarters, we believe the majority of the communities served by our lines believe that anti-railroad legislation has gone too far already, and no encouragement will be given a continuance of the legislative policy which has been so marked the past two years. —*President.*

I think I see some signs on the part of thinking men in some of the states through which we pass of a kindlier feeling toward the corporations, and a query as to whether persecution has not been carried to excess—but it has not reached the state officials. They still seem to feel that their political future depends on harassing the railroads in every possible way. —*President.*

We think local popular feeling in our territory is decidedly less hostile than it was last December. We believe the people generally, and the press in some cases, are realizing that the railroad corporations have been seriously crippled by the action of the politicians during the past year. The people are beginning to realize that the coal famines, congestion of freight and impossibility to provide empties, questions that were so acute last winter, were not due to the "pure cussedness" of railroad officers but largely to conditions over which they had no control; in other words, they are being educated and are beginning to understand the situation. —*Vice-President.*

Pacific.

I do not believe that the popular feeling in our territory against railroads and other corporations is as strong this year as a year ago. I believe the tendency is toward a kindlier feeling on the part of the public. —*Vice-President.*

Local popular feeling toward corporations about the same as heretofore. The only agitation against railroads in this section of the country is on the part of lumber shippers, whose rates to the east have recently been increased. —*Vice-President.*

There is quite a strong anti-railroad feeling in this section at the present time, but I do not think it is as strong as it was a year ago, for the reason that this feeling culminated to a certain extent in the appointment of railroad commissions in both Oregon and Washington at the last legislatures. —*General Manager.*

Canada.

Have not noted any particular change. —*Vice-President.*

QUESTION 11.—IF THERE ARE NEW STATE ELECTIONS IN YOUR TERRITORY THIS YEAR, DO YOU ANTICIPATE THAT THE SUCCESSFUL CANDIDATES WILL BE MORE OR LESS RADICAL THAN THE LAST CROP?

Central West and Trunk Lines.

In the present state of the public mind, it is difficult to anticipate whether successful candidates will be more radical than formerly, as it will depend entirely on whether the people wish to continue the present agitation against corporate interests. —*Vice-President.*

I do not think in the case of new elections that the successful candidates will be as radical as they have been in the past. —*President.*

Nothing apparent to hope for. —*Vice-President.*

There were no new state officers of any prominence elected in this state this year. We expect, in the coming election, candidates of less radical nature will be more successful. —*President.*

East.

The railroads have not been made, to any great extent, a political issue in this section, and I therefore anticipate no troubles from that source. —*President.*

In New York, state elections, we think, have resulted in a less radical crop of office holders than last year. In New Jersey, possibly more radical, however, than a year ago. —*Vice-President.*

While there are no new state elections in our territory this year, we are of the opinion that if there were the successful candidates would not be as radical as the last ones elected. —*President.*

South.

New candidates will be more conservative. —*President.*

I believe the people in the southern states in which we are interested, will be glad to put into office within another year men who are less radical about corporations, for a large portion of the public see now that the stringent laws recently enacted are injuring the development of these states. —*General Manager.*

Less radical. —*President.*

About the same. —*Chairman of Board.*

So long as the popular sentiment is against railroads and other corporations, there is little doubt that the successful candidates will be those that avail of it to the best advantage. —*General Manager.*

It is considered that the anti-railroad feeling has run its course in this section. —*General Manager.*

Southwest.

Candidates for election are apparently of the radical sort, but while apparently none of them has abandoned the motto of "[illegible] to Corporations," some of them have received pretty strong hints that may cause them to mollify their propositions; even the Farmers' Union has refused to accept the dictates of several prominent candidates. —*Vice-President.*

Our next state election will be held in November, 1908, and there will be no change in our state officials until January, 1909. It is probable that the present state officials will be re-elected.
—Vice-President.

All the states touched by our rails will have elections during 1908. It is rather difficult to say what the successful candidates will stand for, although we look for no improvement in the aspect of the state legislature, for the reason that the political situation in most of the states is controlled by the demagogue politician.
—Vice-President.

Texas elects a Governor next year and it goes without saying that it will re-elect the same malignant demagogue that now fills that position. No crime could be committed by a Governor in Texas that would prevent his re-election to a second term, unless he should turn his coat entirely wrong side out and make a display of decency and business ability in handling the legislature in matters where corporations are concerned.
—Vice-President.

West.

I do not think new state elections would be effective or that there will be any radical changes in the attitude of the successful candidates unless and until a reaction more apparent takes place among the voters.
—President.

We hope the successful candidates will be fairly representative of popular feeling, which is distinctly less hostile than a year ago.
—Vice-President.

QUESTION 12.—WHAT IS YOUR ESTIMATE OF THE FIRST YEAR'S WORK OF THE INTERSTATE COMMERCE COMMISSION UNDER THE NEW LAWS?

Central West and Trunk Lines.

Most of the work performed by the Interstate Commerce Commission since the new law went into effect would be unobjectionable to the railroads of the country, as the roads generally have been honestly and squarely conducted, and have nothing to conceal. Some burdens have been added in the methods of accounting, which do not seem to me to be justified, but these matters will all be threshed out and the roads will adjust themselves to the new conditions in due time. No doubt much good will result from the work of this commission. The work of the Interstate Commerce Commission can hardly be attributed as the cause of the lack of confidence on the part of the people in this country and abroad in the stability of the railroads and other large corporations, because the railroads can unquestionably adjust themselves to the rules and regulations laid down by the Commission, the members of which and their assistants seem to be thoroughly fair men, but the continued agitation reflected from the National Capitol back to the state and municipal corporations has prompted the enactment of very stringent and arbitrary local laws that have injuriously affected the earning capacity of the roads. It could hardly be fairly said that any action on the part of the Interstate Commerce Commission has caused the lack of confidence in the stability of the railroads of the country which has prompted the monied people to tighten up on their "purse strings," thereby retarding the development of the railroad facilities. It would probably be more nearly correct to assume that the holding up to public odium of the prominent railroad men of the country and generally advertising all over the world some of their shortcomings, ignoring entirely any of the good things which they have accomplished, has made the people of this country and abroad believe that our railroad system is all wrong and that we are, as a class, a lot of highwaymen, when as a matter of fact there is less return on capital invested in railroads in this country to-day than in any other industry, and it is also probably fair to assume that an examination of the history of the railroad men in this country will compare favorably from the standpoint of honor, integrity and stability with any other class of business men.
—Vice-President.

It would take too much time to answer intelligently this question. Generally speaking, the Commission has not been able to do much during the past year. Of course, whatever has been done is in the direction of reducing our rates, but it is safe to say that it has been conservative so far.
—President.

I think the Commission's work has been good.
—President.

Our estimate of the first year's work of the Interstate Commerce Commission, under the new laws, is that the Commission is getting experience and knowledge, and until it gets down to a working basis we cannot tell to what extent it may affect us. We look for some relief from Congress in the enactment of a pooling law, under supervision of the Interstate Commerce Commission, which will help earnings in competitive territory.
—General Manager.

We feel the Commission's work in the main has an educational result that will work to the ultimate advantage of both the public and the railroads, bringing more conservative legislation, more liberal consideration by the public and a more strict regard by the railroads of their public duties.
—Vice-President.

We do not feel competent to answer this question at the present time with the information we have before us.
—President.

The work of the Interstate Commerce Commission during the past year under the new laws has, I think, been about what might have reasonably been expected. The system of accounting which they have prescribed is, in the main, excellent and in most respects a very able [illegible]. Unfortunately, it was adopted without consultation with or consideration by the actual executive and responsible officers of the railroads. It should be noted, I think, in this connection, that it is the determination on the part of the Federal Government to enforce the law rather than the actual law itself, which has brought about the principal improvement in the situation. Every indictment so far found against a railroad company or a corporation has been under the old Interstate Commerce Act and the Elkins amendment. One important feature of the new law has been the operation of the thirty-day clause. This, in connection with the great cost of the tariffs, has made changes in the tariff much less frequent, and it is evident that tariffs are, as a rule, becoming more and more inflexible. In connection with this feature there are some advantages, but at the same time there are also some marked disadvantages. In other words there is a good deal to be said on both sides of the question.
—President.

East.

We are not able to pass judgment upon the year's general work of the Interstate Commerce Commission under the new laws. In such matters as we must study and as are brought to our notice differences of interpretation arise and are confusing. Arbitrary decrees, even if strained, are sometimes better than doubt. The public has, notoriously, been unreasonable in clamor against the physical operation of railroads. It has not been allowed to, even if it would, regard that as distinct from manipulation. The physical operation of railroads is a serious problem. For the best results to the people it requires toleration and consideration by the people. It has been of little use for those wrestling with the railroad side of the problem to so state. There has appeared to be no one representing all the people to state it. The present demonstration may, in the big plan, have its uses.
—President.

We are hardly in position to give you any intelligent expressions of the first year's work of the Interstate Commerce Commission under the new laws. From our standpoint it is too soon to judge.
—Vice-President.

I think we are in the same position as other railroads in that we have been so busy compiling reports and giving information to the Interstate Commerce Commission and the state commissions that we have not had time to conclude whether the first year's work is beneficial or otherwise. So far we might say that we have not been affected.
—President.

Have not as yet formed an opinion in regard to work of Interstate Commerce Commission under new laws.
—General Manager.

The first year's time of the Interstate Commerce Commission has been so largely devoted to determining its forms of procedure, and in interpreting the new provisions of the Interstate Commerce law, that nothing seems yet to have been done disastrously affecting any of the interests involved.
—President.

South.

You can judge the effect in reductions and value of stocks and bonds, which shows the effect of the rate making power. The states, however, do more harm than the National body, but the inspiration was given them by Roosevelt and Congress.
—President.

Without attempting to say anything in detail with reference to the first year's work of the Interstate Commerce Commission, I have been impressed with the conservatism of this Commission, and of all the powers designated to deal with the railroads, the Interstate Commerce Commission seems to have manifested a more just and liberal spirit than any of the others.
—President.

The Interstate Commerce Commission has performed a good work but makes the mistake of condemning all railroads by the acts of a few of them.
—General Manager.

The first year's work of the Interstate Commerce Commission seems to have been fairly good.
—General Manager.

It is preliminary to finally reaching good results.
—General Manager.

The new Interstate Commerce law mainly affected us in the curtailment of passes, greater stability of rates, increased clerical cost and impairment of net earnings to extent of the charges for depreciation of equipment.
—Vice-President.

Decidedly good as seen from the purview of these small roads.
—General Manager.

Southwest.

I have not been able to decide whether the first year's work of the Interstate Commerce Commission has resulted in benefit or injury. I feel they have reduced some rates too low, but from their own viewpoint I believe they have intended to be absolutely fair, but some of their rulings appear to be ill-advised, from a railroad point of view. —*Vice-President.*

It will be some time before an intelligent reply can be made to this question. —*President.*

As far as this company is concerned, we believe, as a whole, the new law has been beneficial to this company. —*Vice-President.*

The work of the Interstate Commerce Commission this year would indicate a disposition on their part to treat fairly with the railroads, and we have no criticism to make. —*Vice-President.*

West.

We have faith in the integrity and intelligence of the Interstate Commerce Commission, and believe that its work the past year has been very beneficial in preventing destructive forces achieving the results which might otherwise have been accomplished. Constructive action on the part of the Commission will doubtless follow in due course, and from such action we believe the railroads will derive a fair portion of benefit as compared with the public. —*President.*

We think the railroads have very little to complain of from the first year's work of the Interstate Commerce Commission under the new laws. The Commissioners have shown a spirit of fairness that has been very encouraging and reassuring, and we think through their instrumentality and decisions of controversies the public will be educated and harmonious relations will be promoted. —*Vice-President.*

In general I think the Interstate Commerce Commission is to be congratulated upon the way it has started out. I believe it is making a sincere effort to divest itself of prejudice and to be a judicial body as it always should have been. —*President.*

Pacific.

I am not prepared to give an estimate of the first year's work of the Interstate Commerce Commission under the new laws. I believe it is an intelligent body of men and aims to do right by both corporations and the public. But at the same time it has an enormous task before it and I do not believe any estimate could be made on its work at this time. —*Vice-President.*

Important Changes in Railroad Officers in 1907.

The following list of official changes during the past year while not complete is intended to show the more important executive appointments by the larger railroads. Some appointments which reflect changes of ownership are also included. Similar lists were published in the *Railroad Gazette* of December 29, 1905, and December 28, 1906.

Astoria & Columbia River.

April—C. M. Levey, Third Vice-President of the Northern Pacific and President of the Portland & Seattle elected President.

Atlantic, Birmingham & Atlantic.

April—J. R. Rowland, Traffic Manager of the Brunswick Steamship Co., appointed Traffic Manager.

October—H. M. Atkinson, President, appointed also General Manager, succeeding to some of the duties of G. D. Wadley, Second Vice-President in charge of construction.

Baltimore & Ohio Southwestern.

January—C. C. F. Bent, General Superintendent of the Baltimore & Ohio, appointed General Manager of the Baltimore & Ohio Southwestern.

Bangor & Aroostook.

October—O. Stewart, Superintendent of Motive Power and Equipment, retired after 60 years of railroad service.

Boston & Albany.

October—A. H. Smith, Vice-President and General Manager of the New York Central & Hudson River appointed also Vice-President and General Manager of the Boston & Albany.

—J. H. Bustis, General Superintendent of the Western division of the New York Central & Hudson River, appointed Assistant General Manager.

—R. D. Smith, Mechanical Expert of the Lake Shore & Michigan Southern, appointed Assistant Superintendent of Motive Power in special charge of the Boston & Albany.

Boston & Maine.

January—Henry Bartlett, Superintendent of Motive Power, appointed General Superintendent of the Mechanical Department.

Buffalo & Susquehanna.

May—Charles W. Goodyear, First Vice-President, elected President, succeeding F. H. Goodyear, deceased.

—A. C. Goodyear elected First Vice-President.

Buffalo, Rochester & Pittsburgh.

July—R. W. Davis, General Freight Agent, appointed Freight Traffic Manager.

November—E. F. Robinson, Assistant Engineer of Tests, appointed Chief Engineer.

Canadian Northern.

July—M. H. McLeod, Chief Engineer, appointed General Manager.

Canada.

March—H. R. Emmerson, Minister of Railways and Canals, resigned.

September—George P. Graham appointed Minister of Railways and Canals.

Canadian Pacific.

February—G. J. Bury, General Superintendent, appointed Assistant General Manager of Western Lines in charge of maintenance and operation.

March—J. E. Schwitzer, Principal Assistant Engineer, appointed Assistant Chief Engineer, with headquarters at Winnipeg.

Chicago & Alton.

October—Edwin Hawley, President of the Minneapolis & St. Louis and the Iowa Central, elected Vice-President of the Chicago & Alton.

—T. H. Hubbard, Vice-President of the Toledo, St. Louis & Western, elected Chairman of the Board of the Chicago & Alton. The various departments of the Toledo, St. Louis & Western and the Chicago & Alton combined in this and succeeding months.

December—Theodore P. Shonts, President of the Toledo, St. Louis & Western, elected also President of the Chicago & Alton.

—George H. Ross, Second Vice-President and General Traffic Manager of the Toledo, St. Louis & Western elected also Vice-President of the Chicago & Alton.

—W. L. Ross, General Freight and Passenger Agent of the T. St. L. & W., appointed General Traffic Manager of the Toledo, St. Louis & Western and the Chicago & Alton.

Central Vermont.

November—William Kennedy, Master Mechanic of the Grand Trunk at Toronto, appointed Superintendent of Motive Power of the Central Vermont, succeeding Archibald Buchanan, Jr., now Chief of the Bureau of Inspection of the New York Public Service Commission, Second district.

Chesapeake & Ohio.

May—H. T. Wickham, General Solicitor, appointed General Counsel.

—H. W. Fuller, General Passenger Agent, appointed Passenger Traffic Manager.

Chicago & North-Western.

January—S. M. Braden, Superintendent at Chicago, appointed General Superintendent of the Lines West of the Missouri river.

Chicago, Burlington & Quincy.

October—Frank E. Ward, General Manager of the Great Northern, appointed General Manager of the Burlington Lines East of the Missouri river, succeeding J. M. Gruber, appointed General Manager of the Great Northern.

Chicago Great Western.

December—Otto Cornelisen, Superintendent of Transportation, appointed General Superintendent.

Chicago, Milwaukee & St. Paul.

January—E. S. Keeley, General Freight Agent, appointed Freight Traffic Manager.

June—H. R. Earling, Assistant General Superintendent, appointed General Superintendent of Western lines, including the Pacific extension, with headquarters at Butte, Mont.

Chicago, Rock Island & Pacific.

March—W. S. Tinsman, General Superintendent of the Southwestern district, appointed Assistant General Manager.

—W. J. Tollerton, Superintendent of Motive Power at Topeka, appointed Assistant General Superintendent of Motive Power.

May—E. L. Pollock, Purchasing Agent of the New York, New Haven & Hartford, elected Vice-President in charge of purchases of the Chicago, Rock Island & Pacific, the St. Louis & San Francisco, the Chicago & Eastern Illinois and the Evansville & Terre Haute.

Chicago, St. Paul, Minneapolis & Omaha.

October—W. A. Gardner, Vice-President of the Chicago & North-

Western, elected President, succeeding Marvin Hughitt, now Chairman of the Executive Committee.

Cincinnati, New Orleans & Texas Pacific.

January—G. P. Biles, General Freight Agent, appointed Freight Traffic Manager of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern.

August—T. C. Powell, Vice-President of the Southern Railway, elected also Vice-President of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern, in charge of the operating and purchasing departments.

October—W. S. Andrews, Assistant to the General Manager, appointed General Superintendent of Transportation of the Cincinnati, New Orleans & Texas Pacific.

Colorado & Southern.

April—J. D. Welsh, Superintendent, appointed General Superintendent in charge of transportation, motive power and maintenance of way, succeeding J. H. Young, General Manager, resigned.

Colorado Southern, New Orleans & Pacific.

February—A. J. Davidson, President of the St. Louis & San Francisco, elected also President of the Colorado Southern, New Orleans & Pacific.

September—J. H. Elliott, General Superintendent of the Third district of the St. Louis & San Francisco, elected Vice-President and General Manager of the Colorado Southern, New Orleans & Pacific.

Corvallis & Eastern.

January—J. P. O'Brien, Vice-President and General Manager of the Oregon Railroad & Navigation, elected also President of the Corvallis & Eastern.

Delaware & Hudson.

February—W. J. Mullen, Assistant to the Second Vice-President, appointed General Traffic Manager.

April—L. F. Loree, Chairman of the Executive Committee of the Kansas City Southern, elected also President of the Delaware & Hudson, succeeding David Willcox, deceased.

May—C. S. Sims, Assistant to the President of the Erie, appointed General Manager.

June—C. S. Sims, General Manager, elected Second Vice-President and General Manager, succeeding Abel I. Culver, resigned.

October—W. H. Williams, Assistant to the President, elected Third Vice-President.

Denver & Rio Grande.

May—W. S. Martin, General Manager of the Mexican International, appointed Assistant General Manager of the Denver & Rio Grande.

Detroit River Tunnel.

November—W. J. Wilgus, who resigned in October as Vice-President in Charge of Engineering of the New York Central & Hudson River, appointed Consulting Engineer of the Detroit River Tunnel Company.

Detroit, Toledo & Ironton.

November—George K. Lowell, General Manager, elected Vice-President of the Ann Arbor and the Detroit, Toledo & Ironton.

El Paso & Southwestern.

April—George F. Hawks, General Superintendent of the Houston & Texas Central, the Houston East & West Texas and the Houston & Shreveport, appointed General Superintendent of the El Paso & Southwestern.

Erie.

January—D. W. Cooke, Assistant General Traffic Manager, with headquarters at New York, appointed General Traffic Manager, with headquarters at Chicago.

February—T. Rumney, Assistant Mechanical Superintendent, appointed Mechanical Superintendent, succeeding George W. Wildin, who went to the Lehigh Valley as Assistant Superintendent of Motive Power.

June—W. J. Harahan, Vice-President of the Illinois Central, appointed Assistant to the President of the Erie, succeeding C. S. Sims, now Second Vice-President of the Delaware & Hudson.

October—T. Rumney, Mechanical Superintendent, appointed General Mechanical Superintendent, succeeding E. A. Williams, resigned several months previous.

Grand Rapids & Indiana.

January—Joseph Wood, First Vice-President of the Pennsylvania Lines West, elected President, succeeding James McCrea.

Grand Trunk.

April—W. G. Brownlee, Superintendent of the Middle division, appointed General Transportation Manager, succeeding to some of the duties of F. H. McGuigan, resigned to go to the Great Northern as First Vice-President.

July—William Wainwright, General Assistant and Comptroller, elected Fourth Vice-President, succeeding F. H. McGuigan.

—Joseph Hobson, Chief Engineer, appointed Consulting Engineer.

—Howard G. Kelly, Chief Engineer of the Iowa Central and the Minneapolis & St. Louis, appointed Chief Engineer.

October—D. Crombie, Master of Transportation, appointed Assistant to the General Transportation Manager.

Grand Trunk Pacific.

April—O. O. Winter, Superintendent of Terminals of the Canadian Pacific at Fort William, appointed General Superintendent of the Grand Trunk Pacific.

October—John W. Loud, Freight Traffic Manager of the Grand Trunk, appointed also Freight Traffic Manager of the Grand Trunk Pacific.

Great Northern.

March—H. A. Kennedy, Assistant General Superintendent at Spokane, appointed Assistant General Manager, in charge of Western lines.

—F. H. McGuigan, Fourth Vice-President of the Grand Trunk, elected to the new office of First Vice-President of the Great Northern.

April—J. J. Hill, President, elected Chairman of the Board.

—L. W. Hill, Vice-President, elected President.

May—Benjamin Campbell, Fourth Vice-President, in charge of traffic, resigned to go to the New York, New Haven & Hartford as Vice-President in charge of traffic.

—W. W. Broughton, Freight Traffic Manager, appointed General Traffic Manager.

August—F. H. McGuigan, First Vice-President, resigned.

October—J. M. Gruber, General Manager of the Burlington Lines East of the Missouri river, appointed General Manager of the Great Northern in charge of maintenance and operation, succeeding F. E. Ward, who took Mr. Gruber's place on the Burlington.

Hocking Valley.

February—S. S. Stiffey, Superintendent of Motive Power, appointed General Superintendent of Motive Power of the Hocking Valley and its controlled lines.

Houston & Texas Central.

March—G. Radetzki, Superintendent of the G., H. & S. A., appointed General Superintendent of the Houston & Texas Central, the Houston East & West Texas and the Houston & Shreveport, succeeding G. F. Hawks, who went to the El Paso & Southwestern as General Superintendent.

Illinois Central.

January—I. G. Rawn, General Manager, elected Vice-President, in charge of operation. Frank B. Harriman, General Superintendent of Northern and Eastern lines, appointed General Manager.

February—C. L. Ewing, Superintendent at Carbondale, Ill., appointed General Superintendent of Northern and Western lines, succeeding F. B. Harriman.

June—W. J. Harrihan, Vice-President in charge of traffic and construction, resigned to go to the Erie as Assistant to the President.

July—Authority of I. G. Rawn, Vice-President in charge of operation, and F. B. Harriman, General Manager, extended over the Yazoo & Mississippi Valley.

Interborough Metropolitan Company.

January—Theodore P. Shonts, Chairman of the Isthmian Canal Commission, elected President, succeeding August Belmont.

April—Theodore P. Shonts, President, elected also Chairman of the Executive Committee composed of the operating heads of the Interborough Rapid Transit, the Manhattan Elevated and the New York City Railway.

International & Great Northern.

December—H. M. Clarke, Superintendent of Transportation of the Mobile & Ohio, elected Second Vice-President and General Manager of the International & Great Northern. Effective January 1, 1908.

Isthmian Canal Commission.

January—T. P. Shonts, Chairman, resigned.

March—John F. Stevens, Chief Engineer, resigned.

—Major G. W. Goethals appointed Chairman, succeeding Mr. Shonts, and also Chief Engineer, succeeding Mr. Stevens.

—Major D. D. Gaillard, Major W. L. Sibert, Senator J. C. S. Blackburn and R. R. Rodgers, General Counsel, appointed Commissioners.

Kansas City, Mexico & Orient.

June—Frederick Mertsheimer, formerly Superintendent of Machinery of the Kansas City Southern, appointed Superintendent of Motive Power and Rolling Stock of the Kansas City, Mexico & Orient.

Kansas City Southern.

January—R. J. McCarty, Assistant Secretary and Auditor, appointed Vice-President and Auditor.

February—R. M. Galbraith appointed Superintendent of Machinery, succeeding F. Mertsheimer, resigned to go to the Kansas City, Mexico & Orient as Superintendent of Motive Power and Rolling Stock.

Lake Shore & Michigan Southern.

December—D. C. Moon, Assistant General Manager, appointed General Manager, succeeding E. A. Handy, deceased.

Macon, Dublin & Savannah.

February—Alfred Walter, President of the Seaboard Air Line, elected also President of the Macon, Dublin & Savannah.

Mexican Central.

February—E. E. Styner, General Manager, resigned.

May—H. R. Nickerson, Vice-President, resigned to go to the Rio Grande, Sierra Madre & Pacific as President.

November—S. M. Felton, President of the Chicago & Alton, elected President of the Mexican Central.

—E. Richards, Acting President, re-elected Vice-President and General Counsel.

—J. N. Galbraith, formerly General Manager of the Tehuantepec National, appointed General Manager of the Mexican Central.

Mexican International.

May—W. S. Martin, General Manager, resigned to go to the Denver & Rio Grande as Assistant General Manager. See National Lines of Mexico.

Mexican Southern.

July—W. L. Morkill, General Manager, resigned to go to Peru.

December—J. H. Chisholm appointed General Manager.

Michigan Central.

May—S. W. Brown, Assistant General Superintendent of the Lake Shore & Michigan Southern, appointed General Superintendent of the Michigan Central, succeeding H. S. Nutt, General Superintendent, resigned to go to the Northern Pacific.

Minneapolis & St. Louis.

July—W. D. Wheeler, Division Engineer of the Iowa Central, appointed Chief Engineer of the Iowa Central and the Minneapolis & St. Louis, succeeding H. G. Kelley, now Chief Engineer of the Grand Trunk.

Missouri, Kansas & Texas.

February—C. Haile, Traffic Manager, elected Vice-President in charge of traffic.

Missouri Pacific.

July—Charles L. Stone, General Passenger Agent of the Louisville & Nashville, appointed Passenger Traffic Manager of the Missouri Pacific.

October—A. C. Bird, Vice-President in charge of traffic of this road and other Gould lines, resigned.

November—J. M. Johnson, Assistant to the Vice-President, elected Vice-President in charge of traffic.

—B. M. Flippin, Assistant Freight Traffic Manager, appointed Freight Traffic Manager.

Mobile, Jackson & Kansas City.

March—T. F. Whittelsey, Second Vice-President and General Manager, resigned to go to the Seaboard Air Line as General Manager.

—H. S. Jones, Chief Engineer, appointed General Superintendent, succeeding to Mr. Whittelsey's duties.

May—W. D. Stratton, Chairman of the Board, elected also First Vice-President.

July—L. S. Berg elected President, succeeding B. M. Robinson, resigned.

—W. F. Owen appointed General Manager.

August—H. S. Jones reappointed Chief Engineer and office of General Superintendent abolished.

National Lines of Mexico.

May—Authority of A. Clark, General Manager of the National Railroad of Mexico, extended over other National lines.

June—J. M. Reed, Chief Engineer of the National Railroad of Mexico, appointed Chief Engineer of Construction of the National Lines of Mexico.

New Orleans & North-eastern.

June—D. E. Curran, Vice-President and General Manager, elected President of this road and allied lines, and in September made also General Manager.

New Orleans Great Northern.

June—C. W. Goodyear, Vice-President, elected President, succeeding F. H. Goodyear, deceased.

September—E. A. Niel, Traffic Manager of the Buffalo & Susquehanna, appointed also Traffic Manager of the New Orleans Great Northern.

New York Central & Hudson River.

March—P. E. Crowley, General Superintendent Western district, appointed Assistant General Manager.

May—George H. Daniels, Manager General Advertising Department, retired.

October—W. J. Wilgus, Vice-President in charge of construction, resigned.

New York Central Lines.

May—B. B. Mitchell, Freight Traffic Manager of the Lines East of Buffalo, appointed General Freight Traffic Manager of all New York Central lines.

—Francis LaBau, Assistant Freight Traffic Manager of the Lines East, appointed Traffic Manager of the Lines East.

New York, New Haven & Hartford.

January—E. J. Buckland, Counsel, elected Vice-President.

June—Benjamin Campbell, Fourth Vice-President of the Great Northern, elected Vice-President in charge of traffic of the New York, New Haven & Hartford.

—A. E. Mitchell, Expert and Engineer of Tests, appointed also Manager of Purchases and Supplies.

August—John F. Stevens elected Vice-President in charge of operation.

Norfolk & Western.

July—W. G. MacDowell, Vice-President, elected First Vice-President.

—N. D. Maher, General Manager, elected also Vice-President.

—T. S. Davant, Freight Traffic Manager, elected Vice-President and Traffic Manager.

Northern Pacific.

May—C. M. Levey, Third Vice-President, given charge of maintenance and operation.

—H. J. Horn, General Manager, appointed General Manager of the Eastern lines.

—H. S. Nutt, General Superintendent of the Michigan Central, appointed General Manager of the Western Lines of the Northern Pacific.

October—H. J. Horn resigned and succeeded by George F. Slade, formerly General Superintendent of the Great Northern.

Northwestern Pacific.

January—E. E. Calvin, Vice-President and General Manager of the Southern Pacific, elected President.

—A. H. Payson, Assistant to the President of the Santa Fe, elected Vice-President.

September—W. S. Palmer, General Superintendent of the Northern district of the Southern Pacific Pacific system, appointed General Manager.

Panama Railroad.

April—Major G. W. Goethals, Chairman of the Isthmian Canal Commission, elected President of the Panama Railroad, succeeding T. P. Shonts, now President of the Interborough-Metropolitan Company. E. E. Drake, Secretary, Treasurer and Assistant to the President of the Panama Railroad, elected Vice-President, succeeding John F. Stevens, resigned to go to the New York, New Haven & Hartford as Vice-President in charge of operation.

September—J. A. Smith appointed General Manager, succeeding W. G. Bierd, now General Superintendent of the New York, New Haven & Hartford.

Pennsylvania.

January—James McCrea, First Vice-President of the Lines West, elected President of the Pennsylvania Railroad, succeeding A. J. Cassatt, deceased.

September—George D. Dixon, Freight Traffic Manager, appointed General Traffic Manager.

Pennsylvania Lines West.

January—Joseph Wood, Second Vice-President in charge of traffic, elected First Vice-President, succeeding James McCrea.

—J. J. Turner, Third Vice-President in charge of transportation, elected Second Vice-President.

—E. B. Taylor, Fourth Vice-President in charge of treasury and accounting, elected Third Vice-President.

—D. T. McCabe, Freight Traffic Manager, elected Fourth Vice-President in charge of traffic.

—William Hodgdon, Freight Traffic Manager of the Vandalia, appointed Freight Traffic Manager, succeeding Mr. McCabe.

Pere Marquette.

December—William Cotter, General Attorney, elected President.

Phoenix & Eastern.

May—Epes Randolph, President of various Southern Pacific lines in Arizona, elected also President of the Phoenix & Eastern.

Rio Grande, Sierra Madre & Pacific.

April—L. D. Baldwin, elected Vice-President.

May—H. R. Nickerson, Vice-President of the Mexican Central, elected President of the Rio Grande, Sierra Madre & Pacific.

St. Louis, Brownsville & Mexico.

October—William Doherty, General Passenger Agent, appointed Traffic Manager.

Seaboard Air Line.

February—W. A. Garrett, First Vice-President and General Manager, elected President, succeeding Alfred Walter, deceased.

—T. F. Whittelsey, Second Vice-President of the Missouri, Jackson & Kansas City, appointed General Manager of the Seaboard Air Line.

September—A. J. Poole appointed General Master Mechanic, succeeding R. P. C. Sanderson, Superintendent of Motive Power, resigned to go to the Virginian Railway.

Sonora Railway.

January—Epes Randolph, President of Southern Pacific lines in Arizona, appointed also General Manager of the Sonora Railway.

March—A. R. Oster appointed Assistant General Manager, succeeding J. A. Naugle, resigned.

Southern.

January—R. A. Dugan, Assistant General Manager, resigned and office abolished.

March—M. M. Ritchie, General Superintendent of the Middle district, appointed Manager of the Middle and Western districts.

—J. N. Seale, Manager of Transportation, appointed Manager of the Northern and Eastern districts.

September—C. P. Cooper, General Superintendent of the St. Louis-Louisville lines, appointed Manager of those lines.

November—E. H. Coapman, General Superintendent of the Northern district, appointed Manager of the Northern and Eastern districts, succeeding J. N. Seale, deceased.

Southern Pacific.

November—W. R. Scott, General Superintendent of the Northern district of the Pacific system, appointed General Manager of the Pacific system.

Tehuantepec National.

June—W. B. Ryan, Vice-President, appointed also General Manager.

Toledo, St. Louis & Western.

December—W. L. Ross, General Freight and Passenger Agent, appointed General Traffic Manager of the Toledo, St. Louis & Western and the Chicago & Alton.

Trinity & Brazos Valley.

March—W. E. Greene elected Vice-President and General Manager.

Union Pacific.

November—W. A. Worthington appointed Assistant to the Director of Maintenance and Operation of this system and of the Southern Pacific.

Virginian Railway.

August—R. P. C. Sanderson, Superintendent of Motive Power of the Seaboard Air Line, appointed Superintendent of Motive Power of the Virginian Railway.

Wabash.

May—Henry Miller, General Manager, elected also Vice-President.

Washington & Columbia River.

July—Authority of Northern Pacific officers extended over the Washington & Columbia River.

Western Maryland.

March—B. F. Bush elected President, succeeding W. S. Pierce.

—Alexander Robertson, General Manager, elected also Vice-President.

October—R. C. Evans appointed Superintendent of Motive Power, succeeding William Miller, resigned.

Western Pacific.

December—W. J. Barnett, Vice-President and General Attorney, resigned.

Wheeling & Lake Erie.

January—Robert Blickensderfer, Consulting Engineer, retired.

A New Switch Indicator.

The drawings and photographs shown herewith illustrate a new switch indicator for use in connection with automatic block signals, which is held "clear" with one-third the current used to energize the coils in the first place. It is made by the General Electric Company. It possesses several novel features suggested by the experience of signal engineers.

Fig. 1 is a front and Fig. 2 a back view. As shown by Fig. 3, with the indicator "clear" a resistance, equal to double that of the operating coils, is connected in series with them, thus reducing the current consumption to one-third. With the indicator at danger, the effect of this resistance is nullified, as the armature when down closes a back contact, causing two-thirds of the current to flow through the coils of the magnet. Thus, the magnets being de-energized and the miniature semaphore showing danger, the closing of the circuit by the clearing of the block section track circuit which controls the instrument sends through the magnet coils of the indicator a current of, say, 45 milamperes, but immediately the armature is lifted the resistance is thrown into the circuit and the current is reduced to 15 milamperes; and this is all that is ever required except at the moment of closing.

Fig. 1

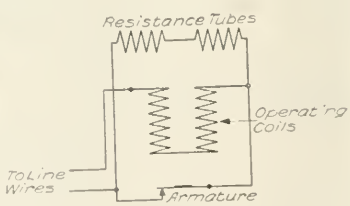


Fig. 3

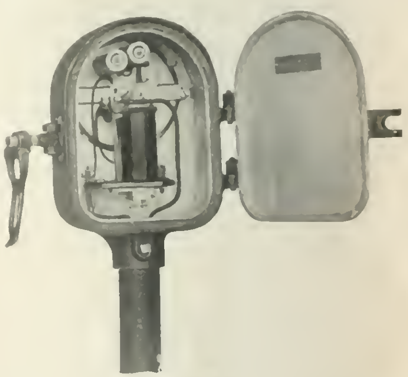


Fig. 2

Switch Indicator, Made by the General Electric Company, Schenectady, N. Y.

The case of this indicator is made weather proof by a door gasket of elastic felt, which has been found more satisfactory than the tubular rubber gaskets usually used. The connecting wire enters the bottom of the case through an insect barrier of felt, like that used around the door. The case is so designed that it is impossible for spiders or other insects to get at the blade.

The terminals are mounted on non-warping moulded insulation, which is the same as that used in General Electric signal relays. The magnets are wound with enameled waterproof magnet wire. The armature and shaft bearings are cylindrical, the journal being made of hard drawn German silver. A General Electric lightning arrester is furnished when required.

The indicators are made with four different resistances, as follows:

Resistance of operating coils.	Total resistance.
250 ohms.	750 ohms.
500 "	1,500 "
750 "	2,250 "
1,000 "	3,000 "

Changes of Railroad Ownership or Control in 1907.

The following list summarizes briefly the principal changes in ownership or control of railroads during the past year. Purchases of electric roads which have been made by or in the interest of steam railroad companies are included, as well as the steamship lines bought by the New York, New Haven & Hartford during the year. A related event too indefinite to be included in the list but deserving mention was the option which the New Haven gave to the New York Central to buy the New York, Ontario & Western. This is still in effect.

The record of these changes, listed under the name of the purchasing or selling railroad, follows:

Baltimore & Ohio.—May 3 paid par and accrued interest for two years for $15,140,000 bonds of the Chicago Terminal Transfer, which owns 82 miles of belt railroad in Chicago. Later offered $25 a share for minority preferred stock, about 65 per cent. of the issue being controlled by the Burlington.

Boston & Maine.—The Fitchburg Railroad was on May 16 authorized by the Massachusetts legislature to buy the Conway Electric Street Railway operating six miles of electric line at Conway, Mass.; stock $100,000; bonds $35,000.

Chicago, Burlington & Quincy.—On November 1, took over the Sioux City & Western, Sioux City, Neb., to O'Neill, 129 miles, from the Great Northern, which now has no mileage in Nebraska.

Cincinnati, Hamilton & Dayton.—Lease of Pere Marquette abrogated by C., H. & D. stockholders on October 8; by P. M. stockholders December 9.

Delaware & Hudson.—Acquired control in July of Troy & New England, an electric line from Troy, N. Y., to Averill Park, nine miles; stock $180,000; bonds $160,000.

Denver & Rio Grande.—Rio Grande Western in October bought the San Pete Valley Railway, Nephi, Utah, to Morrison, 51 miles; stock $510,000; bonds $815,000.

Fort Dodge, Des Moines & Southern.—Electric interurban line. Announced in July that control of the Newton & Northwestern, a steam road, Newton, Iowa, to Rockwell City, 102 miles, had been acquired; 40 miles of N. & N. equipped for electric operation in January; stock $2,500,000; bonds $3,060,000.

Great Northern.—With Northern Pacific bought in April for price said to be $3,500,000 the Astoria & Columbia River, Goble, Ore., to Seaside, and a branch, 83 miles; stock $1,619,000; bonds $555,000. Valuable for the lumber resources of its territory.

Gulf Line Railway.—New company. In May bought Flint River & Gulf, Ashburn, Ga., to Bridgeboro, 32 miles, and leased Hawkinsville & Florida Southern, Worth, Ga., to Hawkinsville, 44 miles; stock $100,000; bonds $325,000. The Georgia Southern & Florida holds an interest in the H. & F. S. and guarantees the bonds.

Kalamazoo, Lake Shore & Chicago.—On April 15 leased for 25 years South Haven & Eastern branch of Pere Marquette, Lawton, Mich., to South Haven, 34 miles.

Lake Shore & Michigan Southern.—The Indiana Harbor Belt Railroad, owned jointly with Michigan Central, in June leased and on November 4 bought about 46 miles of track of the Chicago Junction Railway, a belt road at Chicago; stock $2,200,000; bonds $2,500,000.

In July arranged to acquire Chicago & Wabash Valley; Dinwiddle, Ind., to McCoysburg and branch, 26 miles; stock $300,000; no bonds.

Lorain & Ashland.—Under construction by interests headed by Joseph Ramsey. In December bought Ashland & Western, Ashland, Ohio, to Custeloga, 23 miles; stock $200,000; no bonds.

Maine Central.—In March bought large majority of stock of Somerset Railway, Oakland, Me., to Moosehead Lake, 91 miles; stock $736,649; bonds $1,761,500, which includes $1,500,000 notes.

May 1 leased for 999 years at rental of $328,000 a year Portland & Rumford Falls and its controlled property, the Rumford Falls & Rangeley Lakes, Rumford Junction, near Auburn, Me., to Rumford Falls and Livermore, 100 miles; stock of both $2,300,000, bonds $2,520,000.

Maritime Coal, Railway & Power Company.—In May bought Canada Coal & Railway Company, owning 12 miles of road in Nova Scotia.

Michigan Central.—In July bought Detroit & Charlevoix, Frederic, Mich., to South Arm and branch, 52 miles, stock $520,300, no bonds.

National Lines of Mexico.—In December, 1906, it was announced that the Mexican government had bought control of the Mexican Central, 3,195 miles. The various lines controlled by the government are to be merged in a new company, the National Railways of Mexico, as soon as the financial situation is favorable.

New York, New Haven & Hartford.—In January acquired control of the Maine Steamship Company, running from New York to Portland, Me.

In February acquired control of the Boston & Philadelphia Steamship Company, running between Boston, Fall River, Providence and Philadelphia.

In March bought one-half the stock of the Merchants & Miners' Transportation Company, owning steamship lines from Boston and Providence to Baltimore and Norfolk, from Philadelphia to Savannah, and from Baltimore to Newport News, Norfolk and Savannah. This company took over the Boston & Philadelphia Steamship Company.

In April, bought for price said to be $400,000, Poughkeepsie & Eastern, Poughkeepsie to Boston Corners, and branch, 39 miles; stock $500,000; bonds $500,000.

May 31 exchanged its own stock share for share for the $30,000,000 stock of the Consolidated Railway owning or leasing, with small exceptions, all trolley lines in Connecticut and Rhode Island and the Sound steamboat lines directly controlled by the New York, New Haven & Hartford.

In May bought about $11,000,000 of the $28,291,790 common stock of the Boston & Maine, 2,228 miles directly operated.

In October announced that New Haven had bought control of the New York, Westchester & Boston and the New York & Portchester, two companies which have franchises to build a high-speed electric road from the northern part of New York City through Mt. Vernon to New Rochelle, on which considerable construction work has been done.

In December bought the Joy Line, running from Providence to New York.

Northern Pacific.—See Great Northern.

Northwestern Pacific.—New company controlled jointly by the Atchison, Topeka & Santa Fe and the Southern Pacific. On January 1 took over North Shore; California Northwestern, San Francisco & Northern Pacific; Eureka & Klamath River, Fort Bragg & Southeastern, and San Francisco & Northwestern, roads in California north of San Francisco previously controlled by the Southern Pacific or the Santa Fe.

Pennsylvania Company.—In May took over Chicago, Indiana & Eastern, Converse, Ind., to Munsey, 43 miles; stock $1,000,000, bonds $500,000. Now part of Logansport division of the P., C., C. & St. L. Pennsylvania Company bought all securities and settled all other debts.

Reading Company.—In April bought control of Williams Valley Railroad, Brookside, Pa., to Lykens, 12 miles; stock $120,000, bonds $120,000.

Seaboard Air Line.—In January bought nearly all stock of Macon, Dublin & Savannah, Vidalia, Ga., to Macon 92 miles; stock $2,040,000; bonds $1,880,000.

Southern Pacific.—In April bought, from the Santa Fe, the Phoenix & Eastern, Phoenix, Ariz., to Winkleman, 96 miles; stock $1,275,000.

In June bought control of Corvallis & Eastern, Yaquina, Ore., to Idanah, 141 miles; stock $1,410,000; bonds $1,110,000.

Southern Railway.—In June sold the $5,000,000 Central of Georgia stock which had been held since 1896 by the Richmond Terminal reorganization committee, to Oakleigh Thorne and Marsden J. Perry, 1,899 miles operated. In October control of Central of Georgia reported sold to E. H. Harriman.

Toledo, St. Louis & Western.—In August bought from the Rock Island Company $11,420,000 of the $19,512,800 common and $6,380,000 of the $19,544,000 preferred stock of the Chicago & Alton, 970 miles.

Virginian Railway.—New company. In May took over Tidewater Railway and Deepwater Railroad, Norfolk, Va., to Deepwater, W. Va., 443 miles, of which about 300 are built.

Western Maryland.—January 17 bought the $1,000,000 stock of Georges Creek & Cumberland, Cumberland, W. Va., north to Pennsylvania state line and west to coal workings, 33 miles, bonds $601,000. Owns only available outlet to the west from Cumberland.

Pensions on the Grand Trunk.

The Grand Trunk has announced the details of its pension system for employees which goes into effect January 1. It includes employees of all grades and departments. Every employee must retire at the age of 65. If he has served 15 years or more he will be entitled to annuity of 1 per cent. of the highest average annual pay received for 10 consecutive years. Thus if a man had served 30 years receiving an average of $1,000 per year for any 10 consecutive years of that period he would be entitled to 30 per cent of $1,000, making a pension of $300 a year. The minimum is fixed at $200, irrespective of the rate of pay or length of service. The shareholders have set aside $200,000 as a nucleus for the fund, but it is thought that at least $75,000 additional will have to be provided each year. Provision is also made for men incapacitated by accident. The pension fund will be administered by a board of trustees and will be wholly maintained by the company without contributions from its employees. The number affected is about 35,000.

For officers, station men and clerical employees the Grand Trunk has had a pension fund for over 30 years but the employees themselves contributed half of the money for it

Comparative Physical Tests of Car Wheels and Tires.*

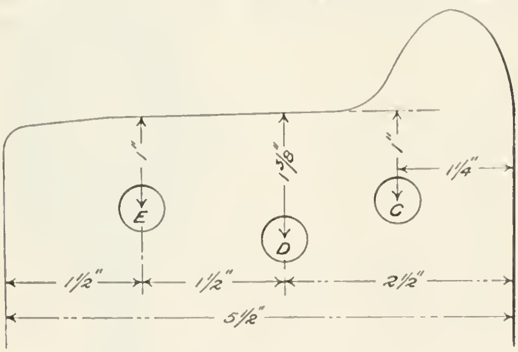
BY GEO. L. FOWLER.

(Reprinted from a volume of reports made to the Schoen Steel Wheel Co.)

All the tires and wheels referred to in this work were bought in the open market, chosen at random, and tested under identical conditions in comparison with each other. They represent the principal brands in use, giving satisfactory service, and the results stand on the basis of each sample representing the average of its class and brand. They will be designated as tires A, B, C and D, wheels E and F and Schoen steel wheel.

Tests were made of the tensile strength, including the limit of elasticity, per cent. of elongation and the reduction of area at the point of fracture. The steels were tested for hardness by a drop of the Martel scale. Abrasion tests were made in order to find the resistance of the several materials to grinding at various points below the tread. Specimens were also cut for the determination of the specific gravity of the metals at different points below the tread. Chemical analyses were made from samples of each tire and wheel taken from a point below the center of the tread. Finally, a series of microphotographs were taken of etched specimens of the metals in order to show their structure and the relation of that structure to the physical and chemical properties, previously determined independently.

The chemical analyses for carbon were all made by the combustion process and the tensile tests were made in the usual manner, using test pieces 2 in. long between marks. The reason for choosing this length was that the curvature of the treads of the wheels and tires made it impossible to cut longer ones. These specimens were cut from the points, C, D and E, as indicated on the diagram showing the location of tensile test specimens. These test



Location of Tensile Test Specimens.

pieces were cut on a chord of the tire and gave an available length of 2 in. on the reduced area ½ in. in diameter, the center of which was carefully located at the point indicated on the drawing. The tensile tests were made in an Olsen testing machine of 100,000 lbs. capacity, and the results obtained are given in detail in the following table marked "Comparative Tests of Steel Wheels and Tires"

Comparative Tests of Steel Wheels and Tires.

Test piece.	Tire or wheel	Per cent Elongation in 2 in.	Per cent Reduction of area.	Max. load, pr sq. in., lbs.	Lbs., per sq. in. of section Breaking load.	Lbs., per sq. in. of section Approximate limit of elasticity.	Pr ct of limit of elasticity to total load.	Hardness on the Martel scale.
C	C tire	14.00	16.31	115,825	112,672	73,758	63.68	787
D	C "	14.00	15.39	116,639	112,264	76,286	65.40	787
E	C "	12.45	15.97	117,818	115,120	81,388	69.08	880
C	A "	9.85	8.60	124,013	123,682	94,258	76.00	861
D	A "	11.75	13.48	125,512	122,511	91,673	73.02	778
E	A	12.50	12.37	122,488	117,859	89,018	72.67	823
C	D	20.75	26.79	115,139	103,381	94,143	81.55	786
D	D "	20.75	32.00	116,533	106,000	99,232	85.15	750
E	D	21.50	31.80	115,977	102,905	91,648	79.02	812
C	B "	15.10	18.89	115,784	108,690	94,710	81.79	839
D	B "	16.00	19.53	112,680	106,573	96,883	85.09	787
E	B "	14.85	19.32	115,113	108,703	94,104	81.75	773
C	E wheel	10.50	10.50	115,290	108,132	83,761	72.65	901
D	E "	4.00	3.01	107,967	107,967	84,270	78.0[illegible]	79[illegible]
E	E "	7.75	7.08	117,572	117,453	79,130	67.19	921
C	F	15.75	19.68	114,616	110,320	91,051	82.05	907
D	F	15.75	17.11	115,266	111,424	94,825	82.26	867
E	F "	15.25	14.54	113,548	110,828	97,861	86.19	851
C	Schoen wheel	7.00	8.32	127,078	126,354	103,252	81.25	1,003
D	" "	8.00	12.11	121,950	119,875	108,977	89.36	1,223
E	" "	11.00	20.80	124,129	118,340	110,142	88.75	1,149

The averages of these are collected and presented in a condensed form in the table marked "Average of Comparative Tests of Steel Wheels and Tires"

Average of Comparative Tests of Steel Wheels and Tires.

Tire or wheel	Per cent Elongation in 2 in.	Per cent Reduction of area	Max. load, pr sq. in. lbs.	Lbs., per sq. in. of section Breaking load	Lbs., per sq. in. of section Approximate limit of elasticity	Pr ct of limit of elasticity to total load	Hardness on the Martel scale
C tire	13.50	15.89	116,761	113,352	77,133	66.66	818
A "	11.35	11.45	124,018	121,951	91,646	73.89	817
D "	20.90	29.50	115,963	104,095	95,008	81.92	783
B "	15.10	19.33	114,519	107,989	95,232	83.18	799
E wheel	7.40	6.87	113,610	111,184	82,388	72.63	872
F "	11.90	17.13	114,477	110,857	95,589	83.50	875
Schoen wheel	8.66	12.32	124,386	121,523	104,124	86.45	1,125

From this table it will be seen that, in the wheels examined, the average maximum tensile strength varied from 113,610 lbs. to 124,386 lbs. per square inch of section, that the elongation in 2 in. varied from 7.40 per cent. to 20.90 per cent., the limit of elasticity from 66.66 per cent. to 86.45 per cent. of the maximum tensile strength, and the hardness from 783 to 1,125 points on the Martel scale.

In reviewing these results it is necessary to consider the relative influence of the chemical composition on them. This is given in the table marked "Chemical Composition of Steel Wheels and Tires."

Chemical Composition of Steel Wheels and Tires.

Wheel	Carbon	Phosphorus.	Sulphur	Manganese	Silicon
C tire	0.616	0.048	0.011	0.698	0.305
A "	0.716	0.065	0.023	0.753	0.263
D "	0.573	0.075	0.038	0.763	0.309
B "	0.676	0.061	0.035	0.833	0.254
E wheel	0.646	0.071	0.029	0.978	0.219
F "	0.671	0.081	0.042	0.775	0.241
Schoen wheel	0.690	0.012	0.008	0.870	0.094

As would be expected the low carbon content of the D tire is accompanied by comparatively low tensile strength, high ductility and low hardness.

At the same time it is evident that the work put on the wheel is an influential factor in all of these results, and there is a variation of tensile strength and ductility that is not fully accounted for by the variation of carbon content. Take as an extreme example the E wheel and the Schoen wheel. There is a variation of but .044 per cent. in carbon and yet the maximum tensile strength of this E wheel was but 113,610 lbs. per square inch, while that of the Schoen wheel was 124,386 lbs. with a corresponding elongation in 2 in. of 7.40 per cent. and 8.66 per cent., respectively, while the limit of elasticity was 72.63 per cent. and 86.45 per cent. of the tensile strength, respectively. The actual variation in limit of elasticity was much greater, because of the higher base of comparison with the Schoen wheel, the limit of elasticity of the E wheel being but 79.12 per cent. of that of the Schoen wheel. In making these tensile tests great care was exercised not only in the preparation of the specimens, but in making the tests themselves. The machine was run slowly after a stress of 50,000 lbs. had been reached, so that the limit of elasticity could be very accurately determined.

A comparison of the results obtained with all wheels and tires with those obtained with the Schoen steel wheel are given in the table marked "Comparative Results of Physical Tests of Schoen Steel Wheels with Other Wheels and Tires," in which the results obtained with the Schoen wheel are taken as a base, and the results obtained with the other wheels and tires are given in percentages of that base. From this table it appears that the Schoen wheel leads all of the others in the items of tensile strength, limit of elasticity, per cent. of limit of elasticity to ultimate strength and in hardness.

Comparative Results of Physical Tests of Schoen Steel Wheels with Other Wheels and Tires.

Tire or wheel.	Maximum load per sq. in. lbs.	Per cent Elongation in 2 in.	Per cent Reduction of area.	Lbs. per sq. in. of section Breaking load.	Lbs. per sq. in. of section Approx limit of elasticity.	Per ct. of limit of elasticity to total load.	Hardness on the Martel scale
Schoen wheel	100.00	100.00	100.00	100.00	100.00	100.00	100.00
A tire	99.70	131.06	92.94	100.35	88.02	85.47	72.62
C "	93.87	155.89	128.98	93.28	74.08	76.41	72.71
D "	93.23	241.34	239.45	85.66	91.25	94.76	69.60
B "	92.07	177.84	156.90	88.86	91.47	96.22	71.02
F wheel	92.05	172.05	139.04	91.22	91.79	96.59	77.78

The tests for hardness were made with a drop arranged with a pyramidal punch. The principle on which this work was done was to measure the force of a blow delivered by the punch on the smooth face of the metal to be tested, as well as the amount of metal displaced by the blow. This method of testing was devised by Col. J. T. Rodman, of the United States Army. It was afterward developed and formulated by Lieut.-Col. Martel, of the French army, and was then adopted as a standard test by the French government. The results obtained are known as the degrees of hardness by the Martel scale. By his investigations Colonel Martel showed that the amount of metal displaced by the punch varied inversely as the hardness and directly as the weight of the drop and the height of the fall.

In this investigation the Rodman pyramidal punch was used. It was fastened to a drop, weighing, together with the punch, 2.2616 kilograms and the height of fall was 600 millimeters. The punch was of hardened tool steel, carefully ground to form, and it withstood the work without deformation.

The specimens for the test were cut from the tires and wheels

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at the same points as the tensile test pieces, as indicated at C, D and E, and the results obtained are given with the other physical properties in the several tables.

These tests show the Schoen wheel to have been the hardest of the seven specimens tested, and that the D tire was the softest. This was to be expected, judging from the carbon content; but we note that while the A tire has a higher percentage of carbon than the Schoen wheel for some reason the latter is the harder of the two.

For the abrasion tests a cylinder ½ in. in diameter was cut from a point near the center of the tread of each wheel, extending vertically down into the body of the metal. This was placed in a frame, with the end that was at the tread resting on an emery wheel. A load of 2 lbs. 11½ ozs. was put on the upper end of the cylinder to hold it down on the wheel. This weight was selected after some preliminary trials made to ascertain the pressure that could be used without heating the material or grinding it away too rapidly so as to make the count smaller than would be convenient for making comparisons. To this weight must be added the weight of the cylinders themselves, which varied about 0.54 oz., a variation which was duly considered and the proper allowance made therefore, although it is practically a negligible quantity.

The wheel used was made by the Carborundum Co., and was $10\frac{9}{64}$ in. in diameter and ¾ in. thick when new. At the conclusion of the tests the wheel was worn to a diameter of $10\frac{7}{64}$ in. It was known on the maker's schedule as Grit 120, Grade H., Bond G 9. It was run at a speed of about 2,500 revolutions per minute.

While grinding a constant and uniform stream of water was kept running on the wheel and specimen, and at the conclusion of the test the specimens were invariably cool and showed no signs of heating whatever.

The counting of the revolutions was done by means of a special counter coupled to the shaft and having a worm meshing with a gear of 25 teeth mounted on a shaft to which a revolution counter was attached. The reading of the counter was, therefore, multiplied by 25 to obtain the number of revolutions of the wheel.

In addition to the regular tests, a cylinder was cut from the same position in a chilled cast iron wheel, and the results of its abrasion test, as well as those of the wheels and tires, have been plotted and shown in the illustration "Diagram of Abrasion Tests of Steel Tires and Wheels." The abscissas indicate the location of the metal below the tread, and the ordinates the number of revolutions of the wheel required to grind off ⅛ in. from a cylinder ½ in. in diameter.

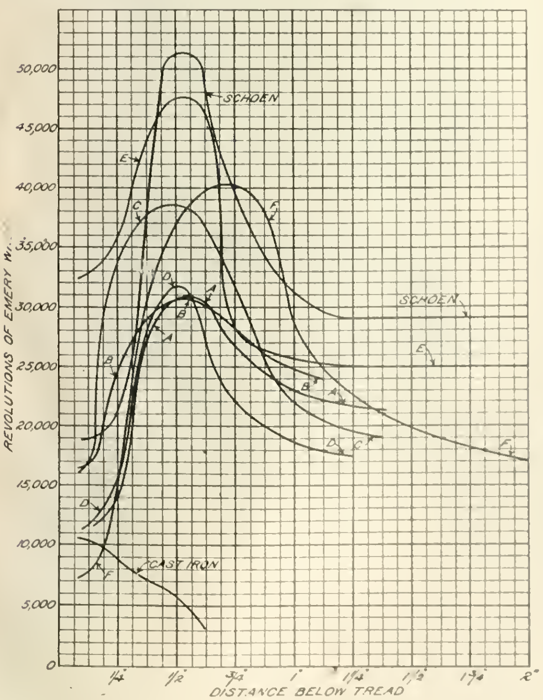


Diagram of Abrasion Tests of Steel Ties and Wheels, Showing Relation of Rate of Wear at Various Depths Below Tread, and Revolutions of Every Wheel.

It will be noted that in every test there is a rise in the number of revolutions at a point about ½ in. below the surface of the tread, or for the space between ¼ in. and ¾ in. Had the work been done in rotation this peculiarity might have been attributed to a change in the texture of the wheel, glazing, heating the material or a similar cause. The tests were started, however, before all of the cylinders had been finished, and those from the A, B, C and D tires were well along when a start was made with the cylinder cut from the Schoen wheel. This was worked down in rotation with those from the tires, when that from the E wheel was introduced, and this was followed in the same way by that of the F wheel, so that the wheel structure itself is responsible for the diagram. By reducing these diagrams to an average the results are as follows

Average Abrasion Per ⅛ Inch of Tires and Wheels.

Tire or wheel.	Revolutions.	Linear feet.
Schoen wheel	32,635	86.483
E wheel	30,660	81.249
C tire	28,205	74.743
B tire	26,320	69.748
F wheel	25,540	67.681
A tire	23,270	61.666
D tire	21,445	56.729
Cast iron wheel	5,485	14.535

Reducing these to percentages on the basis of the Schoen wheel we have:

Tire or wheel	Per cent
Schoen wheel	100.00
E wheel	93.95
C tire	86.43
B tire	80.65
F wheel	78.26
A tire	71.30
D tire	65.71
Cast iron wheel	16.81

From this it appears that the resistance of the Schoen wheel to abrasion was greater than that of any of the other wheels and tires with which it was compared. The cast iron wheel gave the lowest resistance of any cylinder tested. The wheel was of good material, with a depth of chill of about ⅝ in.

An explanation of the peculiar rise in the number of revolutions required to grind these tires between ¼ in. and ¾ in. will be brought out in the discussion of the microphotographs. The examination made of the specific gravities of the metal of the tires and wheels at different points below the surface of the tread, also tends to show a reason for the peculiar rise in the rate of abrasion by the emery wheel. From this examination it appears that with slight local aberrations the density of the material increases from the tread down to a depth of about 1 in. and then decreases down to 2 in. A few observations made below these depths show that there is again a tendency to increase in density as the inner edge of the tire is approached. There was, however, a variation of this condition found in the rim of the Schoen wheel. Although there was a tendency to follow the general behavior of the other specimens, it was along a wavy line, corresponding, but not in exact location, with the variation in the texture of the grain which will be brought out in the microphotographs to be discussed later.

Another peculiarity that was developed is the relation of hardness, resistance to abrasion and tensile strength to the specific gravity of the material.

It will be noted that the rate of wear of the cast iron wheel as shown on the diagram, was much greater than that of any of the steel tires or wheels. The rapid fall in the number of revolutions per ⅛ in. of metal removed as the chill was worn away is easily accounted for, but it was not expected that the variations from the results obtained with the steel tires would be so great as they were. In the laboratory the metal and wheel were kept cool, so that at no time did the temperature rise, even on the face of the specimen, above that of the hand. As these abrasive tests have been checked in other ways, as will be shown later, it appears that the avoidance of heat is the explanation of the great difference.

It must be borne in mind that the primary object of these investigations was to ascertain to what extent the metal entering into the construction of the Schoen wheel fulfilled the requirements of actual service as determined by comparison with other wheels already upon the market and doing satisfactory work.

The conclusions to be drawn from a general review of the results obtained in this investigation are as follows:

From the physical tests of the metal of the Schoen solid forged and rolled steel wheel, it appears that it is the strongest of any of the tires and wheels examined. This strength appears in the maximum stress to which the metal was subjected, the point at which rupture took place and the limit of elasticity, all of which were higher than in any other wheel or tire, with the single exception of that of the A tire. This tire had a breaking load exceeding that of the Schoen wheel by but 428 lbs. per square inch of section, an amount that is unimportant.

The limit of elasticity, as expressed both in actual figures and in the percentage of the total load, was far higher in the Schoen wheel than in any of the others.

The ductility of the metal of the Schoen wheel, as indicated by the elongation of the tensile test pieces, is less than that of any of the other specimens with the exception of the E wheel. Here there is a difference of nearly 15 per cent. in favor of the Schoen wheel, despite the fact that the E wheel contains nearly .05 per cent. less carbon. This is probably due to the difference in the amount of work put on the two wheels.

In hardness the Schoen wheel stands the highest on the scale. This is shown in another way by the abrasion tests, which show the Schoen wheel to be the slowest of any to grind away.

In specific gravity the Schoen wheel is the highest.

The chemical composition is, of course, a matter that is regulated by specifications, and a review of these since the introduction of steel-tired wheels has shown a steady advance in the carbon content. The makers of the Schoen wheel have placed their wheel next to the highest in carbon content. This explains, in part, the high ultimate tensile strength, although it cannot account for it, altogether because the Schoen wheel leads the A tire, which has a higher carbon content, in elasticity and maximum load, and in ductility is above the E wheel, having a lower carbon content. In this analysis special attention is directed to the sulphur, not a trace of which could be found in the Schoen wheel specimens under examination.

Some Chicago Manufacturers on the 1908 Outlook.

J. M. Hopkins, Vice-President and General Manager, Camel Co., Chicago.—There is no business at present, and I do not believe that it will be at its best again until the early fall of next year.

E. F. Carry, First Vice-President and General Manager, American Car & Foundry Co., Chicago.—At present, of course, there are no car orders. Before April next business will begin again.

M. A. Garrett, Vice-President, Farlow Draft Gear Co., Chicago.—I think there will be a slight increase in business after January 1, but I do not look for anything big until after the Presidential nomination.

Chas. Riddell, Western Representative, Baldwin Locomotive Works, Chicago.—We are hopeful of a gradual increase after the first of January, but next year, being a Presidential year, will tend to keep business down somewhat.

Percy Manchester, Secretary, Quincy, Manchester, Sargent Co., Chicago.—We look for a decided improvement after February, 1908, which we believe will be the beginning of a healthy but gradual growth; in fact, this is indicated by the business of the past two weeks.

J. R. Cardwell, President, Cardwell Manufacturing Co., Chicago.—We positively believe that money will be easier after the first of the year and securities higher, which is sure to benefit business in all channels. We, therefore, are expecting larger orders.

A. C. McCord, President, McCord & Co., Chicago.—There are just two disturbing possibilities in making up our outlook: Some new political heresies and the extent of the commercial failures that inevitably follow a panic. If these failures are not too extensive we shall begin recovery in the spring and progress rapidly.

L. M. Viles, Secretary, Buda Foundry & Manufacturing Co., Chicago.—I believe that it will be some time before business will resume on the old basis, probably three or four months; but after that time I think there will be a gradual increase, because the lack of confidence, which is the predominating cause in this depression, will have disappeared.

W. H. Rooper, General Agent, Safety Car Heating & Lighting Co., Chicago.—There is no doubt in my mind as to the outcome of this situation, providing there is no possibility of a change of administration; but, on the other hand, if there is a possibility, I greatly fear that the so-called hard times will continue until such time as the people will again have sufficient confidence to invest their money.

G. E. Pratt, General Sales Manager, Hicks Locomotive & Car Works, Chicago.—We are not doing much business at present; we are doing some, however. I do not believe that orders will be lacking after the first of the year. Of course, it cannot be expected that business will resume on the same basis as it has been heretofore, but I do firmly believe the growth will be a gradual, consistent and a healthy one. I also believe that the firms with the cars and locomotives ready for immediate delivery will be the ones who will get the bulk of the business.

M. E. Ward, General Sales Agent, Chicago-Cleveland Car Roofing Co., Chicago.—When a patient drops into coma, you can fear a funeral, but when finance, commerce and trade fall into a dead stupor, as typified in the present situation, the patient is only taking a needed rest, and always arises reinvigorated. If it were not that everybody is possessed of a sort of nightmare feeling the situation could be readily righted, for the fundamentals of prosperity are scarcely ruffled by this disturbance. It is the most superficial of panics and, though its shadows may lengthen out to the fall months of 1908, I look for a marked, but not normal, revival of equipment orders in the first quarter of the new year.

G. C. Marsh, Manager, Contractors' Supply & Equipment Co., Chicago.—As we see it, the situation has changed greatly for the better within the last few days. We have had more inquiries for concrete mixers and hoisting engines and other machines used in railroad and other construction work in the past week than we have had in six weeks before. We look for a very decided change for the better after January 1st. With the cost of labor less and the efficiency of labor greater, it should be quite an incentive to new construction. Bond houses which finance railroads should recognize the fact that railroads built when labor and material are cheap are better security than when built with high prices for these articles. We are feeling quite optimistic.

W. E. Symons, President Pioneer Cast Steel Truck Co., Chicago.—While there is evidence of a partial restoration of confidence and resumption of business activities in all directions, particularly in the railroad line, yet it would seem unsafe to attempt to predict, with any degree of accuracy, what may occur in a very short period of time. This condition has been especially emphasized by our recent experience in which we have learned that, while in the midst of the most prosperous epoch in American history, it is possible for a few persons to so completely destroy confidence in all financial, industrial and business concerns, and to so question the honesty of their fellow men and neighbors, that about 40,000,000 people have withdrawn and hoarded sums ranging from millions down to a few dollars with the result that in the midst of prosperity many of the most influential and well-managed business institutions are on the verge of bankruptcy.

The Mississippi Valley will, not many years hence, be the abiding place and furnish sustenance for a population equal to that of the United States at present, and in order to provide transportation facilities, both rail and water, additions on as broad or broader scale than any yet predicted by Mr. Hill or Mr. Harriman will be necessary, but with the public confidence shaken, as it is, it would seem that the problem of financing such additions as are at present badly needed is one very difficult of solution, and the future is decidedly problematical.

H. C. Dolph, President, The Ostermann Manufacturing Co., Chicago.—With adjustment of money conditions and movement of crops, a gradual improvement in business should follow.

The following expressions are from important officers or representatives of railroad supply and car building concerns, who desired their names withheld:

"If times were normal the railroads would need more cars, but as the case is now, the foreign cars are being returned to their home roads, which gives the railroads sufficient cars for handling the crops, consequently there is no market for new cars."

"Wall street had its own way for a long time, but Theodore Roosevelt has shaken matters up, causing a slow money market. This has reacted upon the railroads and they, in turn, are curtailing expenses."

"The present turn of affairs is for the good of all and will help to weed out the businesses established on illegal foundations. Last year's market was far above normal and it will be a long time before such a market is reached again."

"The labor situation of the past has been a fruitful cause in bringing about the present condition of the market and I would consider it one of the reasons for the railroads postponing the purchase of new equipment. A recovery in the market can hardly be looked for before six months. Crops are plentiful this year and the railroads seem to have sufficient cars to handle them."

"The inevitable dullness that always follows a panic is sure to return this year, as in former years, therefore I would say that we expect no business until after the Presidential election. There is a slow movement in handling the crops, consequently railroads are not in need of new equipment. The present uncertainty of the money market, and adverse state legislation, have caused the railroads to defer action until a decision has been reached."

Foreign Railroad Notes.

The Italian State Railroads report that they are now running $17\frac{1}{2}$ per cent. more trains than when they took over the management from the companies July 1, 1905; that the speed of many trains has been increased, and in many cases freight separated from passenger traffic, while since Nov. 15 last third class cars are attached to all so-called "fast" trains, while it contemplates attaching them to some "express" trains.

There is a conflict between the general government of China and the province of Che-kiang over the building of a railroad from Soo-chow, a city 50 miles west of Shanghai and connected with it by rail, extending south by west 65 miles to Hang-chow, and thence east 65 miles along a bay to Ning-po. The province claims that two years ago it was given the right to build the line, and the Pekin government says that it is going to contract with an English-Chinese company to build. Shanghai merchants are said to be ready to subscribe $15,000,000 to the provincial enterprise, and they threaten to boycott English goods and to refuse to pay taxes if the English are let into the enterprise.

GENERAL NEWS SECTION

NOTES.

It is reported in Iowa that the Chicago, Burlington & Quincy will hereafter sell no liquors on dining cars in that state.

The Maine Central, controlled by the Boston & Maine, has followed the B. & M. in withdrawing from the per diem agreement.

The Pennsylvania and the Philadelphia & Reading have decided not to grant reduced passenger rates to clergymen. Certificates now held by clergymen, and expiring December 31, are not being renewed.

The Union & Southern Pacific announce that they now have 4,593 miles of line protected by the "Most Modern Safety Block Signal System." This means, apparently, the mileage of automatic signals.

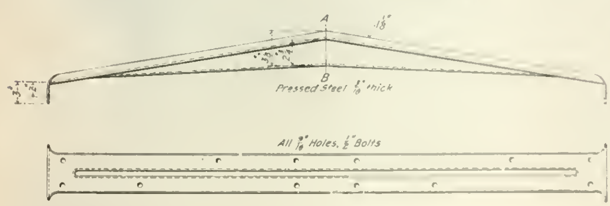
The Erie Railroad has made reductions of 2 to 10 per cent. in the salaries of officers and clerical employees. The reduction, it is said, applies to all of the classes named who receive more than $50 per month, and it affects 1,700 persons.

On the Saturday before Christmas, December 21, the lines of the Interborough Rapid Transit Company, New York City, carried 1,649,752 passengers. Of these 961,114 were carried on the Elevated lines and 688,638 on the Subway division.

The Boston Elevated Railway has distributed to its employees $60,000 in the shape of rewards of $15 each to those employees who during the past year have not been reported for delinquency or misconduct. It is said that this year 85 per cent. of the men received the rewards. This is the fifth time the company has made New Year gifts of this kind.

The Chicago, Burlington & Quincy has established a Bureau of Employment, which will supervise, over the whole of the company's lines, all applications for employment, except in unskilled labor; also the records of all employees in the service. The Superintendent of the bureau is J. N. Redfern, who is also Superintendent of the Relief department.

The Pittsburgh Railways Company, operating the street car lines in Pittsburgh, Pa., has adopted a rule that passengers must pay fare on entering the cars. This action is taken without waiting to provide special large-platform cars, as in Montreal. The main object, it is said, is to keep the conductor always at the rear platform, where he can have control of the brakes while descending hills.



Pressed Steel Carline.

The Central of New Jersey, which has been notified by the New York, New Haven & Hartford that through freight traffic between the two lines by way of New York harbor will no longer be encouraged by the New Haven, has filed with the Interstate Commerce Commission a formal petition asking the Commission to order the New Haven to pay the regular rate (50 cents a day) on freight cars sent by the Central to the New Haven; or, if the Commission does not approve the rate, that a fair per diem rate be prescribed. The other roads terminating in New Jersey have joined the Central of New Jersey in the petition—namely, the Pennsylvania, the New York Central (West Shore), the Erie, the Baltimore & Ohio, the Lehigh Valley, the Delaware, Lackawanna & Western, the Philadelphia & Reading, the Delaware & Hudson and the Lehigh & Hudson River. From this action it would seem that the New Haven has not settled its car service balances for the months of October and November. The complainants declare that 50 cents a day is below a reasonable rate.

Improved Service on the New York Subway Lines.

By shortening and more strictly regulating the stops at stations, the officers of the New York City Subway have succeeded in running express trains in the busy hours at the rate of 30 trains an hour and in exceptional cases a little better than this. This is a considerable improvement over the best previous practice. These trains stop at intervals of about $1\frac{1}{2}$ to two miles and are run under the block system, with overlaps, so that except at stations trains when running at full speed have to be kept something more than a half mile apart. Under the new arrangement there is at a busy station like that in Forty-second street, a man with a stop watch, situated where he can have an unobstructed view of the whole length of the platform, who by a bell signal orders the trains started after they have been stopped 45 seconds, except in cases where (a) the passengers desiring to alight have not all got out or (b) the station platform is so crowded that it is necessary to send away some of the waiting passengers. It is said that but comparatively few passengers have had to wait for a later train by reason of the shortening of stops. The policemen now on duty at the express stations have succeeded in making passengers distribute themselves along the platform better than formerly, thus relieving the congestion at the entrances of the cars at the middle of the train.

New Signal Orders.

The Union Switch & Signal Company's orders booked during December last total a larger sum than in any month since August. They are larger, too, than for the corresponding month in 1906. It is also significant and worthy of note that no overwhelmingly large order, during this past month, swells the total. It consists of a great many orders from many railroads. The block signalling orders are comparatively slight; the bulk of the business now is in supplies and orders for minor installations of interlocking plants. Colonel Prout has for the past six months considered the outlook serious, and, in mentioning the above facts, says that they do not at all coincide with his somewhat pessimistic theories of the to be expected results of the financial disturbance.

New Pattern of Pressed Steel Carline.

The pressed steel carline made by the Cleveland Car Specialty Co., Cleveland, Ohio, was described in the *Railroad Gazette*, April 29, 1904. A new pattern is now being made, a drawing of which is shown herewith. It combines a channel and I section to give a maximum of strength and lightness. The channel also provides room for a 5-in. nailing strip, which is bolted to it, giving a wide support for the longitudinal course of boards.

SECTION A-B.

Because of their lightness and strength, fewer pressed steel carlines are required per car than wooden ones and an appreciable reduction in weight is gained. Also, in most cases, greater inside clearance is obtained. These pressed steel carlines are made in several patterns, for different types of cars. The one shown here is for an outside metal roof.

State Regulation of Railroad Details.

The New York State Public Service Commission, First District, on Dec. 27 issued orders to railroads on a great variety of subjects. Two orders applying to the Staten Island Rapid Transit Railway and the Staten Island Railway Company provide that the companies shall install warning bells at all crossings, signs requiring the engineers to ring their bells at certain specified places, gates at specified crossings of especial danger, all stations to be adequately lighted, as well as trains, all trains to be run to connect with incoming and departing boats at the municipal ferry at St. George. The Staten Island Rapid Transit is ordered to abate smoke and noise nuisances at the freight yards on the west side of the island. Unnecessary labor on Sundays is prohibited.

The Staten Island Railway is commanded to place a flagman at a specified crossing in Tottenville, to lay planking where its tracks cross certain streets to make a level crossing and to run three additional trains daily on Sundays and holidays. The number of cars and the times are specified. The Brooklyn Union Elevated is ordered to repair its waiting rooms at the 36th street station, which now are used chiefly as storerooms for working materials, and to erect windbreaks there to shelter passengers. This work must be completed by January 25. The Interborough (New York) is directed to resume a discontinued service along Amsterdam avenue, from Kingsbridge road to the 155th street terminus. The Commission also adopted a resolution providing for the widening of the subway stairway leading from Vanderbilt avenue at the Grand Central Station.

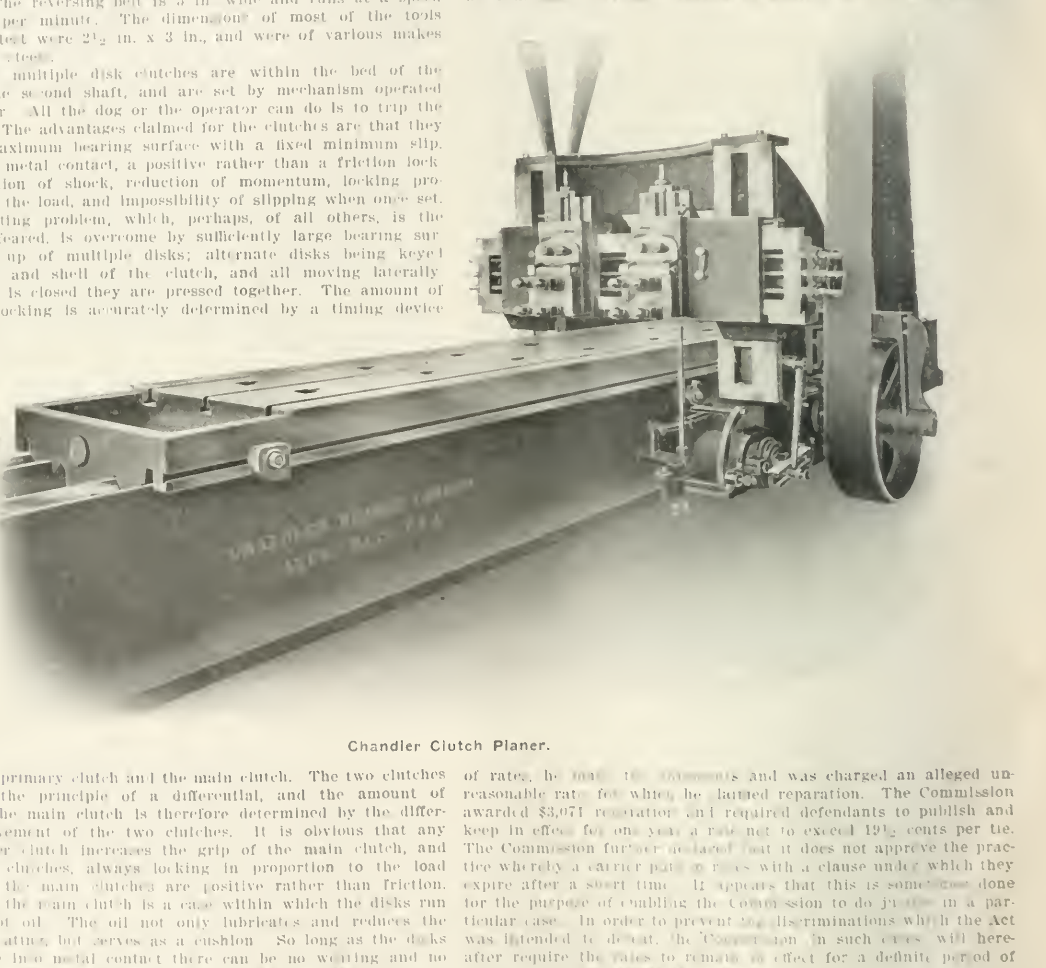
Chandler Clutch Planer.

The Chandler Planer Co. has been testing at its shop at Ayer, Mass., a clutch-driven planer shown in the accompanying illustration. The planer removes the side of the head up to the web, on a pair of extra hard 75-lb. easy switch points, cutting back 9 ft. in less than 6 minutes. The company expects to reduce that time about 20 per cent. At a cutting speed of 20 ft., it removed from a 10-point carbon steel forging a chip ¾ in. deep with ¾ in. feed. It runs for hours on a 14 in. stroke without any indication of injurious heating or wearing.

It is 42 in. x 20 in. x 20 ft., and weighs about 30 tons. In order to subject the clutches to the severest class of work, the planer is of the frog and switch type. Its cutting speed is 20 ft., with a return of 4 1. The cutting belt is 10 in. double and runs at a speed of 1,860 ft. per minute with ratio of 93 ft. of belt to 1 ft. of platen. The reversing belt is 5 in. wide and runs at a speed of 3,900 ft. per minute. The dimensions of most of the tools used in the test were $2\frac{1}{2}$ in. x 3 in., and were of various makes of high speed steel.

The two multiple disk clutches are within the bed of the planer on the second shaft, and are set by mechanism operated by the planer. All the dog or the operator can do is to trip the mechanism. The advantages claimed for the clutches are that they provide a maximum bearing surface with a fixed minimum slip, avoidance of metal contact, a positive rather than a friction locking, elimination of shock, reduction of momentum, locking proportionate to the load, and impossibility of slipping when once set.

The heating problem, which, perhaps, of all others, is the most to be feared, is overcome by sufficiently large bearing surfaces, made up of multiple disks; alternate disks being keyed to the shaft and shell of the clutch, and all moving laterally. When clutch is closed they are pressed together. The amount of slip before locking is accurately determined by a timing device



Chandler Clutch Planer.

between the primary clutch and the main clutch. The two clutches operate on the principle of a differential, and the amount of locking of the main clutch is therefore determined by the difference in movement of the two clutches. It is obvious that any slip of either clutch increases the grip of the main clutch, and insures the clutches always locking in proportion to the load. In a sense, the main clutches are positive rather than friction. The shell of the main clutch is a case within which the disks run in a bath of oil. The oil not only lubricates and reduces the chance of heating, but serves as a cushion. So long as the disks do not come into metal contact there can be no wearing and no heating. One clutch engages with the cutting belt shaft and one with the reversing belt shaft. Consequently, one clutch is idle while the other is in operation. This gives the idle clutch a chance to rest and become thoroughly lubricated before engaging. When engaged, both the primary and main clutch revolve as one clutch.

As momentum is the product of weight multiplied by velocity, every material reduction of either greatly reduces the difficulty of reversing. The clutches are on the second shaft, and the only parts of the clutch that reverse are the disks that are keyed to the shaft. The clutch case and all the other operating mechanism moves constantly in one direction. Supplementing the primary and main clutches is a mechanically operated device which insures a proper and positive engagement of the primary clutch and leaves nothing to the mischance of dogging, and provides a proper margin of safety to meet all the conditions of varying platen load. To run the planer light at a cutting speed of 20 ft., with return speed of 4:1, requires 6 to 7 h.p. on either stroke. To reverse requires about 29 h.p. On severe cutting loads the clutches hold without slipping under a load of over 50 h.p.

INTERSTATE COMMERCE COMMISSION RULINGS.

Reduced Rates Ordered for a Fixed Period of Time.

In an opinion rendered by Commissioner Harlan the Commission has announced its decision in the case of the Holcomb-Hayes Company against the Illinois Central and the Southern. These companies in December, 1905, leased the Tennessee Central and a few days later canceled the through tariffs formerly in effect over that road. When this occurred complainant was engaged in filling a contract for delivering a large number of ties at Pawnee Junction, Bloomington and Baxter, Illinois, from various shipping points on the Tennessee Railroad. Instead of waiting for the readjustment of rates, he made the shipments and was charged an alleged unreasonable rate for which he claimed reparation. The Commission awarded $3,071 reparation and required defendants to publish and keep in effect for one year a rate not to exceed $19\frac{1}{2}$ cents per tie. The Commission further declared that it does not approve the practice whereby a carrier puts in rates with a clause under which they expire after a short time. It appears that this is sometimes done for the purpose of enabling the Commission to do justice in a particular case. In order to prevent the discriminations which the Act was intended to defeat, the Commission in such cases will hereafter require the rates to remain in effect for a definite period of time, to be designated in the order.

New Road Not Encouraged to "Divide the Traffic" With Old.

In an opinion by Commissioner Harlan the Commission has announced its decision in the case of the Chicago & Milwaukee Electric Railroad against the Illinois Central and others. The Commission holds that the act makes no distinction between railroads that are operated by electricity and those that use steam locomotives. The complainant made application for the establishment of through routes and joint rates on freight in both directions between points on its own line and points on the lines of the defendants, but it appeared that the shipping community was already supplied with a reasonable or satisfactory through route, and the Commission decided that the complaint should be dismissed.

The Commission further declared that the proviso in section 15 of the amended law limiting the power of the Commission to establish through routes and joint rates to cases where "No reasonable or satisfactory through route exists" is to be interpreted as meaning that the law is not intended to afford a means by which new lines, with the aid of the Commission, may profitably force their way into shipping districts built up and already well served by older lines, and thus seize and divide with the latter such traffic as may be offered. The purpose of the clause was to afford relief to shipping communities and not to aid carriers to acquire strategic advantages in their contests with one another.

Miscellaneous Rulings.

A number of administrative rulings, involving questions of importance affecting the operation of the interstate commerce law, have been issued by the Interstate Commerce Commission.

It is held that employees of produce companies must pay full fare in traveling to points on the carriers' lines where they expect to obtain consignments and become caretakers.

It is also held that the limitation of rates to shipments handled by steam power as against those handled by electric power is unlawful and must be eliminated from the tariff.

The Commission adheres to its previous ruling that carriers must exhaust their legal remedies to collect undercharges from consignees before filing their petitions for redress.

A tariff containing a new reconsignment privilege cannot be applied retroactively for a previous reconsigned shipment, and cannot be accepted for the basis of a refund.

The granting by carriers of commissions to persons acting as consignees on import merchandise, it is decreed, is a practice that cannot be sanctioned.

The Commission holds it has no power to relieve carriers from the obligations of tariffs providing for demurrage charges on the ground that such charges have been occasioned by a strike.

Where stock in one railroad company is owned by another railroad company, but both maintain separate organizations and report separately to the Commission, it is decided that they may not lawfully carry freight free for each other.

When, after complaint is made and before a hearing, a rate is reduced to the sum demanded by the complainant, the order disposing of the proceedings will be made to require the maintenance of that rate as a maximum for not less than two years.

A tariff filed without naming a date on which it was to take effect was held unlawful and as never having taken effect.

OBITUARY NOTICES.

Edward Payson Rogers, formerly Assistant General Freight and Passenger Agent of the Southern Pacific lines in Oregon, died at his home in Portland, December 21, at the age of 77. Mr. Rogers was one of the pioneers of the northwest, having gone from Iowa to Oregon in 1877. He was born in Vermont and before going to the Pacific Coast was General Freight and Passenger Agent of the Burlington, Cedar Rapids & Northern. His entire railroad career of 30 years in Oregon was passed on lines which finally were all merged into the Southern Pacific. He retired from active service in 1903.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Beaumont & Great Northern.—Leroy Trice, formerly Vice-President of the International & Great Northern, has been elected a Director and Vice-President of the Beaumont & Great Southern, with headquarters at Palestine, Tex.

Canadian Pacific.—Grant Hall, Assistant Superintendent of Motive Power, will also assume the duties of Assistant to the Second Vice-President, succeeding William Cross, whose office has been abolished.

St. Louis & San Francisco.—W. F. Evans, General Attorney, has been appointed General Solicitor, succeeding L. F. Parker, deceased.

Operating Officers.

Chesapeake & Ohio.—This road will hereafter be operated in three general divisions, as follows: The Virginia General division will consist of the Richmond division and Clifton Forge division; the West Virginia General division will consist of the Hinton division, Huntington division and Greenbrier division, and the Kentucky General division will consist of the Ashland division (formerly Kentucky division) and Cincinnati division. The following Superintendents have been appointed: J. W. Knapp, Division Superintendent, has been appointed General Superintendent of the Virginia General division, with office at Richmond, Va. E. J. King, Trainmaster, has been appointed Superintendent of the Richmond division with office at Richmond, Va. E. P. Goodwin, Division Superintendent, has been appointed General Superintendent of the Kentucky General division, with office at Covington, Ky. J. A. Fox, Assistant Division Superintendent, has been appointed Superintendent of the Ashland (formerly Kentucky) division, with office at Ashland, Ky. J. P. Stevens, Assistant Division Superintendent, has been appointed Superintendent of the Cincinnati division, with office at Covington, Ky. The office of Assistant Superintendent of the Kentucky division and the office of Assistant Superintendent of the Cincinnati division have been abolished.

Ohio River & Columbus.—E. H. Blair, Vice-President, has been appointed General Manager, with office at Ripley, Ohio, and the position of Superintendent is abolished.

Oregon Short Line.—J. M. Davis, Assistant General Superintendent, has been appointed Acting General Superintendent of the Oregon Short Line and the Southern Pacific lines east of Sparks, with headquarters at Salt Lake City, Utah, succeeding E. Buckingham, resigned.

Seaboard Air Line.—R. E. Boswell, Superintendent of the Alabama Great Southern at Birmingham, Ala., has been appointed Superintendent of Transportation of the Seaboard Air Line, succeeding H. W. Standley.

Traffic Officers.

Chicago & Alton.—E. A. Keane, Assistant General Freight Agent of the Toledo, St. Louis & Western at St. Louis, has been appointed to the same office on the C. & A. and will have charge of the freight business of both roads at St. Louis.

C. J. Chisam, Assistant General Freight Agent of the C. & A. at St. Louis, has been transferred to Chicago, where he will have supervision, with the same title, of the coal and lumber traffic of the C. & A. and the Toledo, St. Louis & Western.

B. C. Stevenson, Assistant General Freight Agent of the Toledo, St. Louis & Western at Toledo, has been transferred to Chicago. He will hold the same title on the Toledo, St. Louis & Western and the C. & A.

E. M. Davis, Traveling Freight Agent of the Toledo, St. Louis & Western, has been appointed Division Freight Agent at Toledo.

The authority of George B. Simpson, Assistant General Freight Agent of the C. & A. at Kansas City, is extended over the Toledo, St. Louis & Western.

D. Bowes, Assistant General Passenger Agent of the C. & A. at St. Louis, has been appointed Chief Assistant General Passenger Agent of both the C. & A. and the T., St. L. & W.

R. J. McKay, Assistant General Passenger Agent of the T., St. L. & W. at St. Louis, has had his jurisdiction extended over the C. & A., and will move his headquarters to Chicago.

T. J. Burns, of the T., St. L. & W. at Kansas City, becomes Assistant General Passenger Agent of both roads.

C. R. Davidson has been appointed Assistant General Passenger Agent of the C. & A. at Chicago.

Chicago, Rock Island & Pacific.—The headquarters of G. B. Albright, Assistant General Freight Agent, have been transferred from St. Louis, Mo., to Kansas City, Mo., succeeding K. M. Wharry, resigned.

International & Great Northern.—R. E. Lee, chief clerk in the general passenger department, has been appointed Assistant General Passenger Agent, with office at Palestine, Tex., succeeding G. D. Hunter, promoted.

Kansas City Southern.—H. A. Graber, commercial agent, has been appointed General Agent, with office at St. Louis, Mo., succeeding C. H. Ivers.

Missouri, Kansas & Texas.—J. E. Arnold has been appointed Traveling Manager of dining car service between St. Louis and New Orleans.

Toledo, St. Louis & Western.—See Chicago & Alton.

Wabash.—R. W. Owens, heretofore commercial agent at Denver, Colo., has been appointed General Agent of the passenger department, succeeding P. P. Hitchcock, resigned to go into other business.

Engineering and Rolling Stock Officers.

Chicago & Alton.—Charles E. Fuller, Superintendent of Motive Power, has resigned, effective January 1. Peter Maher, Superintendent of Motive Power of the Toledo, St. Louis & Western, will now hold that office for both the T., St. L. & W. and the C. & A.

Chicago, Cincinnati & Louisville.—K. L. Dresser has been appointed Master Mechanic, with headquarters at Peru, Ind., succeeding G. W. Dickson, resigned.

Grand Trunk.—G. W. Dickson, Master Mechanic of the Monon at Peru, Ind., has been appointed Master Mechanic of the Grand Trunk in Canada. K. L. Drexler succeeds Mr. Dickson.

LOCOMOTIVE BUILDING.

The United States Government Engineer Corps, War Department, Portland, Ore., has ordered three Forney locomotives weighing 17 tons, with 9 [illegible] x [illegible]-in. cylinders, from the Davenport Locomotive Works.

CAR BUILDING.

The Grand Trunk is said to be figuring on six or eight cars.

The Waterloo, Cedar Falls & Northern has ordered two interurban electric cars and five 10-bench open cars from McGuire-Cummings Company for April delivery.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS, OKLAHOMA & WESTERN.—Surveys are being made for an extension of this road from Rogers, Ark., northeast to Eureka Springs, and from Siloam Springs, Ark., west to Pryor Creek, Okla., a total of 10 miles. Contract let for some of the work to the W. R. Felker Construction Company, of Rogers, Ark.

BESSEMER & LAKE ERIE.—The extension of the Western Allegheny to West Pittsburgh, where a connection is to be made with the Pittsburgh & Lake Erie and with the Baltimore & Ohio, will be finished and put in operation early in 1908. The new line is two miles long. It runs from the present terminal of the Western Allegheny near Cascade Park, Pa., through Shenango township to West Pittsburgh.

BLAIR LUMBER COMPANY'S ROAD.—Contract has been given to Vito Greco, of Ligonier, Pa., for building a line for this company from Laurel Summit, Pa., to Indian Creek, four miles. Address J. W. Baker, Ligonier.

BUFFALO CREEK & GAULEY.—Surveys are made by this company for an extension from Cresmont, W. Va., to Camden-on-Gauley, 40 miles. Wm. D. Janney, Chief Engineer, Clay, W. Va.

CAROLINA VALLEY.—This company is building an extension from Thomasville, N. C., to High Point, six miles, and from High Point to Greensboro, 16 miles; also from High Point to Winston-Salem, 21 miles.

CHICAGO & WABASH VALLEY.—This company is building an extension from Dinwiddie, Ind., north to Gary, 20 miles.

DULUTH & NORTHERN MINNESOTA.—This company, which last year extended its line north in Minnesota five miles to mile 50, is making surveys from that point north to mile 170.

FLORIDA CENTRAL.—An officer writes that this company, which last year built 28 miles of line in Georgia and Florida, is building with its own men an extension from Maysville, Fla., north to Roddenbury, Ga., 22 miles. J. L. Philips, President, Thomasville, Ga.

GRAND RAPIDS & INDIANA.—See Pennsylvania Lines West.

KENTUCKY MIDLAND.—Contract has been given to A. B. Wood, of Cottage Grove, Ore., for building an extension from Cypress Creek, Ky., to Midland, ten miles. Surveys under way for an extension from Midland to Madisonville, 13 miles. M. M. Wheeler, Chief Engineer, Central City.

LITTLE RIVER.—Contract let to J. W. Anderson & Co., of Townsend, Tenn., for an extension from Forks, Tenn., to Trenthams, four miles.

LOUISIANA & FORT BOYD.—Contracts have been given to S. R. Neel, of Hunter, Ark., for building an extension from Dollar Junction, Ark., to New London, 15 miles. An extension is projected from New London to Wilmington, 17 miles further.

MINIDOKA & SOUTHWESTERN.—See Union Pacific.

MORGANTOWN & NORTH FORK.—This company is building with its own men an extension from Paragon, Ky., southeast to Redwine, ten miles.

MOUNTAIN CENTRAL.—This company has projected a 12-ft. line from Campton, Ky., northeast to Hazel Green, ten miles. J. C. M. Day, General Manager, Clay City, Ky.

NORTHWESTERN RAILROAD.—See Union Pacific.

OREGON RAILROAD & NAVIGATION.—See Union Pacific.

OREGON SHORT LINE.—See Union Pacific.

OREGON, WASHINGTON & IDAHO.—See Union Pacific.

PENINSULA RAILWAY.—An officer writes that this company, which has projected a line from Bartow, Fla., west to Tampa, 50 miles, also from Bartow southwest to St. Lucie, on the Atlantic coast, has four miles graded and track laid on about one mile. Work has been stopped on account of the financial stringency. E. C. Stuart, President, Bartow, Fla.

PENNSYLVANIA & MARYLAND STREET (ELECTRIC).—It is reported that this company, which is building a line to connect Salisbury, Pa., Meyersdale, Berlin and Somerset, now nearly finished, will build a line through Somerset county to Johnstown, where a connection is to be made with the South Cambria.

PENNSYLVANIA LINES WEST.—The Grand Rapids & Indiana has given contracts to the McDonald-O'Connor Company, of Grand Rapids, Mich., for building a 10-mile extension from Ardis, Mich. Surveys are being made from Harbor Springs northwest 12 miles.

SOUTH OMAHA & WESTERN.—See Union Pacific.

TOLEDO, ST. LOUIS & NEW ORLEANS.—Negotiations are under way between this company and residents of Paducah, Ky., to secure an entrance to that place. The company, several years ago, asked for a bonus of several thousand dollars, agreeing to make this point a terminal and to spend $500,000 on improvements.

TOPEKA & NORTHWESTERN.—See Union Pacific.

UMATILLA CENTRAL.—See Union Pacific.

UNION PACIFIC.—The report of this company for the year ended June 30, 1907, shows work done as follows by the following companies:

Work on the projected line from Hershey, Neb., to Northport, about 115 miles, has been finished for 51 miles and work is progressing on the remaining 61 miles.

South Omaha & Western.—Grading on this double-track line from South Omaha, Neb., to Lyman, about 11.60 miles, is nearing completion.

Topeka & Northwestern.—Grading on the extension from Onaga, Kan., to Marysville, 32.1 miles, is progressing and it is expected to finish the line by May 1, 1908. This line, in connection with the trackage arrangements over the St. Joseph & Grand Island Railway, will effect a saving of about 98 miles between Kansas City, Mo., and Cheyenne, Wyo., as against the Denver line, and will also [illegible] between these points of much more favorable gradients and curvatures than via Denver.

Oregon Short Line.—An extension of the North Kemmerer branch, in Wyoming, along Willow creek, about eight miles, is nearing completion.

Minidoka & Southwestern.—On the extension from Twin Falls, Idaho, to Buhl, 15.22 miles, work has been finished.

Northwestern Railroad.—This company was organized to build a line from Blake's Spur, Ore., northward along the west side of the Snake river to Homestead, Ore., 58 miles. Grading is under way along the entire line.

Yellowstone Park.—Of the remaining 53.97 miles of this line, 21.15 miles are finished. Grading under way on the remaining 32.82 miles.

Oregon Railroad & Navigation.—On the extension of the Elgin branch from Elgin, Ore., to Joseph, about 40 miles are graded ready for track, and grading is progressing on the remaining 14 miles.

Oregon, Washington & Idaho.—Track has been laid from Texas City, Wash., to Vaola, 37 miles, and grading on the remaining 25 miles has been finished.

Umatilla Central.—This company, which was organized to build a line from a point near Pendleton, Ore., to Pilot Rock, 14.29 miles, has finished the line.

UNITED TRACTION COMPANY.—Contract has been let to A. W. Sykes, of Sykesville, Pa., for building seven miles of electric line from Sykesville, Pa., to Big Run. E. W. Hess, Chief Engineer, Du Bois, Pa.

WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

WESTERN PACIFIC.—This company is pushing work in the foothills of the Sierra Nevada mountains. George J. Gould, in speaking of the work carried on during the year, states that with 8,000 men at work more earth and rock has been moved than 20,000 men have moved on the Panama canal. During the first eleven months of 1907, 11,171,300 cu. yds. were moved, more than half of which was rock, as compared with 8,171,000 cu. yds. moved on the Panama canal. In addition, the Western Pacific during the same period has driven more than three miles of tunnels, most of which are lined, has built a large amount of masonry, and erected numerous steel bridges. Nearly 200 miles of detached main line steel track was laid and ballasted and a number of stations have been put up; also water tanks, coal chutes and telegraph lines. The Utah Construction Co., of Ogden, Utah, and the E. B. & A. L. Stone Co., of Oakland, Cal., are at work on the remaining 577 miles to finish the line from Salt Lake City, Utah, west to Oakland, Cal., a total of 929 miles.

YELLOWSTONE PARK.—See Union Pacific.

UNION PACIFIC RAILROAD COMPANY—TENTH ANNUAL REPORT.

INCOME FOR THE YEAR.

The gross receipts and disbursements of the Union Pacific Railroad and auxiliary companies, after excluding all offsetting accounts between them, were as follows:

	1907	1906.
Average miles of rail lines operated during year	5,644.55	5,403.55
Transportation Operations.		
Gross transportation receipts	$76,040,726.65	$67,281,542.60
Operating expenses	$40,574,889.10	$35,261,170.84
Taxes	2,069,734.46	1,702,602.32
Total operating expenses and taxes	$42,644,623.56	$36,963,773.16
Receipts over operating expenses and taxes	$33,396,103.09	$30,317,769.44
Fixed Charges.		
Interest on funded debt outstanding	$8,640,608.34	$8,870,898.05
Sinking fund, Utah & Nor. Ry. Co. cons. mtg.	12,013.33	12,013.33
Rentals to Un. Pac. Equip. Ass'n., for equipment	153,578.76	....
	$8,806,200.43	$8,882,911.38
Surplus after payment of fixed charges	$24,589,902.66	$21,434,858.06
Application of Surplus.		
Dividends on stocks of Union Pacific R.R. Co.:		
2 per cent. on preferred, paid Apr. 1, 1907	$1,990,882.00	$1,990,882.00
2 per cent., on preferred, payable Oct. 1, 1907	1,990,882.00	1,990,882.00
3 per cent. on common, paid April 1, 1907	5,864,337.00	5,776,497.00
1½ per cent. on common, payable Jul. 1, 1907	2,932,168.50 }	5,864,337.00
1½ per cent. on common, payable Oct. 1, 1907	2,932,318.50 }	
On stocks of Ore. R. & Nav. Co. outstanding:		
2 per cent. on prfd., paid Jan. 1, 1907	134.00	134.00
2 per cent. on prfd, payable July 1, 1907	98.00	134.00
	$15,710,820.00	$15,622,866.00
Surplus after payment of dividends	$8,879,082.66	$5,811,992.06
Income Other Than from Transportation Operations.		
Interest on bonds owned other than Ore. Sh. L. and Ore. R.R. & Nav. Companies	$258,841.28	$297,910.67
Dividends on stock owned other than Ore. Sh. L. and Ore. R.R. & Nav. Companies	*11,563,105.25	7,237,916.67
Bal. rentals from steamships, other property, etc	242,458.14	506,179.24
Bal. int. on loans and open accounts other than with auxiliary companies	....	2,287,809.02
Total	$12,064,407.67	$10,329,815.60
Less—balance of interest on loans and on open accounts other than auxiliary companies.	477,389.45	....
Balance	$11,587,018.22	$10,329,815.60
Deductions—Dividends on Union Pacific stock:		
2 per cent. on common, paid Apr. 1, 1907	$3,909,558.00	....
1 per cent. on common, payable July 1, 1907	1,954,779.00 }	$3,909,558.00
1 per cent. on common, payable Oct. 1, 1907.	1,954,879.00 }	
Total deductions	$7,819,216.00	$3,909,558.00
Surplus.	$3,767,802.22	$6,420,257.60
Total surplus from transportation and other income after payment of dividends.	$12,646,884.88	$12,232,249.66
Applied as follows:		
For betterments made during the year	$1,959,002.03	$2,700,000.00
For betterments and additions of branch lines	.....	500,000.00
For new equipment.	....	1,000,000.00
Total	$1,959,002.03	$4,200,000.00
Net surplus	$10,687,882.85	$8,032,249.66
Increase in net surplus,* 1907 over 1906	2,655,633.19	..

*Does not include dividends of $2,015,962.50, declared since July 1, 1907, for year ended June 30, 1907, on shares of Atchison, Topeka & Santa Fe, Baltimore & Ohio, and the Illinois Central railroads.

ASSETS AND LIABILITIES

The assets and liabilities of the Union Pacific Railroad and Auxiliary Companies are shown in detail in Table No. 5. The securities of the Auxiliary Companies owned by the Union Pacific Railroad Co. and of the proprietary railroads which are operated as an integral part of the system and are owned by the Union Pacific Railroad and auxiliary companies, as well as all offsetting accounts between the companies, are eliminated, thus dealing only with the securities in the hands of the public and the assets due from and liabilities due to the public.

The increase or decrease in assets and in liabilities since the last report, briefly stated, is as follows:

Increase in Assets		
Cost of railways, equipment and appurtenances as shown in detail under "Capital Expenditures"		$21,073,150.32
Stocks and bonds, including $18,000,000 San Pedro, Los Angeles & Salt Lake R.R. Co. 4 per cent. bonds taken over in settlement for advances		113,175,005.75
Material, fuel and supplies		2,051,621.24
Current cash accounts		1,041,225.22
Expenditures for construction of new lines, for terminal properties and for rolling stock	$14,468,083.22	
Less: Expenditures for construction of new lines in preceding years, dealt with as deferred assets in last year's report, transferred this year to cost of railroads, equipment and appurtenances	6,040,260.03	
		8,427,823.19
Total increase in assets		$145,768,825.72
Deduction—Received from San Pedro, Los Angeles & Salt Lake R. R. Co.	$17,300,000.00	
Decrease in cash and demand loans	45,398,034.05	
Decrease in unadjusted accounts	68,276.16	
		62,766,310.21
Net increase in assets		$83,002,515.51
Increase in Liabilities		
Capital stock	$29,130.00	
Current cash accounts	2,185,834.56	
Loans and bills payable	69,050,220.00	
Reserve depreciation and replacement of equipmt	420,688.56	
Due to proprietary companies	1,503,623.16	
Insurance, trust and hospital funds.	97,724.01	
	$73,287,220.29	
Deduct—Decrease in funded debt	466,500.00	
		72,820,720.29
Net increase of assets (gain in profit and loss)		$10,181,795.22

Since the close of the year the company has sold $75,000,000, face value "20-Year 4 Per Cent. Convertible Gold Bonds," hereinafter referred to, and the proceeds have been applied to the discharge of current liabilities.

There were sold during the year:

64,000 shares	Great Northern Railway Co.	$19,220,000.00
92,000 "	Northern Pacific Railway Co.	18,954,055.56
13,200 "	Great Northern Railway Ore Ctfs	1,021,789.63
Total		$39,195,845.19

which was credited against the cost of stocks owned. The proceeds from the sale of above stocks, together with the sales reported in the annual reports for the years 1905 and 1906, amounted to $117,869,799.66.

The state of the account in respect of the cost of the stock of the Northern Securities Company and of the preferred stock of the Great Northern Railway Company acquired under subscription rights, and the amount realized from the sale of stocks received in the distribution of the stocks of the Northern Securities Company, is as follows:

Cost of 824,918.71 shares Northern Securities Company stock.		$79,459,691.36
" 37,444.0 " Great Northern Railway Co. stock, acquired under subscription rights		3,744,400.00
Total cost		$83,204,091.36
The amounts realized from the stocks sold were:		
For 100,000.00 shares Nor. Securities Co. stock*	$16,880,019.46	
" 163,600.89 " Gt. Nor. Ry. Co. stock	49,801,576.47	
" 240,300.82 " Nor. Pac. Ry. Co. stock.	50,166,357.97	
" 18 " Nor. Securities Co. stubs	56.13	
	$116,848,010.03	
" 13,200.00 " Gt. Nor. Ry. Co. ore ctfs.	1,021,789.63	
		117,869,799.66
Amount realized from sales in excess of total cost of stocks†		$34,665,708.30

*Sold prior to distribution of Gt. Nor. Ry. Co. and Nor. Pac. Ry. Co. stocks.

†Besides 90,364 shares Great Northern Ry., 77,164 shares Great Northern Ry. Ore certificates, 41,528 shares Northern Pacific Ry. and 7,249 shares Northern Securities stubs still on hand unsold.

The annual dividends on the stocks amounted to $3,290,512.01. The average price realized per share was $168.80 for Northern Securities Company, $304.41 for Great Northern Railway Company, $208.76 for Northern Pacific Railway Company, and $77.41 for Great Northern Railway Company ore certificates. At these prices the dividends averaged per annum 2.67 per cent. on Northern Securities Company stock, 2.30 per cent. on Great Northern Railway Company stock, and 3.35 per cent. on Northern Pacific Railway Company stock, or an average of 2.79 per cent. for all. It was therefore decided to dispose of these holdings and to reinvest the proceeds in securities yielding a greater return.

Accordingly, there were purchased stocks costing $83,415,732.48, and, subsequently stocks of the Baltimore & Ohio Railroad Company costing $45,466,960. The deferred payment on the latter purchase amounted to $36,29[illegible] 432, against which the company had on hand, unsold, 100,364 shares of Great Northern Railway Company and 79,528 shares Northern Pacific Railway Company stocks, worth, at the then prevailing prices, about $47,000,000.

The state of the account in respect of these reinvestments, the value of Great Northern and Northern Pacific stocks unsold, and the annual dividends or interest are as follows:

	Shares	Cost	Annual Dividends or Interest: Rate	Annual Dividends or Interest: Amount
A., T. & S. F. Ry. Co., pf.	100,000	$10,395,000.00	5	$500,000.00
C., M. & St. P. Ry. Co., com.	36,900	5,997,750.24	7	258,300.00
C. & N. W. Ry. Co., com.	32,150	5,946,673.94	7	225,050.00
Illinois Central R. R. Co.	186,231	32,618,882.53	7	1,303,617.00
N. Y. C. & H. R. R. R. Co.	142,857	19,634,279.93	6	857,142.00
Railroad Securities Co., pf.	18,984	1,917,988.42	4	75,936.00
Railroad Securities Co., com.	34,154	6,905,156.42	8	273,232.00
Total		$83,415,732.48		$3,493,277.00
B. & O. R. R. Co., pf.	72,064	6,665,920.00	4	288,256.00
B. & O. R. R. Co., com.	323,342	38,801,040.00	6	1,940,052.00
Total		$128,882,692.48		$5,721,585.00
Twenty-five per cent. paid on C., M. & St. P. Ry. Co. pf.	18,450	461,250.00	5	23,062.50
Twenty-five per cent. paid on C., M. & St. P. Ry. Co., com.	9,225	230,625.00	5	11,531.25
Fifty per cent. paid on subscription to Gt. Nor. Ry. Co. stk.	36,145.60	1,807,280.00	5	90,364.00
Twelve and one-half per cent. paid on subscription to Northern Pacific Ry. Co. stk.	24,916	311,424.00	7	21,799.68
Total		$131,693,271.48		$5,868,342.43

Value of unsold stocks on hand (market value June 29, 1907):			
90,364 shares Great Northern Ry. Co. @ 131..	$11,837,684 00		
77,164 shares Great Northern Ry. ore certificates @ 58..	4 475,512 00		
41,528 shares Northern Pacific Ry. Co @ 129	5,357,112 00		
7,219 shares Northern Securities Stubs @ 100 ..	724,900 00		
		$22,395,208 00	1,036,653 00
Proceeds from sale of Northern Securities, Great Northern and Northern Pacific stocks (from which the annual dividends amounted to $3,290,512.01) ..		117 869,799 66	
Total—Value of unsold stocks and proceeds from sales ..		$140,265 007 66	
Cost of Northern Securities and of Great Northern stocks		83,204 091 36	
Surplus		$57,060,916 30	
Annual income from reinvestment stocks, Great Northern Railway, and Northern Pacific Railway stocks on hand, unsold			$6,901,995 43

The income from the reinvestments yields an average of 4.46 per cent. against 2.79 per cent. on the original investment. This amounts to an annual gain of $1,968,424.72.

The market value of Northern Securities, Great Northern, and Northern Pacific stocks which were sold for $117,869,799.66, would, if still on hand, have been, at the prices of June 29, 1907, $62,342,263.04, a shrinkage of $55,527,536.12

The market value of the reinvestments made, at the prices of June 29, 1907, was $108,543,376.55, a shrinkage of...... 23,149,894.93

Increase in value by reinvestments..... $32,377,641.19

The stocks and bonds owned, other than stocks and bonds of the Union Pacific Railroad and auxiliary companies, stand charged at the close of the year with $209,406,811 81, an increase during the year of $112,625,005.75. This increase was mainly in the aforementioned reinvestments, the purchase of $20,000,000 San Pedro, Los Angeles & Salt Lake Railroad Company 4 per cent. bonds, the payment of $1,050,000, subscription of 25 per cent. to preferred stock of the Southern Pacific Company, and $2,022,540 paid for 50,822 shares of the preferred and common stocks of the St. Joseph & Grand Island Railway Company. The details of the stocks and bonds owned, pledged and unpledged, and the increase or the decrease during the year, are shown in tables Nos. 9, 10 and 11.

The details of the stocks and bonds of the Union Pacific Railroad and auxiliary companies are shown in tables Nos. 7 and 8. From table No. 8 it will be seen that the companies own bonds, unpledged, to the amount of $83,432,500 face value.

Including the miles of railroad released by the satisfaction of the Union Pacific Railroad Company first lien convertible 4 per cent. mortgage, the companies own, free of mortgage debt, the following miles of railroad and the entire outstanding stocks and bonds of the following railroads built in their interest:

	Miles.
Union Pacific Railroad Co.:	
Julesburg to La Salle, Col.	151.53
Valley, Neb., to Manhattan, Kan	189.05
Valparaiso to Stromsburg, Neb.	53.30
Stromsburg to Central City, Neb.	21.98
Blue Springs Junction to Blue Springs, Neb.	.67
Columbus to Norfolk, Neb.	50.37
Oconee to Albion, Neb	34.54
Genoa to Spalding, Neb.	44.42
Grand Island to Ord, Neb.	60.77
Scotia Junction to Scotia, Neb	1.37
St Paul to Loup City, Neb	39.40
Boelus to Pleasanton, Neb.	22.09
Hershey to Northport, Neb.	53.52
Thayer to Superior, Wyo.	9.05
Salina to Oakley, Kan., via Colby	225.35
Baum Mine Junction to Baum Mine, Col	0.96
St. Vrain's Junction to Grant Mine, Col.	6.47
Leavenworth to Miltonvale, Kan.	165.33
Total, Union Pacific Railroad Co.	1,130.17
Oregon Railroad & Navigation Co.:	
St. John's to Troutdale, Ore	5.23
Elgin to Joseph, Ore	9.30
All stocks and bonds of the following companies	
Boise City Railway and Terminal Company	8.48
Columbia River & Oregon Central Railroad Company	45.31
Columbia Southern Railway Company	69.46
Malad Valley Railroad Company	46.40
Malheur Valley Railway Company	14.24
Minidoka & Southwestern Railroad Company	59.09
St. Anthony Railroad Company	37.46
Salmon River Railroad Company	85.99
Snake River Valley Railroad Company	65.85
Topeka & Northwestern Railroad Company	37.50
Wyoming Western Railroad Company	19.02
Yellowstone Park Railroad Company	16.40
Total miles	1,649.90

The profit and loss surplus at the close of the year amounted to $52,977,821 61. However, the actual annual surpluses since the company's reorganization aggregated a much larger amount. The above profit and loss surplus of $52,977,821 61 is the sum that remained after applying against this account profits applied in diminution of the cost of stocks and bonds, appropriations from income applied in writing down the cost of railroads, equipment and appurtenances, and, also, liabilities created by appropriations from income and by charges to expenses. The items thus applied have been reported in detail in the several annual reports and were as follows:

Profits from sale of Northern Securities, Great Northern and Northern Pacific stocks in excess of their cost ($31,665,708.30), credited against the aggregate cost of stocks and bonds (less $1,955,479.30 credited to profit and loss in the year 1905)	$29,710,229.00
Appropriations from income for betterments and additions applied in writing down cost of railroads, equipment and appurtenances	16 959,816.24
Received from improvement and equipment fund applied in writing down cost of changes in line	7,252,036.56
Appropriations from income for a reserve fund for future betterments, additions and new equipment	4,678,350 93
Charged to expenses for a reserve fund for maintenance renewals, etc	4,774,610.39
Total of items not included in the above profit and loss surplus	$63,375,043 12

CAPITAL EXPENDITURES.

The charges to capital account, other than for stocks and bonds in companies other than the Union Pacific Railroad and auxiliary companies, were as follows:

Expenditures for account of new railroad construction			$10,763,831.69
Expenditures for account of extensions			704 871.10
Stocks and bonds of following companies pledged under Oregon R.R. & Navigation Co. 4 per cent consolidated mortgage as muniments of title to railroads which form part of its main line. These stocks and bonds were in former reports included in stocks and bonds owned			
Cascades R. R. Co., capital (par, $300,000)		$150,000 00	
Columbia & Palouse R.R. Co.:			
Capital stock, par value		1,000,000 00	
First mortgage 6 per cent bonds, face value		2,829,000 00	
Mill Creek Flume & Mfg Co. capital, par value		200,000.00	
Walla Walla & Columbia Rvr R.R. Co., capital, par		700,000 00	
			4 879,000 00
Expenditures for betterments (Table No. 25) and for additions (Table No. 26), viz.			
For ballasting		$116,578.04	
" bridges, viaducts and culverts		571,506.03	
" shops, buildings and yards		1,856,428.72	
" real estate		467,814.01	
" fencing, telegraph lines, and shop machinery		95,544.02	
" additional side and passing tracks		385,695.00	
" second main track		2,768,125 78	
" changes in line, reducing grades, widening embankment		655,183.25	
" interlocking and block signals		1,075,191.07	
" addit'l equipment for preceding fiscal year		8,453 91	
" water supply and pipe lines	$38,830.53		
" other minor items	6,374 90		
		45,205.43	
			8,045,725 26
Total charges			$24,393,428 05
Credits:			
Appropriated from income account for betterments made during the year		$1,959,002.03	
Amount received from trustee of Union Pacific Railroad Co. first mortgage 4 per cent. bonds in payment of expenditures for betterments, improvements, equipment, etc., not otherwise provided for		1,260,000.00	
Proceeds from sale of property applied under provisions of mortgage for payment of betterments and improvements		7,172.05	
Amounts deducted from cost of railroads, equipment and appurtenances on account of difference between face value of stocks and bonds of auxiliary companies and the price at which they were taken over		83,172.09	
Cost of surveys written off		10,563.39	
Collection old claims acquired in reorganization		368.17	
			3,320,277 73
Net expenditures for capital account.			$21,073,150.32

EQUIPMENT.

The changes in the equipment during the year were as follows:

	Destroyed, etc.†	Added and charged to— Replacem't fund.	Capital account	Free assets.	Un. Pac Equipment Ass'n	Total.
Locomotives	9	4	11	55	109	179
Baggage cars	1	6		..	9	15
And mail cars	.		1	..	..	1
And pass. cars	2	..	..	..	..	..
Mail and pass'gr	1	.	..	..	..	..
Business cars	..	1	..	.	..	1
Dining cars	1	..	1	*1	5	5
Motor cars	1	2	.	..	..	2
Observation cars	1	..	.	.	..	.
Passenger cars	6	1	3	39	..	43
Postal cars	1	1	..	9	..	10
Box cars	699	255	162	*112	1,225	1,530
Caboose cars	21	10	2	..	35	47
Flat cars	43	2	100	*100	..	2
Furniture cars	67	..	.	.	..	.
Gondola cars	289	.		.	..	.
With drop botms	4		.	200	500	700
With hpr botms	3		.	.	200	200
Refrigerator cars	69		.	..	.	.
Stock cars	184			97	500	597
Tank (oil)	.			45	.	45
Narrow gauge	2	..		..	..	.
Road service cars	155	479		..	150	629
Credited or chrgd	$593 686	$600,391	$403,614	$1,512,187	$4,730,949	$7,247,142

*Credit.

†Destroyed, condemned, sold or transferred and credited to replacement fund.

The locomotives added during the year averaged 99.95 tons total weight of engine without tender, and 85.50 tons upon drivers. The freight cars added during the year averaged 48.05 tons capacity.

The locomotives and cars owned and their capacity at the close of the year were as follows:

	This year	Last year	Inc.	Per cent
Locomotives, standard gage	1,050	880	170	19.20
Locomotives, narrow gage	1	1	.	
Total	1,051	881	170	19.18
(Standard Gage.)				
Total weight, excluding tender, tons	85,419	68,005	17,414	25.61
Average total weight, exclдg tender, tons	81.35	77.28	4.07	5.27
Total weight on drivers, tons	70,109	55,251	14,858	26.89
Average total weight on drivers, tons.	66.77	62.78	3.99	6.36
Passenger train cars, standard gage	642	579	63	10.88
Passenger train cars, narrow gage	1	1	..	..
Total	643	580	63	10.86

Freight train cars, standard gage	25,371	23,629	1,742	7.37
Freight train cars, narrow gage	6	8	*2	25.00
Total	25,377	23,637	1,740	7.36
Total capacity, stand. gage cars, tons	864,955	747,846	117,109	15.66
Av. capacity standard gage cars, tons	34.64	32.16	2.48	7.71
Road service cars	2,929	2,454	475	19.36

*Decrease, allowed for in total.

The equipment owned by the respective companies is shown in table No. 24. The changes during the year, the capacity, and the service of all equipment are shown in Tables Nos. 31, 32 and 33.

TRANSPORTATION OPERATIONS.

The results of the year's transportation operations compared with those of the preceding year are as follows:

	Year ended June 30. 1907.	1906.	Increase.	Per cent.
Av. miles operated	5,644.55	5,403.55	241.00	4.46
Receipts.				
Pass., inc. extra baggage	$14,912,508.37	$13,236,054.90	$1,676,453.17	12.66
Mail and express	4,143,581.72	3,264,857.68	878,724.04	26.91
Freight	54,859,302.41	48,992,014.90	5,867,287.51	11.97
Switching, rentals, etc.	1,735,712.54	1,386,214.25	349,498.29	25.21
Total rail lines	$75,651,105.04	$66,879,141.73	$8,771,963.31	13.11
Water line	389,621.61	402,400.87	*12,779.26	3.18
Total	$76,040,726.65	$67,281,542.60	$8,759,184.05	13.02
Operating expenses.				
Maint. way and structures	$10,066,868.09	$9,900,409.28	$166,458.81	1.68
Maint. of equipment	7,853,933.09	7,118,940.10	734,992.99	10.33
Conducting transportation	20,276,530.16	16,203,782.61	4,072,747.55	25.11
General expenses	1,958,191.20	1,600,943.94	357,247.26	22.32
Total rail lines	$40,155,522.54	$34,824,075.93	$5,331,446.61	15.31
Water lines	419,366.56	437,094.91	*17,728.35	4.06
Total	$40,574,889.10	$35,261,170.84	$5,313,718.26	15.07
Receipts over operat'g exp.	$35,465,837.55	$32,020,371.76	$3,445,465.79	10.76
Passenger traffic.				
No. passengers carried	5,663,828	4,803,094	860,734	17.92
Passengers carried 1 mile	680,278,509	642,544,422	37,734,087	5.87
Receipts, passenger trns pr mile of main track	$3,376.02	$3,053.72	$322.30	10.55
Passenger trains per revenue train mile ‡	$1.77	$1.67	$0.10	5.99
Freight traffic.				
Tons comrcl carried 1 mile	5,704,061,535	5,353,374,071	350,687,464	6.55
Receipts, pr mile main trk	$9,718.99	$9,066.63	$652.36	7.20
Do., per rev. train mile†	$3.89	$3.84	$0.05	1.30

*Decrease, allowed for in totals.
†Revenue freight train and all mixed train miles.
‡Revenue passenger train and all mixed train mileage.

The increase in the amount of work done by the transportation department of the rail lines is shown in the following table:

	Increase.	Per cent.
Gross transportation receipts	$8,771,963.31	13.12
Expenses conducting transportation	4,072,747.55	25.13
Passengers carried 1 mile	37,734,087	5.87
Mileage of passenger cars	3,258,929	4.76
Locomotive mileage with passenger trains, inc. helping	668,288	6.64
Tons of revenue freight carried 1 mile	350,687,464	6.55
Tons of revenue and company freight carried 1 mile	189,456,253	2.91
Mileage of freight cars	19,375,459	4.78
Locomotive mileage with freight and mixed trains, including helping	1,399,214	9.73
Total locomotive mileage in conducting transportation	2,765,764	9.70

[illegible]e average number of tons of freight per train, and loaded cars per [illegible]nding caboose) and the tons per loaded car for the respective com[illegible] the year were:

Revenue and Company Freight (Way-bill Tonnage).

Tons per train:*	Union Pacific R. R.	Oregon Short Line R.R.	Oregon Railroad & Navigation	Average all lines.
Tons	455.94	530.03	477.08	474.97
+ inc., — dec., tons	38.33	28.45	25.41	34.74
Per cent	7.75	5.09	5.05	6.82
Loaded cars per train:				
Cars	23.30	20.87	20.83	22.44
+ inc., — dec., tons	1.11	1.48	1.41	1.23
Per cent	4.55	6.62	6.34	5.20
Per cent. of loaded car mileage to total car mlge	75.10 + 0.17	70.40 1.99	81.21 2.20	74.75 0.07
Tons per loaded car:				
Tons	19.57	25.40	22.90	21.16
+ inc., — dec., tons	—0.68	0.41	0.31	0.38
Per cent	3.35	1.64	1.37	1.76

*Ton-miles per revenue freight train and all mixed train miles.

The decrease in tons per train resulted from the sm[illegible]r tr[illegible]ns run in order to relieve the congestion of traffic and to move the increased traffic with all possible despatch. The decrease in tons per train on the Union Pacific Railroad was augmented by using eastern coal on its line between Council Bluffs and Cheyenne so as to send a greater amount of Wyoming coal to the Inter mountain territory. This greatly reduced the traffic for eastbound cars, and as the fullest loading had been heretofore secured with eastbound traffic on account of the favorable grade, the change materially reduced both train and carload.

GENERAL

To provide funds for paying off current liabilities, for equipment to be delivered, for improvements and construction under way, and for other corporate purposes, the Board of Directors of the Union Pacific Railroad Co. on May 9, 1907, authorized the issue of "Twenty Year Four Per Cent. Convertible Gold Bonds" not exceeding $75,000,000 and recommended to the stockholders an increase of $100,000,000 in the common capital stock of the company.

At a special meeting of the stockholders of the Union Pacific Railroad Company held at Salt Lake City, Utah, on June 15, 1907, resolutions were adopted amending the Articles of Association of the company for the purpose of increasing its common capital stock by the amount of $100,000,000 and authorizing the issue of such additional common capital stock from time to time for such lawful corporate purposes and upon such lawful terms as should be determined by the Board of Directors of the company. These resolutions further provided that the said stock or so much thereof as the Board of Directors should set aside or reserve for that purpose might be issued from time to time in exchange for the "Twenty Year Four Per Cent. Convertible Gold Bonds" of this company authorized to be issued. At a special meeting of the Board of Directors of the Union Pacific Railroad Company held on July 8, 1907, $42,857,200 par value of the additional common capital stock authorized was set apart and reserved to be issued in exchange for the "Twenty Year Four Per Cent. Convertible Gold Bonds. The stock so set apart is not to be issued or used prior to the first day of July, 1917, except to such extent as such bonds should, in the meantime, have been redeemed or paid off.

The convertible bonds issued under this authority were offered to the holders of the preferred stock and common stock of the Union Pacific Railroad Company in amount equal to 25 per cent. of their respective holdings of such stocks at 90 per cent. of the face value of the new bonds. Subscriptions were payable 25 per cent. thereof on, or before July 10th, 25 per cent. August 9th, and 50 per cent. September 10th. The bonds bear interest from July 1, 1907, payable January 1 and July 1. They will be convertible at the option of the holder at any time after issue and prior to July 1, 1917, into paid-up shares of the common stock of the railroad company at $175 per share. The bonds may be called for redemption by the company on July 1, 1912, or on any semi-annual interest day thereafter or on 90 days notice, at a premium of 2½ per cent.

Under provisions of the Interstate Commerce Commission Act as amended, the railroads are required to provide refrigerator cars, to show the charges for such cars and for the service of the refrigeration, ventilation, etc., in their tariffs, and to include such charges in their freight bills. In order to furnish these cars and service, it was deemed advisable for the Union Pacific Railroad Company and the Southern Pacific Company to arrange for the incorporation of a company whose stock should be taken by said companies and who should acquire and furnish them and their allied lines the necessary cars and service. In pursuance of this plan there was organized under the laws of the state of Utah the "Pacific Fruit Express Company" with an authorized capital of $12,000,000. Six thousand six hundred refrigerator cars were ordered, costing about $10,180,800. There have already been delivered 3,600 cars, and the delivery of the remaining 3,000 cars will be completed during December, 1907.

For the purpose of purchasing equipment for the use of the Union Pacific Railroad and auxiliary companies, there was also incorporated under the laws of the state of Utah a corporation known as the "Union Pacific Equipment Association. The equipment company either holds title to the equipment and leases it to the several companies, or holds title thereto until such equipment is distributed among the companies. The association received during the year 109 locomotives, 14 passenger train cars, 2,460 freight train cars, and 150 road service cars, costing $4,730,949.48. There remained to be delivered on outstanding contracts 15 locomotives, 44 passenger train cars and 1,340 freight train cars which will cost about $2,150,000.

As this fiscal year completes a decade of the company's operations since its reorganization, the following statement showing the receipts, disbursements and surplus, by years, will, it is believed, be of interest to the owners of these properties:

Years.	Miles of Road Operated.	Gross Receipts and Income	Surplus after Payment of Operating Expenses and Taxes.	Fixed Charges	Surplus after Payment of Fixed Charges.	Dividends	Surplus after Payment of Dividends
1907	5,644.55	$87,474,766.11	$44,829,542.55	$8,652,621.67	$36,176,920.88	$23,530,036.00	$12,646,884.88
1906	5,403.55	77,611,358.20	40,647,585.04	8,882,911.38	31,764,673.66	19,532,424.00	12,2[illegible],249.66
1905	5,357.54	65,671,840.38	33,809,125.95	11,023,618.97	22,785,506.98	11,087,060.50	11,698,446.48
1904	5,352.71	59,516,469.44	29,019,026.81	12,421,925.00	16,597,091.81	8,334,636.00	8,263,45[illegible]
1903	5,762.28	55,610,466.23	26,863,250.24	11,586,607.77	15,276,642.47	8,333,168.00	6,94[illegible],474.47
1902	5,710.91	50,554,202.49	21,994,976.13	10,491,727.36	14,503,248.77	8,187,288.00	6,[illegible]15,960.[illegible]
1901	5,543.44	44,514,812.04	19,957,666.97	7,422,609.37	12,535,057.60	7,980,970.00	4,554,087.60
1900	5,427.89	40,396,973.52	18,969,428.29	6,732,037.91	12,237,290.58	7,393,429.50	4,843,861.08
1899	5,357.73	36,425,820.13	17,357,633.03	7,399,620.35	9,958,012.68	3,020,582.90	6,9[illegible]7,4[illegible]9.78
1898	5,325.68	33,281,125.78	13,700,834.89	4,188,260.06	9,212,574.83	1,781,130.95	7,431,44[illegible].88

In the year just closed, the revenue of the companies and the traffic moved were the largest since their reorganization in 1898. They carried over their rails an average of 1,010,547 tons one mile per mile of road against 410,758 tons in 1898, a ratio of 2.46 to 1, and 120,520 passengers one mile per mile of road against 42,854 passengers in 1898, a ratio of 2.81 to 1.

These results were made possible by the expenditures in past years for changes in line, for reducing grades, for second track, for enlargement to and addition of shops, terminals, etc., and for betterments and additions in all directions by which the service to the public was increased, and also by the building of new lines and payments for account of new lines from which additional traffic was secured. These expenditures to June 30, 1907, amounted to $104,127,986.85, and were principally for:

Changes in line	$11,802,289.51
Reducing grades, second tracks, passing tracks, shops, buildings, terminals and other betterments and additions	33,519,565.93
New equipment	26,382,588.37
Construction of new lines and payments for account of San Pedro, Los Angeles & Salt Lake R. R. Co.	32,723,543.04
Total	$104,127,986.85

In addition to the above expenditures the companies have also expended for account of new lines in course of construction and for terminal properties, $26,212,601.19.

The details of the investment stocks are shown in table No. 10. Since the close of the year, the remaining payments on the subscription to the preferred stock of the Southern Pacific Company and payments on account of subscriptions to other stocks have been made. Excluding the hereinbefore mentioned amount realized from the sale of Northern Securities, Great Northern and Northern Pacific stocks in excess of their cost (which stands as a credit against the aggregate cost of stocks and bonds), the investment stocks owned December 5, 1907, cost $227,346,292.36. The market value of these stocks on that day was as follows:

Shares.		Market Value. Last Sale or Bid.	Value.	Annual Dividends or Interest. Rate.	Amount.
87,864	Gt. Nor. Ry. Co. pf.	120	$10,543,680	7	$615,048.00
38,645.60	*Gt. Nor. Ry. Co. pf.	115	3,478,104	5	145,932.25
77,164	Gt. Nor. Ry. Co. ore ctfs.	46	3,549,544	...	.....
33,028	Nor. Pac. Ry. Co., com.	118	3,897,304	7	231,196.00
33,416	†Nor. Pac. Ry. Co. com.	106	1,453,596	7	80,893.61
7,249	Northern Securities stubs.	100	724,900	5	36,245.00
100,000	A., T. & S. F. Ry. Co. pf.	83	8,300,000	5	500,000.00
19,800	C., M. & St. P. Ry. Co., com.	105	2,079,000	7	138,600.00
26,325	‡C., M. & St. P. Ry. Co., com.	97	812,400	5	53,675.00
18,450	*C., M. & St. P. Ry. Co., pf.	123	1,070,100	5	32,287.50
32,150	C. & N. W. Ry. Co., com.	139	4,468,850	7	225,050.00
142,857	N. Y. C. & H. R. R. R. Co.	98	13,999,986	6	857,142.00
72,064	B. & O. R. R. Co. pf.	76	5,476,864	4	288,256.00
323,342	B. & O. R. R. Co., com.	84	27,160,728	6	1,940,052.00
900,000	Southern Pacific Co., com.	75	67,500,000	6	5,400,000.00
342,000	Southern Pacific pf.	107	36,594,000	7	2,394,000.00
103,431	C. & A. R. R. Co., pf.	54	5,585,274	4	413,724.00
201,231	Illinois Central R. R. Co.	126	25,355,106	7	1,408,617.00
19,359	R. R. Securities Co., pf.	100	1,935,900	4	77,436.00
34,829	R. R. Securities Co., com.	126	4,388,454	4½	156,730.50
	Total		$228,403,790		$15,000,890.86

*75 per cent. paid.
†37½ per cent. paid.
‡35 per cent. paid.

No. 4.—Profit and Loss for the Year Ended June 30, 1907.

Appropriated for betterments made during the year		$1,959,002.03
Reserved for depreciation of rolling stock owned and leased to other companies		312,009.08
Adjustments in accounts		238,444.47
Balance June 30, 1907		52,977,821.61
		$55,487,277.19
Balance June 30, 1906, viz:		
Income account		$41,887,564.64
Sinking funds		908,461.75
Bal., income from transportation operations	$8,879,082.66	
Balance, income other than from transportation operations	3,767,802.22	
		12,646,884.88
Sinking fund contributions and income from sinking fund investments		20,625.73
Proceeds from sales of unpledged lands and town sites		23,740.19
		$55,487,277.19

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.

No. 5.—Assets and Liabilities, June 30, 1907.

(Excluding stocks and bonds owned of Auxiliary and Proprietary companies and all offsetting accounts between them.)

ASSETS.

	June 30, 1907.	June 30, 1906.
Capital assets:		
Cost of railways, equipment and appurtenances	$373,954,997.91	$353,573,155.30
Cost of extensions	1,290,689.25	596,381.54
Stocks and bonds owned, as detailed in Tables Nos. 9, 10 and 11	209,406,811.81	96,781,806.06
Trust funds	300,464.54	252,011.84
	$584,949,963.51	$451,203,354.74
Current assets:		
Cash	$7,520,848.64	$21,258,882.69
Demand loans	3,050,000.00	54,710,000.00
Bills receivable	8,929.90	8,929.90
Agents and conductors	852,800.05	689,536.71
Traffic balances	212,554.90	464,242.37
Dividends and interest accr'd to June 30	3,758,952.50	4,560,057.59
Individuals and companies	1,170,186.45	1,762,290.57
U. S. Government transportation	1,069,455.21	759,012.23
Material, fuel and supplies	9,884,409.78	7,832,788.14
	$29,507,897.01	$71,845,800.20
Deferred assets:		
Advances for the construction and acquisition of new lines	$26,212,601.19	$22,836,611.37
Payments for account of San Pedro, Los Angeles & Salt Lake Railroad Co.	...	17,300,000.00
Ocean steamships "Manchuria" and "Mongolia"	5,126,796.58	5,126,796.58
Rolling stock	11,503,580.41	5,784,337.86
Land and miscellaneous property	6,935.43	124,344.61
Individuals and companies	32,715.60	.
Due from proprietary companies	884,659.15	963,198.59
	$43,767,288.36	$52,135,289.01
Contingent assets:		
Unadjusted accounts	$319,030.84	$387,307.00
Land and town lot contracts	3,281,855.33	2,927,826.22
	$3,600,886.17	$3,315,133.22
Total assets	$661,826,035.05	$578,499,577.17

LIABILITIES.

	June 30, 1907.	June 30, 1906.
Capital liabilities:		
Union Pacific Railroad Company:		
Common stock	$195,477,900.00	$195,446,900.00
Preferred stock	99,544,100.00	99,544,100.00
Stocks of auxiliary companies in hands of the public, viz:		
Oregon Short Line Railroad Co. Common stock	10,000.00	10,000.00
Oregon Railroad & Navigation Co. Common stock	20,200.00	20,200.00
Preferred stock	6,010.00	7,880.00
Funded debt (excluding bonds of auxiliary and proprietary companies owned) Table No. 14	201,065,500.00	201,532,000.00
	$496,123,710.00	$496,561,080.00
Current liabilities:		
Coupons matured but not presented	$172,102.65	$135,320.15
Coupons due July 1	2,528,005.00	2,528,005.00
Interest accrued on bonds and loans to June 30	1,878,815.74	618,958.32
Dividends due but uncalled for	33,660.50	32,469.00
Dividends payable July 1 and Oct. 1	11,765,105.00	11,764,777.00
Bonds satisfied of mortgage	3,000.00	12,225.00
Loans and bills payable	69,050,220.00	....
Vouchers and pay rolls	6,221,595.98	5,327,346.28
	$91,652,504.87	$20,419,100.75
Deferred liabilities:		
Taxes assessed but not due	$985,212.64	$929,973.27
Individuals and companies	....	52,588.93
	$985,212.64	$982,562.20
Contingent liabilities:		
Insurance fund (Table No. 23)	$492,076.93	$452,521.56
Trust accounts	81,918.78	51,878.44
Equipment replacement funds	204,329.31	132,238.43
Reserve for depreciation on steamships and rolling stock leased	1,111,654.24	763,056.56
Reserve fund for betterments, additions and new equipment	4,678,350.93	4,678,350.93
Reserve fund for maint., renewals, etc.	4,774,610.39	4,774,610.39
Hospital fund	76,581.00	....
Union Pacific Coal Co.	2,848,829.45	2,125,191.40
Union Pacific Land Co.	2,081,559.47	986,559.47
Due to proprietary companies	455,020.10	848,574.43
Principal of deferred payments on land and town lot contracts (Table No. 17)	3,281,855.33	2,927,826.22
	$20,086,785.93	$17,740,807.83
Balance to credit of profit and loss (Table No. 4)	$52,977,821.61	$42,796,026.39
Total liabilities	$661,826,035.05	$578,499,577.17

No. 9.—STOCKS OWNED OF OTHER COMPANIES, JUNE 30, 1907.

	Amt. in hands of public, June 30, 1907.	——Owned by Union Pacific Railroad and Auxiliary Companies—— Union Pacific R. R. Co.	Ore. Shrt Line R. R. C.	Oregon R. R. and Nav. Co.	Total	Of the Total Owned there are— Pledged.	Unpledged.	Increase.
Caliente & Pioche R. R. Co. Capital stock	$15,000.00	....	$15,000.00	....	$15,000.00	....	$15,000.00	$15,000.00
Gray's Harbor & Puget Sound R. R. Co. Capital stock	....	$10,000.00	....		10,000.00	....	10,000.00	10,000.00
Green Riv. Water Wks. Co. Capital stock	....	225,000.00	....	....	225,000.00	....	225,000.00	....
Ilwaco Railroad Co. Capital stock	....	152,500.00	....	....	152,500.00	....	152,500.00	152,500.00
Kansas City Term. Ry. Co. Capital stock	900,000.00	100,000.00	....	....	100,000.00	....	100,000.00	100,000.00
Leav., Kan. & Wstn. Ry. Co. Capital stock	....	1,000,000.00	....	....	1,000,000.00	....	1,000,000.00	....
Leavenworth & Topeka Ry. Co. Capital stock	25,000.00	25,000.00	....	....	25,000.00	....	25,000.00	..
Leavenworth Depot & R. R. Co. Capital stock	100,000.00	50,000.00	....	....	50,000.00	....	50,000.00	..
Occidental & Oriental SS. Co. Capital stock	1,250,000.00	8,750,000.00	....	....	8,750,000.00	....	8,750,000.00	
Ogden Union Ry. & Depot Co. Capital stock	150,000.00	150,000.00	....	....	150,000.00	....	150,000.00	
Oregon & Wash. R. R. Co.	....	1,000,000.00	....	....	1,000,000.00	....	1,000,000.00	1,000,000.00
Pacific Express Co. Capital stock	3,600,000.00	2,400,000.00	....	....	2,400,000.00	....	2,400,000.00	
Pacific Fruit Express Co. Capital stock	600,000.00	600,000.00	....	....	600,000.00	....	600,000.00	600,000.00
Rattlesnake Creek Water Co. Capital stock	....	78,300.00	....	....	78,300.00	....	78,300.00	..
St. J. & Gr. Isl. R. R. Co. Common stock	4,600,000.00	2,900,000.00	....	....	2,900,000.00	....	2,900,000.00	2,900,000.00
First preferred stock	5,498,500.00	932,200.00	....	....	932,200.00	....	932,200.00	932,200.00
Second preferred stock	3,500,000.00	1,250,000.00	....	....	1,250,000.00	....	1,250,000.00	1,250,000.00
San P., L. A. & St. L. R. R. Co. Capital stock	12,500,000.00	....	12,500,000.00	....	12,500,000.00	....	12,500,000.00	12,500,000.00
Short Line Land & Imp. Co. Capital stock	50,000.00	....	50,000.00	....	50,000.00	....	50,000.00	
Spokane Union Depot Co. Capital stock	....	125,000.00	....	....	125,000.00	....	125,000.00	
Topeka Iron Co. Capital stock	55,000.00	55,000.00	....	....	55,000.00	....	55,000.00	
Un. Dep. & Ry. Co. (Denver) Capital stock	160,000.00	240,000.00	....	....	240,000.00	....	240,000.00	
Union Depot Co. (Kan. City) Capital stock	450,000.00	45,000.00	....	....	45,000.00	....	45,000.00	
Union Land Co. Capital stock	....	10,000.00	....	....	10,000.00	....	10,000.00	
Union Pacific Coal Co. Capital stock	....	5,000,000.00	....	....	5,000,000.00	....	5,000,000.00	
Union Pacific Equip. Assn. Capital stock	....	100,000.00	....	....	100,000.00	....	100,000.00	100,000.00
Union Pacific Land Co. Capital stock	....	100,000.00	....	....	100,000.00	$99,400.00	600.00	..
Union Pacific Water Co. Capital stock	....	500.00	....	....	500.00	....	500.00	
Washington Union Coal Co. Capital stock	....	170,200.00	....	....	170,200.00	....	170,200.00	170,200.00
Total, 1907	....	$25,468,700.00	$12,565,000.00	....	$38,033,700.00	$99,400.00	$37,934,300.00	$19,729,900.00
Total, 1906	....	18,253,800.00	50,000.00	....	18,303,800.00	99,400.00	18,204,400.00	....

No. 10. INVESTMENT STOCKS OWNED, JUNE 30, 1907.

	——Owned by Union Pacific and Auxiliary Companies—— Union Pacific R. R. Co.	Oregon Short Line R. R. Co.	Oregon R. R. and Nav. Co.	Total.	Of the Total Owned there are— Pledged	Unpledged.	Increase —Decrease.
A., T. & S. F. Ry. Co. Preferred stock	....	$10,000,000.00	....	$10,000,000.00	....	$10,000,000.00	$10,000,000.00
B. & O. R. R. Co. Common stock	....	32,334,200.00	....	32,334,200.00	....	32,334,200.00	32,334,200.00
Preferred stock	....	7,206,400.00	....	7,206,400.00	....	7,206,400.00	7,206,400.00
C. & A. R. R. Co. Preferred stock	$10,343,100.00	....	....	10,343,100.00	....	10,343,100.00	..
C. & N.-W. Ry. Co. Common stock	....	3,215,000.00	....	3,215,000.00	....	3,215,000.00	3,215,000.00
C., M. & St. P. Ry. Co. Common stock	....	3,690,000.00	....	3,690,000.00		3,690,000.00	3,690,000.00
Common stock (25% pd)	....	922,500.00	....	922,500.00		922,500.00	922,500.00
Preferred stock (25% pd)	....	1,845,000.00	....	1,845,000.00		1,845,000.00	1,845,000.00
Great Northern Ry. Co. Preferred stock	....	9,036,400.00	....	9,036,400.00		9,036,400.00	[illegible]
Preferred stock (50% pd)	....	3,614,560.00	....	†3,614,560.00		3,614,560.00	3,614,560.00
*Iron Ore Certificates		....		....			
Illinois Central Ry. Co. Capital stock	18,623,100.00	....	....	18,623,100.00		18,623,100.00	18,623,100.00
N. Y. C. & H. R. R. R. Co. Capital stock	....	14,285,700.00	....	14,285,700.00		14,285,700.00	14,285,700.00
Northern Pacific Ry. Co. Common stock	....	4,152,800.00	....	4,152,800.00		4,152,800.00	[illegible]
Com. stock (12½% pd)	....	2,491,600.00	....	2,491,600.00		2,491,600.00	2,491,600.00
Northern Securities Co. Stubs	....	721,900.00	....	721,900.00		721,900.00	
Railroad Securities Co. Common stock	3,415,400.00	....	....	3,415,400.00		3,415,400.00	3,415,400.00
Preferred stock	1,898,400.00	....	....	1,898,400.00		1,898,400.00	1,898,400.00
Southern Pacific Co. Common stock	....	90,000,000.00	....	90,000,000.00	‡$90,000,000.00		
Preferred stock	....	18,000,000.00	....	18,000,000.00	18,000,000.00		
Preferred stock (25% pd)	....	†16,200,000.00	....	16,200,000.00		16,200,000.00	16,200,000.00
Total, 1907	$34,280,000.00	$217,719,060.00	....	$251,999,060.00	$108,000,000.00	$143,999,060.00	$104,141,[illegible]
Total, 1906	10,343,100.00	137,514,100.00	....	147,857,200.00	108,000,000.00	39,857,200.00	

*77,164 shares, par value of shares not stated in certificates. †Full par value of stocks. ‡Deposited as collateral under Oregon Short Line R. R. Co. 4 per cent. refunding mortgage. Of the total $100,000,000 outstanding bonds, $55,000,000 are [illegible] in the treasury of the Union Pacific Railroad Co.

No. 11.—Bonds Owned of Other Companies, June 30, 1907.

	Amt. in hands of public, June 30, 1907.	Owned by Union Pacific Railroad and Auxiliary Companies: Union Pacific R. R. Co.	Ore. Short Line R. R. Co.	Ore. R. R. & Nav. Co.	Total.	Of the Total Owned there are Pledged.	Unpledged.	+ Increase. − Decrease.
Atchison Un. Dep. & R. R. Co. Second mortg. 5 per ct.	$31,500.00	$4,500.00	. . . .		$4,500.00		$4,500.00	....
Cheyenne County Con. Refunding 5 per ct. ..	..	26,200.00	....	.	26,200.00		26,200.00	....
Green River Water Wks. Co. First mortg. 6 per ct.		208,000.00	......		208,000.00		208,000.00	
Ilwaco R. R. Co. First mortg. 6 per ct.	.	305,000.00	.....		305,000.00		305,000.00	+ $305,000.00
Leavenworth & Topeka Ry. Co. First mortg. 4 per ct.	102,500.00	102,500.00	....	..	102,500.00		102,500.00	..
Leavenworth Dep. & R. R. Co. First mortg. 5 per ct.	87,000.00	63,000.00		.....	63,000.00		63,000.00	...
Northern Pacific Term. Co. First mortg. 6 per ct.	..	43,000.00	....	$125,000.00	168,000.00		168,000.00	− 3,000.00
Ogden Union Ry. & Depot Co. First mortg. 5 per ct.	163,000.00	163,000.00	....	....	163,000.00		163,000.00	
Payette Valley Ry. Co. First mortg. 5 per ct.	....	.	$44,000.00	.....	44,000.00		44,000.00	+ 44,000.00
Rattlesnake Creek Water Co. First mortg. 6 per ct. ..	......	146,000.00		.....	146,000.00	..	146,000.00	..
S. P. L. A. & S. L. R. R. Co. First mortg. 4 per ct....	.....	......	$20,000,000.00	....	20,000,000.00		20,000,000.00	+ $20,000,000.00
Union Pacific Coal Co. First mortg. 5 per ct. ...	*1,022,000.00	3,978,000.00	....	..	3,978,000.00	.	3,978,000.00	− 794,000.00
Union Pacific Land Co. First mortg. 4 per ct. ..	....	10,000,000.00	....	.....	10,000,000.00	$10,000,000.00		
Total, 1907	....	$15,039,200.00	$20,044,000.00	$125,000.00	$35,208,200.00	$10,000,000.00	$25,208,200.00	+ $19,952,000.00
Total, 1906	....	15,129,200.00	......	127,000.00	15,256,200.00	10,000,000.00	5,256,200.00	......

*Held by Union Pacific Coal Co. sinking fund.

No. 12.—Recapitulation of Stocks and Bonds, June 30, 1907.

	Issued and Outstanding, June 30, 1907.	Amt. in hands of public June 30, 1907.	Owned by U. P. R. R. & Auxiliary Companies: Total	Of which there are pledged.	And there remains Unpledged.
Stocks of Union Pacific, Oregon Short Line, Oregon R. R. & Navigation Co., and proprietary companies (Table No. 7)	$361,550,000.00	$295,058,210.00	$66,491,890.00	$37,016,100.00	$29,445,790.00
Stocks of other companies (Tables Nos. 9 and 10)	....	....	289,032,760.00	108,099,400.00	180,933,360.00
Total stocks	....	....	$355,524,650.00	$145,145,500.00	$210,379,150.00
Bonds of Union Pacific, Oregon Short Line, Oregon R. R. & Navigation Co., and proprietary companies (Table No. 8)	$289,891,000.00	$201,065,500.00	$88,825,500.00	$5,393,000.00	$83,432,500.00
Bonds of other companies (Table No. 11)	....	....	35,208,200.00	10,000,000.00	25,208,200.00
Total bonds	....	....	$124,033,700.00	$15,393,000.00	$108,640,700.00
Total stocks and bonds.....	....	....	$479,558,350.00	$160,538,500.00	$319,019,850.00

Table No. 29.—Union Pacific Railroad and Auxiliary Companies, General Operating Results, Year Ended June 30, 1907.

	Year ended June 30: 1907.	1906.	Increase.	Per ct. chnge.
Av. miles of road operated......	5,641.55	5,403.55	241.00	4.46
Receipts and expenses.				
(Rail and water lines.)	Dollars.	Dollars.	Dollars.	
1. Gross transportation receipts.	76,010,726.65	67,281,542.60	8,759,184.05	13.02
2. Operating expenses	40,574,889.10	35,261,170.84	5,313,718.26	15.07
3. Receipts over operating exp..	35,465,837.55	32,020,371.76	3,445,465.79	10.76
4. Per cent. of operating expenses to gross receipts..........	53.36	52.41	0.95	1.81
(Rail lines only.)				
5. Gross transportation receipts.	75,651,105.04	66,879,141.73	8,771,963.31	13.12
6. Operating expenses	40,155,522.54	34,824,075.93	5,331,446.61	15.31
7. Receipts over op. expenses..	35,495,582.50	32,055,065.80	3,440,516.70	10.73
8. Per cent. of operating expenses to gross receipts	53.08	52.07	1.01	1.91
9. Gross transportation receipts†	13,402.50	12,376.89	1,025.61	8.29
10. Operating expenses.†	7,114.03	6,444.67	669.36	10.39
11. Receipts over op. expenses† ..	6,288.47	5,932.22	356.25	6.01
12. Gross transportat'n receipts‡[1]	3.11	3.00	0.11	3.67
13. Operating expenses‡[1] ..	1.65	1.56	0.09	5.77
14. Receipts over op. expenses.‡	1.46	1.44	0.02	1.39
Train and Locomotive Mileage				
Locomotive mileage:				
15. Run with passenger train..	10,231,416	9,510,740	720,676	7.58
16. Run with freight trains ..	13,569,398	12,381,863	1,187,535	9.59
17. Run with mixed trains ...	517,458	373,190	144,268	38.66
18. Total revenue train mileage[1].	24,318,272	22,265,793	2,052,479	9.22
Locomotive mileage helping.				
19. (Inc. light) passgr trains.	496,137	548,525	*52,388	9.55
20. (Inc. light) freight trains.	1,686,480	1,619,069	67,411	4.16
21. Total locomotive mileage in rev. service, excldg switchg	26,500,889	24,433,387	2,067,502	8.46
22. Locomotive mileage switching	4,414,445	3,737,613	676,832	18.11
23. Total locomotive mileage in revenue service	30,915,334	28,171,000	2,744,334	9.74
24. Loco. mileage, non rev. trains[4]	366,198	344,768	21,430	6.21
25. Per ct. helping mileage to revenue train mileage	8.98	9.74	*0.76	7.80
Car Mileage.				
26. Mileage of passenger cars.[2]..	71,780,527	68,521,598	3,258,929	4.76
27. Av. No. cars in pass. trains	6.68	6.93	*0.25	3.61
28. Mileage of loaded freight cars.	316,173,710	301,870,552	14,303,158	4.74
29. Mileage of empty freight cars	106,785,663	101,713,362	5,072,301	4.99
30. Total mileage, all freight cars	422,959,373	403,583,914	19,375,459	4.78
Av. No. loaded cars per train				
31. East or north	21.98	24.68	*2.70	10.94
32. West or south .	22.91	22.65	0.26	1.15
33. Av. No. loaded cars per train.	22.44	23.67	*1.23	5.20
34. Av. No. empty cars per train.	7.58	7.97	*0.39	4.89
35. Av. No. of all cars per train	30.02	31.64	*1.62	5.12
36. Per cent. of loaded car mileage to total car mileage[5] ...	74.75	74.80	*0.05	.07
37. Per cent. of empty car mileage to total car mileage . .	25.25	25.20	0.05	.20
Miscellaneous				
38. Av. cost., maint. of way and structures per mile of first and second tracks . .	$1,715.23	$1,777.02	*$61.79	3.48
Av. cost, repairs and renewals				
39. Per locomotive per annum[3]	2,932.92	3,067.79	*134.87	4.40
40. Pssgr train cars pr annum	1,092.37	1,078.53	13.84	1.28
41. Frght train cars pr annum	130.68	123.13	7.55	6.13
Conducting transportation:				
42. Per revenue train mile‡ ...	83.38 cts.	72.77 cts.	10.61 cts.	14.58
43. Per loco. mile rev. service.[4]	64.82 cts.	57.52 cts.	7.30 cts.	12.69

*Decrease.
†Per mile of road.
‡Per revenue train mile.
[1] Includes revenue freight and all mixed train miles, but excluding mileage of locomotives helping, as prescribed by the Interstate Commerce Commission of the United States.
[2] Includes mileage of passenger cars in all classes of trains.
[3] Includes value of equipment destroyed, broken up or condemned.
[4] Includes mileage run with official and other special trains, as the expenses incurred in hauling such trains are included in expenses for conducting transportation.
[5] Including caboose.

Table No. 30. *Review of Traffic, Year Ended June 30, 1907.*

	Year ended June 30: 1907.	1906.	Increase.	Per ct. chnge.
Av. miles of road operated .. .	5,641.55	5,403.55	241.00	4.46
Passenger Traffic.				
1. No. revenue passengrs carried	5,663,828	4,803,094	860,734	17.92
2. No. carried 1 mile..........	680,278,509	642,544,422	37,734,087	5.87
3. No. carried 1 mile pr mile road	120,520	118,912	1,608	1.35
4. Av. distance carried, miles..	120.11	133.78	*13.67	10.22
	Dollars.	Dollars.	Dollars.	
5. Receipts from passengers .	14,912,508.37	13,236,054.90	1,676,453.47	12.67
6. Av. amt. from each pass'g'r.	2.63	2.76	*0.13	4.71
7. Receipts, passenger trains....	19,056,090.09	16,500,912.58	2,555,177.51	15.49
8. Pass. trains per mile road.	3,376.02	3,053.72	322.30	10.55
9. Receipts, pass. trains per revenue train mile †	1.77	1.67	0.10	5.99
10. Av. No. pass. per train......	65.55	66.22	*0.67	1.01
Freight Traffic.				
(Way bill Tonnage.)				
11. Tons revenue freight carried	14,089,649	13,048,346	1,041,303	7.98
12. Tons company freight carried	4,663,995	4,515,608	148,387	3.29
13. Total tons carried	18,753,644	17,563,954	1,189,690	6.77
14. Tons rev. frt. carried 1 mile..	5,704,061,535	5,353,374,071	350,687,464	6.55
15. Tons Co. frt. carried 1 mile.‡	986,805,779	1,148,036,990	*161,231,211	14.04
16. Total tons carried 1 mile .	6,690,867,314	6,501,411,061	189,456,253	2.91
17. Ton miles pr mile road, all frt	1,185,367	1,203,174	*17,807	1.48
18. Average distance carried—revenue freight, miles .	404.84	410.27	*5.43	1.32
19. Receipts, revenue freight	54,859,302.41	48,992,014.90	5,867,287.51	11.98
20. Av. received from each ton..	3.89	3.75	0.14	3.73
21. Receipts per mile of road . .	9,718.99	9,066.63	652.36	7.20
22. Receipts, revenue train mile §	3.89	3.84	0.05	1.30
Tons per revenue train mile:				
23. On revenue freight §	404.92	416.89	*11.97	2.87
24. On all freight § .	474.97	509.71	*34.74	6.82
25. Tons per total locomotive mileage in revenue service, excludg switch'g—all freight	424.19	452.30	*28.11	6.21
26. Av. tons per loaded car, frt .	21.16	21.54	0.38	1.76

*Decrease.
†Based on revenue passenger and all mixed train miles, but excluding locomotives helping.
‡There is no charge for company freight.
§Based on revenue freight and all mixed train miles, but excluding mileage of locomotives helping, as prescribed by the Interstate Commerce Commission of the United States.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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CONTENTS

VOL. XLIV., No. 2. FRIDAY, JANUARY 10, 1908.

By a divided bench, the United States Supreme Court has overthrown the Employers' Liability Act of June 11, 1906. Four justices—Harlan, McKenna, Holmes and Moody—held that the law was valid in whole or in part; a fifth—Justice White—believes that it can be so redrawn as to be valid. Chief Justice Fuller and Justices Peckham and Brewer believe that Congress has attempted regulation repugnant to the Constitution. Thus the application of the law is stopped, the majority opinion being that it was so drawn that the unconstitutional parts were inseparable from the constitutional; but application of the underlying principle is, apparently, only postponed. Two interesting comments suggest themselves—first, that many of the extremely important, radical corporation cases now pending before that august body are pretty likely to terminate in the same way; second, that there are two distinct parties in the court, one of which is willing to see Congress do a great deal more regulating than the other is, and that between these parties the balance of power is quite uncertain, depending on the vote of several justices to whom each case is a new case.

We begin this week the publication in serial form of a paper by Dr. Smith, of the University of Pennsylvania, on the Ocean Carrier. Many historians have described the upbuilding of the merchant marine in this country and foreign countries, and excellent literature on marine architecture has always been available, but Dr. Smith, so far as we know, is the only writer who has studied the development of the ocean carrier from the direct standpoint of the world commerce that the carrier exists to move. In his previous monograph on the Organization of Ocean Commerce, he discussed charter traffic and line traffic and the reasons why line vessels and charter, or tramp, vessels afford respectively the natural and efficient methods of serving different kinds of traffic. Where the freight is, where it is going, how it can best be gotten there, and how much it costs to do it—these are the kinds of topics that Dr. Smith treats of, showing, by the way, how certain types of carriers have been developed while other types have been discarded, and discussing the competitive conditions that have had so strong an effect on modern ocean business. Most traffic men come into contact with a greater or less number of these problems, at one time or another; the history and discussion of them ought to interest them all, and the bearing of water transportation upon rail transportation is so great and is constantly becoming so much greater, owing to the world-wide competition of commodities in search of a market, that the fundamental principles involved ought to be known a great deal more widely than they are. In England, where the over-sea dairy products of Denmark compete actively with those of Devonshire, and nearly every important rail route has a competing water route, the nearby conditions are well appreciated. We have continuous water competition on the Atlantic, Pacific and Gulf coasts and an open-season competition along the Great Lakes and in many other localities, the conditions of which are fully understood, but we also figure in a series of world traffic routes that are not understood so well, and that are yearly becoming more important as commerce expands and the marine engine becomes more efficient. The purpose of the present series of articles is to put some of these matters on record in a form as definite as that of the mere physical history of the steamships in the Atlantic trade.

THE 1908 RAIL ORDERS SITUATION.

The present rail situation is without precedent, and this is meant to include the acceptance of the new specifications, which seems to be quite general; the differing methods now being undertaken to the end of securing safer rails and more economical rails; the prices for better quality; and, lastly, the fact that but few large orders for 1908 delivery have thus far been placed with the mills. We are told by the officers of the steel companies that their December correspondence with the railroads with reference to new orders has been extraordinarily large but, owing to the unsettled conditions above referred to, the holding back of orders was what might have been reasonably expected.

Probably every railroad officer in the United States has been stirred by the development of the extent to which rails break. He has also been moved by the knowledge that rails are so soft as to make a large percentage of increase in the cost of rail maintenance. Undoubtedly also the financial situation is in many cases causing delay in giving orders, first, because it is harder to provide the money to pay the bill, and, second, because in many cases thorough investigations have been made and are still being made to see to what extent the quantities ordered for 1908 can safely be reduced below the average amount required for maintenance. For example, the average amount needed for maintenance on the Pennsylvania Lines West may be said to be about 60,000 tons a year, and for the

Pennsylvania lines east of Pittsburg more than 100,000 tons. The New York Central Lines east of Buffalo need something like an average of 50,000 tons a year. But never before in the history of these two roads has the track been of such a high standard as it is now. It is highly probable that no danger would be involved and no considerable loss caused by reducing the amount of new rails used this year to one-half or possibly one-third of the average amount. This statement is generally true of the railroads throughout the country so that nearly all of them, under financial stress, can make a quick temporary economy by reducing rail orders, and this fact is a considerable factor in the present situation.

The most important item in the new specifications left undecided was the percentage of discard from the top of the ingot to be agreed on by all railroads and to be in force at all mills. We are told that when prices have been asked for rails with a specified discard, those prices have been figured on the basis of $28 a ton for rails made from ingots with a 9 per cent. discard, with an additional cost of 5 per cent. for each additional 5 per cent. of discard. This would make $30.80 a ton for 19 per cent. discard and $32.20 for 24 per cent. discard. This cost would not seem to be unreasonable if the rails were made hard enough so as to effect economy in use in addition to the presumed avoidance of the cost of broken rails. In the matter of price the effect of concentration of ownership of mills has thus far been good. Judge Gary has expressed the sum of opinion, after consultation with many railroad presidents and with his own officers, that $28 a ton is, for all concerned, a good price to adhere to. The mills gave us all a good lesson when they maintained the $28 price for rails during a period when billets were selling for $32.

The failure to agree upon a fixed discard from the ingot by the committee last October was a disappointment to many others as well as to us. Nevertheless, disappointment should never mean discouragement. There is an old song with a line: "The best cure for misfortune is to marry again." The study and the work on this subject has not halted. It has not been confined to the members of the American Railway Association rail committee. Experiments have been made at three different mills to learn if physical defects can always be detected by breaking up crop ends from rails made from that part of the ingot where such defects commonly occur. If this proves practicable, and if the whole heat is rejected when a physical defect is so found, it may be a more scientific method than saying arbitrarily that in every case either a quarter or a fifth of the ingot must not be used. Involved also in this undertaking is a legible numbering of each rail, locating its position in the ingot, so that the record of breakages may indicate something more than it now does; and also so that users may, if they choose, select for the severer services rails with the higher numbers—made from the lower end of the ingot.

There is now intelligent co-operation between the manufacturers and the railroad officers to the end of finding whether the arbitrary discard, which may be presumed to be effective, but which is certainly wasteful, is the only way out. The object of the present study and experiments is, if possible, to devise a specification which will avoid that waste, secure sound rails and furnish to the mills the greatest possible incentive to the improvement of the ingot.

THE VALUE OF TIE PRESERVATION.

The timber preserving plant which the Burlington has built at Galesburg, Ill., described in another column, is the seventeenth treating plant to be built by a railroad in this country, if the record before us is correct. This includes three portable plants of the Union Pacific, Oregon Short Line and the Southern Pacific respectively, and a plant of the Denver & Rio Grande which, though nearly completed for some time, has not yet been put in operation. But, on the other hand, it does not include the large number of privately-owned plants, a part or all of whose product is taken by the railroads on which they are situated, nor two plants of Mexican roads. The estimated capacity of the 17 railroad plants is around 16,500,000 ties a year. The Government report on the consumption of ties for 1906 recently issued (*Railroad Gazette*, Dec. 20) gives the number of ties treated by the roads at their own plants in that year as 6,365,523, and the number of treated ties bought as 4,773,116, or a total of about 11,000,000 treated ties used by the steam roads. On the basis of the estimate given above the number of ties treated by the roads in 1906 was about 40 per cent. of their present estimated plant capacity. All of these plants, with two exceptions, are west of the Mississippi river. This is due to the greater scarcity in this region of suitable tie timber and the need therefore of using the inferior soft woods. But some of the eastern roads have been giving serious consideration to the matter for a year or two past and one of them had practically decided to build one or more plants when the unfavorable monetary conditions caused a postponement; another is proceeding with preparatory work, and others have been making investigations that doubtless will bear fruit in the near future.

A report to one such road on methods and costs of treatment and the saving to be realized, which would be the justification for the installation of a preserving plant, figures conservatively as follows: Untreated white oak ties cost this road 85c. A treated red oak tie would cost the same, at 15c. for treating. Cost of putting in track is 15c., making the total cost of either in track $1. The life of the untreated tie is taken at eight years, and of the treated tie at 12 years. Interest is taken at 4 per cent. Neglecting interest, the yearly saving for each treated tie would be $0.0417, which can be considered the dividend paid to the plant by each treated tie during its life.

On the basis of the annual charge, at 4 per cent. interest, to be made for each kind the figures would be:

Untreated.		*Treated.*	
Interest	.04	Interest	.04
Sinking fund $\left[\frac{.04}{(1+.04)^8-1}\right] =$	.1085	Sinking fund $\left[\frac{.04}{(1+.04)^{12}-1}\right] =$	.0667
Total	.1485	Total	.1067

The difference, or saving, is $0.0418, nearly the same as given above.

The annual charge for the untreated tie, $0.1485, is the interest at 4 per cent. on $3.71; or, in other words, if the expenditure be capitalized, this is the sum which, at the given rate of interest, would furnish a new tie in track at the expiration of the eight-year period. How much can be paid for a tie having this same capital, which would last 12 years?

$$x + \frac{x}{(1+.04)^{12}-1} = \$3.71$$
$$x = \$1.39$$

Therefore a treated tie lasting 12 years would be worth 39 cents more than the untreated eight-year tie. If the treated tie would last 15 years it would be worth $1.65. Therefore, a treating plant having a yearly capacity of 1,000,000 ties would create a value of $390,000 if producing 12-year ties, due to the longer life. Since a well equipped two-retort treating plant with wooden buildings is estimated to cost $60,000 to $70,000, depending on the process, though not including cost of land and tracks, the expenditure for such a plant would appear to be a highly profitable investment according to the computation given.

THE RAILROAD SITUATION IN THE SOUTH.

The appointment of receivers for the Seaboard Air Line with its nearly 3,000 miles of road calls sharp attention again to the situation of the railroads in the South. A brief review of the events leading up to the present crisis in that territory will make the present situation easily understood. The recently issued annual report of the Seaboard Air Line is reviewed in another column.

From the time of the war until a few years ago, the southern railroads had a hard time to get along. There were certain short lines between important points, particularly in Virginia, North Carolina and Georgia, which were very profitable and correspondingly strong financially. But the bulk of the lines either were not specially profitable or were run at a loss. Many railroads were most of the time in receivers' hands. The process of consolidation which has resulted in putting most of the important railroad mileage in the South in the control of three dominating groups—the Atlantic Coast Line-Louisville & Nashville, the Southern Railway and the Seaboard Air Line—began by the extension of the ownership and influence of some of the smaller and very profitable roads. A connecting line would first be taken over, then a line connecting with that and so on until the present systems were formed, stretching from Virginia and Kentucky on the north, to the gulf states. In this process a good many lines locally unprofitable, but necessary as part of a through connection or as a protection against competition, were acquired or built, so that the large systems were usually made up of strong roads, roads which were little more than solvent, and weak or bankrupt roads. For instance, in the case of the Seaboard Air Line, the Seaboard & Roanoke Railroad running from Portsmouth, Va., to Weldon, N. C., the original nucleus of the system, was one of the richest roads in the South.

It was inevitable that systems made up of such different kinds of railroads, many of them running through a territory which had for years produced little traffic, should be found wanting when there was suddenly developed a tremendous increase in industrial activity. These roads had not been built to be low-grade through lines and they had not had funds even if they had had faith to undertake, previous to the need for them, large improvements which would amount in many cases to reconstruction. As a result, when the rush of traffic of the past three years came, the railroads of the South were unable to satisfactorily carry it. It was large enough to require much new double track, many grade reductions and a large amount of new equipment, and these, particularly the first two, cannot be provided in a day. Not only were the weak lines of light traffic overtaxed, but all these pouring their freight together at the various throats of the different systems made still greater congestion on these connecting routes which had previously been the most efficient parts of the roads. The new high traffic level went far beyond the increase in railroad facilities.

The resulting unsatisfactory service, both freight and passenger, gave an opportunity to that class of politician, even more abundant in the South than elsewhere, who appeals for success to public prejudice and passion. Anti-railroad political campaigns were waged in most of the southern states and were generally successful. One great reason why the railroads were unable to make effective opposition to these attacks was that their influence had in the past been strong in the state legislatures and that they therefore could not come forward with clean hands to oppose the unjust proposals of the demagogues. Another was that the South had suffered some of the most flagrant cases of railroad financial jugglery ever carried out in this country, and these more recently than the similar instances in other sections, so that the sincerity of railroad managers was under suspicion. Not only were anti-railroad governors elected, but legislatures also, and the laws passed during last winter's sessions were peculiarly severe.

The rest of the story is only too familiar—decreased net earnings, the impossibility of selling securities to pay for new improvements which were under way and the consequent stopping of these improvements, the conflicts of jurisdiction between State and Federal courts, the extra session of last fall in Alabama called for the sole purpose of bringing the railroads to terms, and finally an industrial reaction in the South, followed by decreases in gross and net earnings and the receivership of the Seaboard Air Line.

Already, however, there have been certain encouraging changes. Public sentiment toward the railroads is showing a decided change. The business men of Alabama as well as the organizations of railroad employees have sent delegations to the Governor protesting against the attacks on the railroads. All kinds of business have already felt, and felt severely, the effects of the reaction, and the farmer, whose railroad ties are no longer as good as currency at his local store, feels the change also. In the case of at least one of the important systems in the South the tactics of the railroad officers have also undergone a change. There is to be no more hurrying to Raleigh or to Columbia or to Montgomery to try to head off hostile legislation. The president, the vice-presidents and the general manager intend in future to devote their time to the business of railroad operation. If the people of the various states through which the road runs insist on ruining it—as there is no doubt they can do—they are to be allowed to bear the whole responsibility for so doing. Most important, of all, as this last statement implies, this railroad is no longer in politics.

This is a strong and sensible stand for the railroads to take. Had it been taken in the past, it is probable that much harm could have been avoided. Whether this is true or not, it is certain that the system of political influence failed utterly to protect the railroads in their hour of greatest need. There is no doubt that the present situation in the South, with its rapidly decreasing traffic, its locomotives newly received from the builders but lying in the shops without the packings taken off, its idle freight cars and its decrease in earnings is a discouraging one; but there is already a promise of a fairer and more honorable relation between railroads and people which should result both in shortening the depression and in uniting both elements, lately so hostile, in the task of developing the South. Specifically, the bare fact that one of the great systems is now so situated that the tactics of state legislators will be met in the open by federal receivers instead of by corporation officers, is of great interest and importance, not only to the Seaboard itself, but to all other southern railroads.

GOOD AND BAD WORK UNDER THE RATE LAW.

The report of the Interstate Commerce Commission is an interesting document and in many ways a conservative one. Yet the point of view which runs through it from beginning to end and appears in one form or another in every recommendation which the Commission makes, is wrong-headed. The Commission assumes, as if there could be no debate on this point, that all citizens desire to see governmental regulation of the railroads made as tight and as complete as possible. Thus—"one is forced to conclude that an authoritative valuation of railway property is the next important step in the development of governmental supervision over railway administration." From the sentence quoted, one is also forced to conclude that the idea of the Commission is to increase and expand governmental control stone by stone and brick by brick until some sort of structure is arrived at the dimensions of which are not clear in the commissioners' own minds as yet.

This point of view illustrates a very serious deficiency and a potential source of much harm in the scope of the Commission's work. We maintain that proper regulation of public service companies is good, provided that this regulation consists of such police powers as may be necessary to protect the lives of travelers and the property of shippers, and the freedom of every man to do business on equal terms with his neighbor. These things can be accomplished under very simple legislation, and, in the main, were fully provided for before the Rate Law of 1906 was enacted, although in some respects justice was facilitated by this law, and the small shipper was given a practical instead of a theoretic basis of equality with his more powerful neighbor before the law. The reason that the work of the Commission has on the whole been good and helpful during 1907 under the new law, has been that this work has proceeded along elemental lines of ordinary fairness. The Commission has attempted nothing radical; it has simply heard the respective cases of the railroads and of their customers, and has found the customers wrong just as often as it has found the railroads wrong. But, as the Commissioners themselves intimate in their report, the chief reason why there has been greater harmony this year between shipper and carrier than has generally prevailed, has been the fact that a tribunal existed. It may be said, somewhat paradoxically, that the efficiency of a city police force is measured not by the arrests which are made, but by the arrests which do not have to be made, and the same thing is true of the year's work of the Interstate Commerce Commission.

In only one important instance has the Commission attempted to make a radical branching out from the precepts of simple justice, and in that instance it has done harm already and has paved the way for much subsequent trouble. We refer to the arbitrary accounting requirements. No careful student of the subject will be disposed to deny that the railroads ought to keep their accounts honestly and in such form as to be intelligible to those who are entitled to see them. But an inflexible system of required depreciation charges is a thoroughly bad thing when applied to American railroads, and the proposal that all betterment charges from income should be clearly ticketed, is not as equitable as it looks. The American railroad system is not old enough or stable enough to provide annually a fixed sum or a fixed proportion for the upkeep of its property. In time it will be, so far as the important lines are concerned. But neither this generation nor the next is likely to see a succession of years with changes in traffic so slight that income and expenditure may be measured year after year with the same rule. It is characteristic of an old country that its commercial business is stable; it is characteristic of a young country that its commercial business fluctuates widely, and so long as America is a young country and has nowhere nearly grown to fill its shell, its railroad traffic is going to have fat years and lean ones. The custom long established of spending great sums on a property in years of abnormal prosperity and economizing strictly in years when prosperity is below the average has given good results in the past, and attempts to arbitrarily change this practice are not going to do any [illegible].

An average of expenditure can be struck which, when spread over a dozen years, is about right, but the money is not spent in equal sums. In a certain year a railroad knows that it is earning materially more than it has ever earned before and more than it can reasonably hope to continue earning season after season without relapses. It seems to the manager wiser to put some of this money back into the property than to declare an extra dividend—and the Commission has no quarrel with him here. What the Commission does want is to have that extra betterment disbursement separated from the regular maintenance charges so that [illegible] can see it. Surely no proposition could sound more equitable than this; but unfortunately, it omits consideration of one very important thing—human nature. When the shipper who thinks he pays too high a rate or the tax assessor who wants to increase state revenues sees this free sum ready to be put back into the property, he proposes to get some of it for himself first, and laws are forthwith passed reducing rates and increasing taxes to absorb this obvious operating surplus. But if business slackens and there is threat of hard times, rates do not get put up again and taxes put down. The railroad manager has been in the business some time and knows that great prosperity does not continue forever; the legislator is interested only in the year's earnings. What this all comes to is that substantial betterment work has got to be done out of earnings, in good times, if it is done at all, and the Commission's theoretic rulings on this subject have greatly increased the difficulties of doing this work.

From these concrete illustrations of the efficiency of the Commission when it devotes its attention to its police functions and to the inefficiency of the Commission when it attempts to proceed along new and radical lines, one ought to be able to judge whether or not it should be given the new powers for which it earnestly asks. We are not disposed to criticize the suggestion that an arbitrary advance in interstate rates should be restrainable until the case can be adjudicated, provided that the Commission does not become so blocked with its duties that, as sometimes happens in a federal court, the delays in making a ruling amount to a denial of justice. But we are wholly opposed to a general valuation, so called, of all the railroads in the United States, with a view to fixing the amount and kind of securities which they can issue—to determining their rates, their payments to shareholders, and what not. We have always maintained the plain fact that a railroad valuation does not mean anything whatever, but that, once made, it will be used by demagogues and politicians just as if it did mean something. The value of a railroad is not what it costs to build it, nor what it would cost to replace it; and if we skip all this, and take a valuation based on the selling price of securities, we become at once entangled in the fact that the price of securities depends upon the earning power of the road, so that if we use our valuation to reduce rates we are going to depreciate the security, which will require us to make a new valuation, which will in turn effect a further change in the value of the security, and so on. The same objection holds true of a valuation made by capitalizing net earnings, although this valuation is the fairest kind which can be made. We do not believe that there are now any serious thinkers and economic students left who hold that the rate which a railroad charges under competitive conditions has any relation to its capitalization or to its valuation. Yet, just as surely as a governmental valuation is established, on whatever basis you please, it will be used in legislation, direct or indirect, affecting rates, which will concern not only the carrier which is subject to the order, but all other carriers feeling its competition, however remote that competition may be.

The whole thing reverts to this: that governmental regulation of common carriers is thoroughly good so far as it is confined to police work performed in a careful and conservative manner, but that it is thoroughly bad when it attempts to do the impossible thing of attending equitably to the details of finance and management which now occupy the entire attention of an enormous corps of highly trained specialists. We should much rather see the Commission work as an efficient than as an inefficient body, because we believe that it can be very useful in righting old wrongs and preventing new ones. Hence we should be extremely sorry to see it become an arbitrary, autocratic bureau charged with duties which it never could perform.

Seaboard Air Line.

"The traffic on your company's lines during the period under review shows a gratifying improvement as compared with that of the previous year. Prosperous conditions prevail in the territory through which your road operates, and with the development now in progress generally throughout the Southern States, it is believed that these conditions, favorable to your company's continued increase in business, will be maintained."

This is the comment of the Seaboard Air Line's president in the annual report for the year ended June 30, 1907, dated October 23, 1907, but not issued until the end of December. Carefully analyzed, it is no doubt literally true, but, as a description of the progress of the Seaboard Air Line during the year and of the outlook for its future, the event has proved that it is strikingly misleading. Mr. Garrett was much franker last February, some three weeks after his election as president of the Seaboard, when in an interview published in an Atlanta paper, he said that unless conditions then existing changed for the better there would be a receivership of the property.

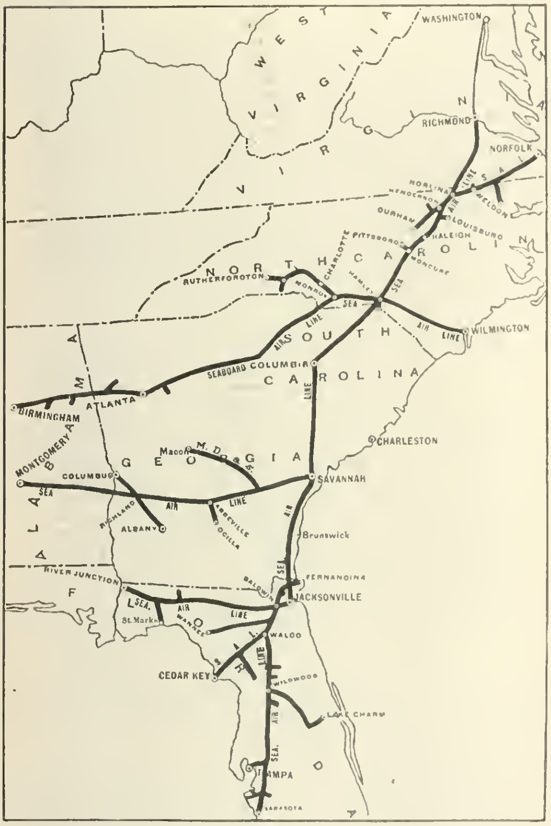
They grew worse instead of better and at the opening of the new year two receivers were appointed for the Seaboard Air Line, the largest railroad company in point of mileage which has suffered receivership since 1893, when a larger mileage of railroads went into receiverships than in any year before or since. The road has not had a fortunate history. Starting under the guidance of John M. Robinson as the Seaboard & Roanoke Railroad, running from Portsmouth, Va., to Weldon, N. C., 79 miles, a short and very profitable line in North Carolina, the system has been steadily expanding until it now comprises altogether 2,975 miles of line. In the effort to get through lines much mileage of thin traffic has from time to time been built or acquired. Instead of leasing the Atlanta & Charlotte Air Line, which would have brought the Seaboard from Charlotte, N. C., to Atlanta, Ga., this road was allowed to go to the Richmond Terminal company, and now is one of the best main lines of the Southern Railway. In order, however, to reach Atlanta, the Georgia, Carolina & Northern, from Monroe, N. C., east to Atlanta was built. This line when built lay between two old-established competitors for through traffic and traversed a country which then produced almost no local traffic. In consequence it was for some time decidedly unprofitable. In 1905 the Birmingham extension from Atlanta east to Birmingham was built, and this has been even more unprofitable, so much so that it has never yet been taken into the operating accounts of the Seaboard Air Line. It cost about $10,000,000, or $45,500 a mile, instead of $6,000,000, or $27,000 a mile, as had been estimated. Last year it had gross earnings of nearly $1,000,000, but its operating expenses were almost as large, the operating ratio being about 92½ per cent. As a result net earnings fell short by $512,000 of meeting fixed charges. The amount due to the parent company by the Atlanta & Birmingham Air Line increased $884,000 during the year. Yet the gross earnings of the Seaboard Air Line itself during the year on business received from this extension were only $545,000. It is evident that instead of being a help to the rest of the system, the Birmingham line has been a great drain on the finances of the parent road. Also, like all the other railroads in the South, the Seaboard has suffered during the last two years from an increase of traffic which greatly exceeded its facilities, higher wages, increased cost of materials and public hostility crystallized in legislation. These difficulties have all been made much worse by the changes and disorganization in the management, which date from January 1, 1895, when Major John C. Winder was succeeded as Vice-President by Everitte St. John.

In 1904 interests headed by Thomas F. Ryan gained control of the property, which they have since held, though under the constant bitter criticism of John Skelton Williams, formerly President and Chairman of the Board, and still largely interested in the road's securities. The Ryan party in 1905 formed the Seaboard Company to hold control of the property. Whatever else has been accomplished by it, this supernumerary holding company has failed to protect the road in time of difficulty, which was the announced reason for its creation. In 1906 Alfred Walter succeeded James M. Barr as President, and would perhaps have succeeded in bringing about the regeneration of the property as he had earlier with brilliant success of the Lehigh Valley, but before his first year of service was over his health failed rapidly, and he died on February 27, 1907. He was succeeded by William A. Garrett, who had been General Manager of the Cincinnati, New Orleans & Texas Pacific, an able and experienced railroad officer. Mr. Garrett has worked with great energy, and if it had not been for the financial crisis and resulting business depression it is possible that he would have succeeded within two or three years in putting the Seaboard property on its feet, but there were too many adverse influences, and they came too suddenly to be overcome. At a time when even the strongest railroad companies had grave difficulties in securing funds, it was impossible for the Seaboard to raise sufficient new capital, for its net earnings were decreasing, the weak points of the property had been carefully disclosed by the attacks of Mr. Williams, and the formation of the holding company and the lack of information in regard to its operations caused distrust.

Operating difficulties fell more severely on the Seaboard than on the other southern roads, because of the demoralization of its organization. The constant changes which had taken place in both the executive and operating departments, including both the highest and the lowest officers in the operating forces, had so unsettled and demoralized the organization that there was lack of co-operation, and, as the inevitable consequence, bad service to the public and expensive service to the company. The lack of confidence of the employees in the management and of the management in the men appears to have been one immediate and direct cause of the great decrease in net earnings. During the early part of 1907, when traffic was heavy, the road was very short in both power and equipment, and a great many of its locomotives were in bad condition. Shop facilities, side tracks and terminals were altogether inadequate to meet the demands of traffic. These physical handicaps taken together with the lack of efficient organization, resulted in an operating ratio, not including the Birmingham extension, which is said to have risen last March as high as 90 per cent.—a figure which leaves little or nothing with which to meet fixed charges.

The results of operation for the fiscal year ended June 30, 1907, show all this. Gross earnings increased $1,300,000, or 9 per cent., but operating expenses rose $2,400,000, or 23 per cent., the result being a decrease of $1,100,000, or 24 per cent., in net earnings. The operating ratio increased from 70 per cent. to 79 per cent.—a very sharp rise. Worst of all, the increase in operating expenses came largely in conducting transportation, which account was $1,700,000, or 27 per cent. larger than in 1906, and rose from 40.7 to 47.7 per cent. of the gross earnings. No further proof is needed of the disorganization of the operating forces than the fact that the Seaboard Air Line had to use nearly 50 per cent. of its gross earnings for paying the direct costs of getting and moving the traffic. The Southern Railway with all the great difficulties which it had to face used only 42.2 per cent. of gross earnings last year for this purpose.

At the same time that there was a decrease of $1,100,000 in net earnings there was an increase of over $300,000 in fixed charges. The two unfavorable influences together were large enough to change a net income of a little less than $1,000,000 in 1906 to a deficit of



Seaboard Air Line.

Including Atlanta & Birmingham Air Line and other subsidiary roads.

nearly $500,000 last year. These are the results from the operation of the rail lines. The water lines, made up of the Baltimore Steam Packet Company, showed a net income of $154,110 last year, so that the total deficit was reduced to a little more than $300,000, this figure however not including the deficit on the Birmingham line.

The largest proportionate increase in net earnings during the year was in passenger earnings, which were 15 per cent. larger than in 1906. The passenger density increased from 52,000 passengers one mile per mile of road to 61,400. The average distance carried rose from 45 miles to 48 miles, probably reflecting the development of the through Florida traffic, for which last winter was a profitable one. The legislative rate reductions of the various southern states began to show their effect in a slight reduction of the passenger-mile rate.

Freight earnings increased 6 per cent., and the freight density from 368,000 tons one mile per mile of road to 392,000. There was a slight reduction in the ton-mile rate. The trainload (whether including company freight or not is not indicated) rose from 194 tons to 208 tons. Gross earnings per mile of road were $6,292, against $5,790 in 1906, but net earnings per mile of [illegible] were only $1,333, against $1,763 in the previous year. Per train mile [illegible] earnings decreased from 52 cents in 1906 to 38 cents last year, a [illegible] off of 27 per cent—a result which eloquently bespeaks [illegible] zation.

The cost of maintaining the way and structures increased 18 per cent. Per mile of road, maintenance of way cost $840, against $715 in 1906. However, although only 163 miles of the line are laid with heavier than 75-lb. rail, and 1,757 out of the 2,548 miles owned are laid with rail weighing 70 lbs. or less, there was a decrease in rail renewals. Maintenance of equipment as a whole increased 19 per cent. Repairs and renewals cost $2,113 per locomotive against $2,061 in 1906; $829 per passenger car against $705 in 1906, and $57 per freight car, against $55 in 1906. This is a case where increased unit maintenance of equipment charges do not represent any concealed equity, for although the average charges during the past year reach a fair average as compared with other roads, the Seaboard Air Line's equipment during the last two years has been in bad condition and larger expenditures are therefore necessary to accomplish the same results as can be obtained on other roads at smaller cost.

Under the head of conducting transportation there was a particularly large increase in the cost of fuel for locomotives, which cost 31 per cent. more than in 1906 and 59 per cent more than in 1905. One of the disadvantages under which the Seaboard Air Line necessarily labors is that except on its Birmingham extension it reaches no coal mining regions, and therefore most of its fuel has to be carried considerable distances. All the items which are made up largely of wage payments also show large increases. Per diem payments were 97 per cent. larger than in 1906. Payments for freight lost and damaged increased 47 per cent., and for injuries to persons 79 per cent. The swift increase of the conducting transportation costs during the last winter is shown by the fact that with 91,000,000 tons carried one mile in November, 1906, the cost of conducting transportation was only $636,000, whereas in April, with only 89,000,000 tons carried one mile, the conducting transportation expense was $731,000.

A new general mortgage and collateral trust 30-year 5 per cent. bond issue amounting to $18,000,000 was authorized exactly a year ago. Of this issue $6,345,000 was sold. If it had been possible to sell the rest the company would probably have come safely through without a receivership, but sales later in the year were out of the question. An issue of $1,655,000 mortgage and collateral trust three-year 5 per cent. notes which matured on March 1, 1907, was extended to May 1, 1911. Three new car trust agreements were made September 26, 1906; May 16, 1907, and July 2, 1907. The total car trust payments during the fiscal year amounted to over $2,000,000.

The balance sheet shows the condition which forced the receivership of the company. On June 30 last, current assets, including over $2,000,000 material and supplies, amounted to $5,100,000, while current liabilities, including $3,900,000 in notes payable, amounted to $9,100,000. Since that time conditions have [illegible] been getting worse, for it has not been possible to issue any new securities, and earnings have been decreasing. According to the bill filed in application for the appointment of receivers there was due on January 1, 1908, on bonds and equipment notes, $7[illegible], and for taxes, traffic balances, pay-rolls, supplies and other claims, $[illegible], much of it overdue, besides floating indebtedness said to amount to about $3,000,000. To take care of the [illegible] indebtedness is the first problem which must be solved in the reorganization. The receivers have been ordered to issue receivers' certificates with which to pay the amount due on bonds and equipment notes.

The best chance for the ultimate success of the property is a drastic reorganization which shall reduce the amount of the road's capital and simplify and unify its securities and its railroads. Then with an able and continuous management it should before many years come into its own. The interests represented by John Skelton Williams are actively co-operating in the receivership proceedings with the Ryan-Blair party who have controlled the road, and with this unity among the stockholders it should be possible to bring about this result.

The following table shows the results of operation for the last two years ended June 30 of the Seaboard Air Line Railway, not including the Atlanta & Birmingham Air Line, 227 miles; the Florida West Shore, 70 miles, the Tallahassee, Perry & Southeastern, 39 miles, and the Plant City, Arcadia & Gulf, 18 miles.

	1907	1906
Mileage worked	2,611	2,611
Passenger earnings	$[illegible]	$[illegible]
Freight earnings	[illegible]	[illegible]
Gross earnings	16,427,91[illegible]	[illegible]
Maint. way and structures	2,2[illegible]	[illegible]
Maint. of equipment	2,[illegible]1,915	[illegible]
Conducting transportation	7,[illegible]13	[illegible]
Operating expenses	12,948,012	[illegible]
Net earnings	[illegible],479,901	[illegible]
Net income	458,[illegible]1*	[illegible]
Net income including Baltimore Steam Packet Co.	304,190*	1,17[illegible]

*Deficit.

CONTRIBUTIONS

Final S in Walschaerts.

London, Dec. 18, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in your issue of Nov. 29 a letter from Mr. F. W. Dean, of Boston, suggesting that the name of the inventor of the Walschaerts valve gear should be spelled without a final "s." Mr. Dean does not give any reason for the spelling he proposes, and the position he takes is quite untenable. If he will refer to your issue of December 8, 1905, page 493, he will find a translation of a short biography of E. Walschaerts, the inventor of the valve motion, written by Prof. M. J. Boulvin, of the University of Ghent. Prof. Boulvin, being a fellow countryman of Walschaerts, should certainly be an authority on the proper spelling of his name. Further, I have before me a quotation from the report of the Belgian members of the jury of the Paris Exhibition of 1878 which refers to the valve gear invented by Walschaerts and patented in 1844.

I think this is conclusive evidence as to the propriety of spelling Walschaerts with a final s. LAWFORD H. FRY.

Discipline Versus Accidents.

Omaha, Neb., Jan. 2, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Can the strong (?) arm of the law prevent railroad accidents?

The recent discussion of this subject in your magazine, ranging from conservative editorials to radical viewpoints of correspondents, is interesting to the students of the art of discipline. This is certainly one of the most important subjects connected with modern railroading, seemingly not confined to the United States, as our cousins on the north (the cold, deliberate Anglo-Saxon) are wrestling with it seriously, while the hot blooded sons of the Latin races on our southern border are frequently accused of chasing the erring engineer or conductor through the cactus and confining him in the old Spanish dungeons or burying him in the Government salt mines, for complicity in some accident which has resulted in loss of life.

Can we not profit by the history of human experience to evolve something that will really accomplish what we desire? Our railroad experience covers only a little over three-quarters of a century, while our general experience goes back into the Dark Ages of centuries past. The Chinese, for instance, have had a longer continuity of civilization than any other nation. The great struggle for existence makes the people of this great empire value human life less and to take a more serious view of business transactions than any other. They ought to be able to view a matter of this kind free from sentiment or prejudice. What would the Chinamen do under similar circumstances? These people are well behaved, law-abiding, economical, modest, industrious and studious as a whole. Incompetency or dishonesty is not tolerated in responsible positions. They are impatient of mistakes as being too serious a burden upon the public at large.

There is a story of a bank failure in China 300 years ago, the investigation of which resulted in the decapitation of every one connected with the institution from the porter up to the president; and no failure since.

We are inclined to the opinion that the Chinese will operate their railroads much the same, viz., exact from employees that for which they are paid—perfect service—and as a natural sequence they will not need to exact it—such service will come spontaneously out of the long heredity of that people; their very habits and characteristics must operate as a compelling force along the lines desired. This we have all witnessed or heard of in the admirable service rendered in menial capacity by the few Chinamen with whom we are acquainted, mostly Canton coolies, the descendants of the lowest classes, even criminals, sent over to this country during our pioneer railroad building to get rid of them. The more intelligent classes have an even better reputation for the higher sense of duty.

Coming back to our own country, take 2,000 young men out of any American rural district, divide them indiscriminately into two military regiments of 1,000 each, put in charge of one an officer who is a disciplinarian, who looks out for the comfort and interests of his men (perhaps it may be for a selfish motive entirely), but who exacts obedience until he is finally able to move this force as one unit at his will. At the head of the other regiment put an indifferent, lax commanding officer, who is kind to himself, cares but little what his men are doing in the idle moments, having as his motto, "Sufficient unto the day is the trouble thereof." Which of the two regiments would you choose to go up against in battle if you were on the other side?

We think it has been made plain that if you have a high sense of moral responsibility in your personnel you have the best material with which to operate, lacking in this, the next essential is to take what you can get and mold it into the best possible substitute. That is what must be done on the railroads in this country—drill, discipline, drill—until the forces at your command cannot exert an adverse force sufficient to prevent obtaining what is desired—good service. Moral suasion will not do it. Your force is not sufficiently pliable. The majesty of the law will not do it, because your subject is a "sovereign." The law cannot prevent serious crimes that are undoubtedly on the increase under our criminal code. Then how can it compel service?

To err is human. There was only one perfect man. Mistakes will be made (regrettable as it may be) until the end of time. If hundreds of train crews and despatchers create hazards of accidents yearly, as they do, with the law taking cognizance of only those in which loss of life occur, where is the consistency? One must be as much of a crime as the other, the only difference being perhaps in the physical conditions or unfortunate adverse circumstances which bring about the fatality and for which the unlucky subject of legal investigation may not be in any way responsible. To punish an individual for destruction of property would lead to imprisonment for debt, petty persecutions and injustice. Who will draw the line, and where? To invite a higher degree of honor, of duty and loyalty will lead to a public sentiment that is stronger than the law in compelling that sense of personal responsibility requisite to perfect service. There should be certain infractions of the rules that require immediate and irrevocable dismissal, the most important of which are insubordination, disloyalty and dishonesty; with a distinct understanding that such offense cannot be discussed by grievance committees, further than, if necessary, to submit to them the proof.

The working forces should be well cared for and closely looked after. Reasonable recreation should be afforded them, and the temptation of the drinking places overcome by others equally attractive; then enforce rules against the use of intoxicants strictly. Place before employees in the train service information relative to their duties in such a way that they may be induced to enter into the operation of the road with a spirit of voluntary loyalty that is genuine.

Give some of your most efficient men, who have absolutely clear records, who are not agitators and who have by meritorious conduct shown that they are willing to render more service than they are paid for, a premium in the way of stock in the property. A few shares scattered here and there would have a wonderful effect in making watch dogs of the treasury. They should be held in escrow during the service of the employee, paid to his family immediately upon demise, or to himself on permanent retirement from the service; the profit sharing to be for exceptional service and at the discretion of the management. Leave something in the hands of the responsible operating official with which he can work to bring about results to his liking. Formerly he had the promotions or preferred runs to work on. This has been taken away by the schedules until now all stand on an equality, and there is nothing looked for or expected but punishment, with a well organized, paid force to contend against, prevent or undo discipline by coercion, argument or pleas for leniency. The monitors of the service are not now in evidence; their efforts to correct among themselves lax duty at present are made odious; to report an infraction of the rules is considered an offense on a par with treason, and one who practices it is liable to social ostracism, if not in danger of physical violence. The trainmaster cannot know all that he should unless information is obtained in this way—he finds it more difficult each day so to obtain it.

Last and most important of all and again is the drill. Anticipate accidents; prevent them by exacting the performances of duty with a military precision. All the indiscriminate forces on the railroad will contend against this—the public, traffic, the operating officials themselves and the employees. Delays will occur, trains will lose time while the drill is going on, but after the battle is won most of the difficulties will vanish and something will be gained. Surprise tests will accomplish wonders in this direction, and are the only things that will. Perhaps the selection of this term is unfortunate, as it gives the men an opportunity to allege the dangerous conditions under which they work and the possibility of personal injury from being "surprised." "Efficiency tests" would be the better expression, and all the term implies could be exacted to any extent desired.

Do not neglect those things which are beyond the control of the men; otherwise they will accuse you of insincerity. Throw every safeguard consistent with existing conditions around them and encourage suggestions from the men themselves along these lines. Too many officials do not know, and not knowing, fear discovery. To ward off such incompetency they assume that high and mighty bearing that chills those who do know, at least that which they do successfully each day, and from experience can possibly offer valuable suggestions.

With the installation of block signals and the operation of railroads along the above lines there will not be much left for the public to criticize—our methods will bear prospective governmental investigation. While accidents will continue to occur, they will be classed as "accidents," and be accepted by the public as unavoidable risks of travel. At present they do not feel this way, and it is up to the railroad men of this country to correct it; the Law cannot do it—the railroad men can.

W. L. PARK,
General Superintendent, Union Pacific Railroad.

Rail Sections and Specifications.

Detroit, Mich., Dec. 31, 1907.

To the Editor of the Railroad Gazette:

I agree with the article of E. W. Heinle of November 27. I wonder why the American Railway Association found it necessary to suggest experimental sections for rails lighter than, say, 80 lbs. per yard?

Perhaps it would be well for some road to try the new sections and see how they roll and how they wear before committing the railroads generally to a section which none of them know anything about.

J. D. HAWKS,
President and General Manager, Detroit & Mackinac.

Pittsburgh, Pa., Dec. 31, 1907.

To the Editor of the Railroad Gazette:

Quoting from Robert Job's article read before the New York Railroad Club: "Twenty or thirty years ago steel rails did not cause the difficulty which is found with the present product. This is due to a number of causes. A vastly greater tonnage is handled to-day by the mills, and the same care is not used in the preparation and cropping of the ingots, while in rolling a much higher finishing temperature is maintained, resulting in a coarser structure with relatively rapid wear. In many cases the composition is better to-day than formerly, yet in spite of what, under present practice, would be considered dangerous composition, it is a well-known fact that the old rails gave generally excellent service, this being due largely to the thorough working of the steel down to a low finishing temperature. Some old 67 John Brown rails, rolled and laid in 1864, have been in track for 34 years. The composition was as follows: Carbon, .330 per cent.; phosphorus, .039 per cent.; manganese, .390 per cent.; sulphur, .030 per cent.; silicon, .070 per cent."

"An 80-lb. rail of somewhat the same composition, namely: Carbon, .396 per cent.; phosphorus, .072 per cent.; manganese, .660 per cent.; sulphur, .033 per cent.; silicon, .286 per cent., and rolled a few years ago, has a far greater coarseness of structure. Under the same traffic the one has given long service, while the other would cut out rapidly."

Mr. Job gives an exceedingly strong argument in favor of a greater number of passes in rolling rail section, if we expect to secure a good rail, in fact, the strongest that has yet been advanced; although he does not say that a greater number of passes will accomplish this result, but if anyone will take the trouble to look up the record of the John Brown mill, they will find that there was used in rolling the No. 67 rail not less than the 25 passes advocated by me; more likely a greater number of passes than these were used.

Mr. Job also corroborates an assertion made by me—although he does not seem to realize that a greater number of passes will do this—that if a greater number of passes were used the carbon content could be reduced. He shows that the John Brown rail was but .330 carbon, and yet the rails were better than the ones rolled to-day with over .50 carbon. What stronger argument does one need than this? Here is one of the foremost metallurgists of the age coming forward and saying that rails rolled 40 years ago with chemical conditions, that to-day would be considered dangerous, are better than rails rolled at the present time, with the best metallurgical conditions that can be secured, and he is right. The answer to it all is, better mechanical treatment of the steel in the earlier days than prevails under present mill practice.

The only way to get rails finished at a low temperature without excessive strain and great disturbance of the molecular structure is to use more roll passes and less reduction per pass. This is a mechanical condition, and metallurgy cannot control it.

If it takes an average of 8 or 9 minutes to roll a finished rail from the ingot with 15 passes, as claimed by F. E. Abbott, of the Lackawanna Steel Co., how are we to get rails finished at a lower temperature than at present, if no more passes are used? Mills cannot give us any lower temperature at the initial pass, and roll the rails with the present reduction; their machinery is not strong enough. Nearly every break of machinery that occurs in rolling mills to-day comes from a delayed piece of steel that has become so cold that the reduction cannot be given without breakage of rolls or other mill parts.

Now what is to be done? Build a mill strong enough to crush the life out of the steel in a few passes at a low temperature, or put in more sets of rolls, thereby getting more passes, allowing the rolling to be done at a minimum reduction per pass, and get a rail approaching the condition so much desired by everybody? That is, a close-fibered, tough, homogeneous body of steel as nearly approaching the condition of cold rolled shafting as is practicable.

S. T. FIERO,
Inspecting Engineer.

The Influence of Heat Value and Distribution on Railroad Fuel Cost.*

The cost of locomotive fuel is about 12 per cent. of the total operating expenses of a railroad, consequently the subject of fuel economy is of the utmost importance. It is not the purpose of this paper to discuss the economical use of coal on locomotives, but to deal with the economical purchase and supply of coal before it reaches the locomotives. In order that coal may be economically purchased and distributed the heat value and cost must be considered. The heat value of coal may be determined by laboratory calorimeter tests or by evaporation tests made on locomotives. The latter method is preferable, as the coal is tested in actual service.

Locomotive Coal Tests.—The heat values of the coals found on or near the railroad system which are being or are likely to be used, should be determined by locomotive evaporation tests. The coals should be tested in groups, and in order that different groups of coals may be compared, even though the tests are made 1,500 miles apart, each group of tests as well as the individual tests should be carried on under similar conditions.

The unit of comparison for coals is the number of pounds of equivalent water evaporated per pound of coal. It is evident that the following items will affect this ratio or unit of comparison: Kind of coal; class of engine; condition of engine; engine crew, especially the fireman; class of service. Since the object of coal tests is to determine the comparative value of various coals, all others of the above conditions should be kept as uniform as possible.

Coals should be tested on a division where they are being used, as the firemen are already accustomed to them. When coals which differ materially from those habitually used are to be tested, a number of trial runs must be made until the firemen can fire the coal properly.

If possible, all the tests made on one railroad system should be made on one class of engine. This is advisable in order that the coals tested at one end of the system can be compared with those tested at the other end without having to correct for the difference in evaporative efficiencies of the engines.

The engines should always be in good condition; this applies especially to condition of flues and firebox. Whether a brick arch is used or not, the conditions in this particular should be the same in all tests.

During a series of tests the same firemen should be used throughout, thus avoiding any difference on this account. It is not so important that the same engineers be used, for while one engineer may use more steam than another, the ratio of the coal to the water used will not change materially.

Passenger service is preferable to freight on account of the more uniform conditions. It is desirable that the time between terminals, the time using steam and the weight of the trains shall be nearly uniform from day to day, and that the average of these values for all tests made with each kind of coal shall be nearly the same. When tests are conducted in freight service, at least twice the length of time will be required to test one kind of coal, and the expense will be more than doubled on account of additional coal weighers being required.

At each terminal a fuel tester is located to take charge of the supply and weighing of the test coal and to see that none of the weighed coal on the engine is used during its stay at the terminal. The coal weigher is relieved by an engine observer before the engine leaves the roundhouse, and he stays with the engine until relieved by the coal weigher at the other terminal. The engine observer keeps record of coal, water, steam pressures, stops, shut-offs, etc., in a printed thumb-indexed note book made up of seven printed forms and three blank pages. From four to eight men are required to make the tests properly, according to whether one or two engines are used and whether they are single or double crewed.

Exclusive of that used for firing up, about 150 tons of each kind of coal should be used on the tests. From six to eight round trips are made with each coal, and where two firemen are used, half the tests are made with each fireman. This is necessary, as one fireman might be slightly better than another. Tests in one direction on account of grades, speed or number of cars may be more favorable than in the other, hence the same number of trips in each direction is necessary.

The data taken for each test are recorded on the blanks already mentioned, and the more important totals and averages are recorded on a "final result" sheet. The data and computations of each test are recorded in a column and the average for all tests in an "average" column. In a series of tests which have all been conducted under similar conditions, the heat value of each coal is pro-

*A paper presented at the November meeting of the Western Railway Club by J. G. Crawford, Fuel Engineer of the C., B. & Q. Ry.

portional to the average of the items showing the equivalent number of pounds of water evaporated from and at 212 deg. per pound of coal.

The results covering the A. B. C. Railroad will be expressed as follows:

Name of coal.	Equiv. evap. per lb. coal, actual.	Rank per cent.	Price, per ton.	Name of coal.	Equiv. evap. per lb. coal, actual.	Rank per cent.	Price, per ton.
A	5.60	80	$1.50	F	7.00	100	$1.10
B	5.60	80	1.30	G	7.70	110	1.40
C	6.30	90	1.30	H	7.70	110	1.20
D	6.30	90	1.60	I	8.40	120	2.10
E	7.00	100	1.30	J	8.40	120	2.50

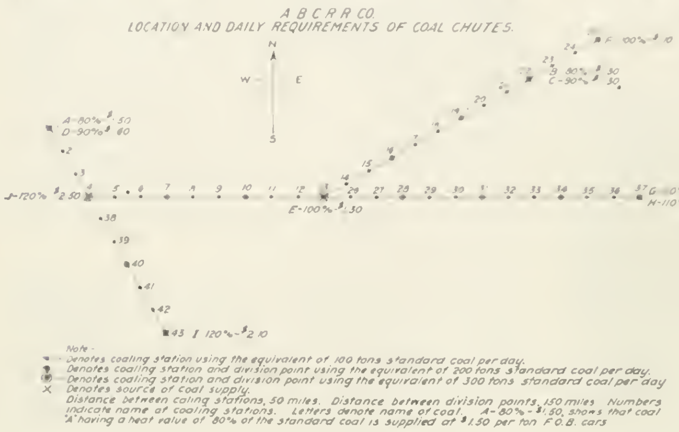


Fig. 1.

The above coals do not necessarily represent individual companies or mines, but coals of equal heat value and price from the same point of distribution are included under one name. For convenience the coals have been assumed to be poorer and better than the standard coal by multiples of 10 per cent. The prices selected in most cases bear little or no relation to the heat value, which is true under actual conditions.

For convenience the A. B. C. Railroad, as shown in Fig. 1, has been assumed as having the following requirements and conditions.

(1) Coaling stations require respectively the equivalent of 100, 200 and 300 tons of standard (100 per cent.) coal per day.

(2) The railroad can get as much coal as it desires from all the sources of supply.

(3) All these coals will mix with each other without additional trouble from clinkering.

(4) Cost of handling at chutes, 10 cents per ton.

(5) Cost of haulage from source of supply to chute, 2 mills per ton-mile. (Under the accounting system put in force by the Interstate Commerce Commission on July 1 no charge is made against the fuel account for the haulage of coal on a company's own line. This has been the practice, at least on the more important lines, for a number of years past; although about 1901 at least two of the important systems charged their fuel account with the haulage of company coal at the rates of 3 and 5 mills per ton mile, respectively. Whether or not the haulage of company coal on a company's own line is, or is not, charged to the fuel account, is a matter of no importance, as the cost remains the same in either case, but in order to work out the best coal distribution it is a

Fig. 4.

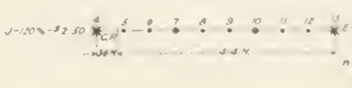


Fig. 5.

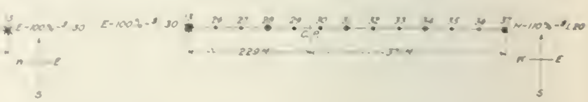


Fig. 6.

matter of the utmost importance to accurately know this cost of haulage. The above rate of 2 mills per ton mile is probably too low in most cases, but is selected at this figure to simplify the computations to follow.)

Competitive Points.—The prices and heat values of the coals have been so selected that they illustrate a number of combinations that arise in practice which will be taken up under the following headings:

Equal Heat Value, Unequal Price and Same Source of Supply.—Coals G and H having the same heat value, and being supplied from the same point should cost the same. As $1.40 per ton is asked for G and $1.20 for H, G should not be used, and thus is eliminated from consideration.

Equal Heat Values, Unequal Price and Different Sources of Supply.—Coals J and I, Fig. 2, have the same heat value, and J is supplied at $2.50 per ton from station No. 4, [illegible] miles from station No. 43, where I is supplied at $2.10 per ton.

The dividing line between coals J and I, which is called the competitive point, is found from the following equation in which x is the distance from station No. 4 to the competitive point.

$$\frac{\$2.50 + \$0.10 + x\,(\$0.002)}{120\ \text{per cent}} = \frac{\$2.10 + \$0.10 + ([illegible] - x)\,\$0.002}{120\ \text{per cent}}$$

x = [illegible] miles.

This shows that at all points north of station No. 38 J coal should be used, south of station No. 38 I coal should be used, and

Fig. 2.

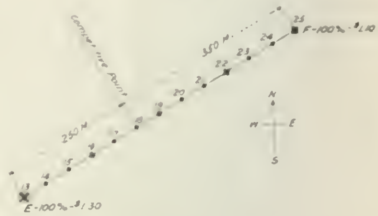


Fig. 3.

at station No. 38 either I or J coal can be used, as both will cost $2.70 on the engine at that point, made up as follows.

	Coal J	Coal I.
F. o. b. station	No. 4	No. 43
First Cost	$2.50	$2.10
Haulage	.10	.50
Handling at chute	.10	.10
Cost on engine per ton	$2.70	$2.70
Cost on engine of amount equivalent to 1 ton standard coal	2.25	2.25

Coals E and F, Fig. 3, have also the same heat value and are from different sources of supply.

The equation for finding the competitive point of these coals is as follows:

$$\frac{\$1.30 + \$0.10 + x\,(\$0.002)}{100\ \text{per cent.}} = \frac{\$1.10 + \$0.10 + (600 - x)\,\$0.002}{100\ \text{per cent.}}$$

x = 250 miles.

This shows that at station No. 18 both coals cost the same, made up as follows:

	Coal E.	Coal F.
F. o. b. station	No. 13	No. 25
First cost	$1.30	$1.10
Haulage	.50	.70
Handling at chute	.10	.10
Cost on engine	$1.90	$1.90

Unequal Heat Values, Equal Price, Same Source of Supply.—Coals B and C, costing the same, are supplied from the same source, but B is an 80 per cent. and C a 90 per cent. coal. As C is 12½ per cent. better than B, C should be used and B excluded.

Unequal Heat Values, Unequal Prices, Same Source of Supply.—Coals A and D are supplied from the same source, but are different in both heat value and price, A being an 80 per cent. coal costing $1.50 per ton, and D being a 90 per cent. coal costing $1.60 per ton. D being 12½ per cent. better than A, and costing only 6⅔ per cent. more, should be used to the exclusion of A.

Unequal Heat Values, Unequal Prices and Different Sources of Supply.—Coals D and J, Fig. 4, are unequal in heat value and price and are supplied from different points. Their competitive point would be found as follows.

$$\frac{\$2.50 + \$0.10 + x\,(\$0.002)}{120\ \text{per cent}} = \frac{\$1.60 + \$0.10 + (150 - x)\,\$0.002}{90\ \text{per cent}}$$

x = 14.3 miles.

The competitive point of coals D and J is 14 miles north of J, therefore stations No. 1, No. 2 and No. 3 should be supplied with

D, and station No. 4 with J. At the competitive point coal on the engine would cost as follows:

	Coal D.	Coal J.
F. o. b. station	No. 1	No. 4
First cost	$1.60	$2.50
Haulage	.27	.03
Handling at chute	.10	.10
Cost on engine, per ton	$1.97	$2.63
Cost on engine of amount equal to 1 ton standard coal. .	2.19	2.19

The competitive point of coals J and E, Fig. 5, is found from the following equations:

$$\frac{\$2.50 + \$0.10 + x\ (\$0.002)}{120 \text{ per cent.}} = \frac{\$1.30 + \$0.10 + (450 - x)\ \$0.002}{100 \text{ per cent.}}$$

$$x = 36.4 \text{ miles.}$$

This shows that J coal cannot be used east of station No. 4 and that E coal should be used at stations No. 5 to No. 13 inclusive. At the competitive point coal on the engine would cost as follows:

	Coal J.	Coal E.
F. o. b. station	No. 4.	No. 13
First cost	$2.50	$1.30
Haulage	.07	.83
Handling at chute	.10	.10
Cost on engine, per ton	$2.67	$2.23
Cost on engine of amount equal to 1 ton standard coal. .	2.23	2.23

The competitive point of coals E and H is determined by the following equation, as shown in Fig. 6:

$$\frac{\$1.30 + \$0.10 + x\ (\$0.002)}{100 \text{ per cent.}} = \frac{\$1.20 + \$0.10 + (600 - x)\ \$0.002}{110 \text{ per cent.}}$$

$$x = 229 \text{ miles.}$$

E coal is thus limited to station No. 29 and west thereof and H coal from stations No. 30 to No. 37 inclusive. At the competitive point the following would be the cost of coal on the engine:

	Coal E.	Coal H.
F. o. b. station	No. 13	No. 37
First cost	$1.30	$1.20
Haulage	.46	.74
Handling at chute	.10	.10
Cost on engine, per ton.	$1.86	$2.04
Cost on engine of amt. equal to 1 ton standard coal....	1.86	1.86

The competitive point of coals C and F, Fig. 7, is found from the following equation:

$$\frac{\$1.30 + \$0.10 + x\ (\$0.002)}{90 \text{ per cent.}} = \frac{\$1.10 + \$0.10 + (150 - x)\ \$0.002}{100 \text{ per cent.}}$$

$$x = -13.2 \text{ miles.}$$

Note that x is a negative quantity which shows that F can be hauled 26.4 miles more than the above 150 miles and then cost the same on the engine at station No. 22, the point of distribution of C, as the amount of C coal equivalent to one ton of standard coal. This is proven by the following table:

	Coal C.	Coal F.
F. o. b. station	No. 22	No. 25
First cost	$1.30	$1.10
Haulage	.00	.30
Handling at chute	.10	.10
Cost on engine, per ton	$1.40	$1.50
Cost on engine of amount equal to 1 ton standard coal. .	1.55	1.50

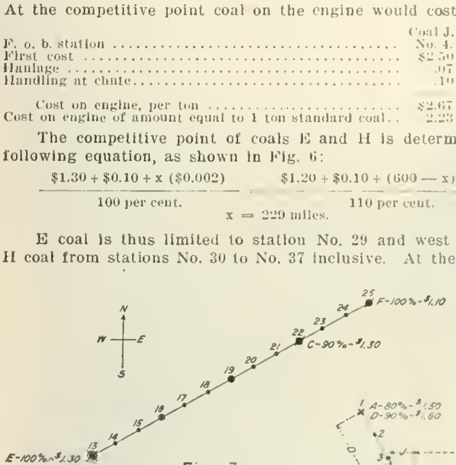


Fig. 7.

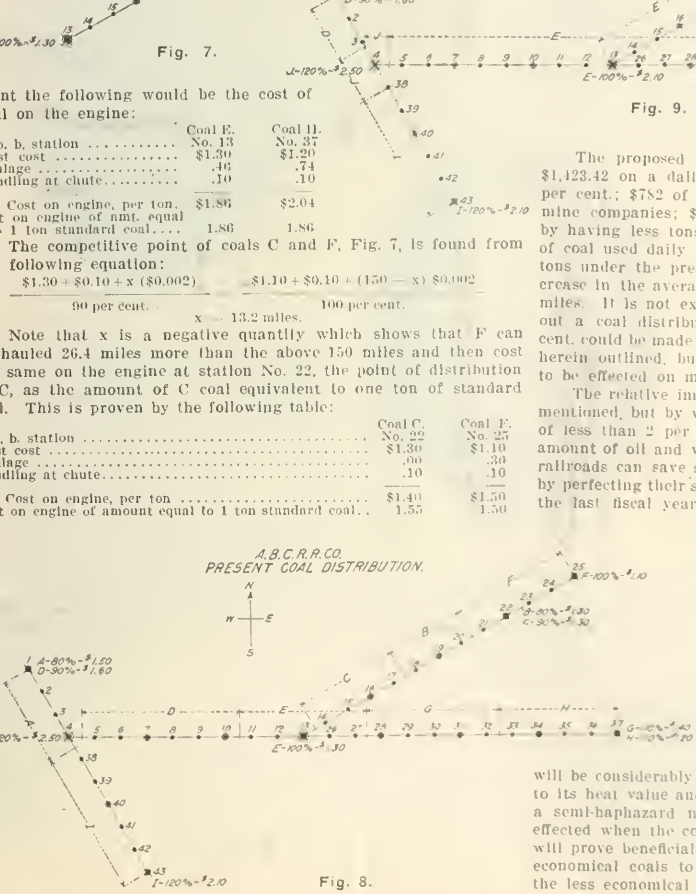


Fig. 8.

Present vs. Proposed Coal Distribution A. B. C. R. R.—The present coal distribution on the A. B. C. Railroad is shown by Fig. 8 and the proposed distribution by Fig. 9. Some objection may be offered to the distribution shown in Fig. 8, but when it is considered that the relative heat values are not known before tests have been made the distribution is not an improbable one.

The cost of fuel per day under the present system of coal distribution, and that of the proposed distribution, are shown in two large tables not reproduced here. The following totals, made up from these tables, show the amount of each kind of coal used under the present and proposed distributions:

Kind of coal	Present distribution: Tons used.	Present distribution: Equivalent to following tons of standard coal.	Proposed distribution: Tons used.	Proposed distribution: Equivalent to following tons of standard coal.
A	875.0	700	. . .	. . .
B	500.0	400	. . . .	. . . .
C	555.5	500	. . . .	. . .
D	888.8	800	444.4	400
E	700.0	700	2,300.0	2,300
F	700.0	700	1,100.0	1,100
G	636.3	700	. . .	.
H	636.3	700	999.9	1,100
I	666.4	800	583.1	700
J	. . .	. .	333.3	400
Total	6,158.3	6,000	5,760.7	6,000

Below are given the averages and totals of these tables, and the savings to be made by adopting the proposed distribution:

Distribution.	Coal Tons.	Average Haulage.	Average Tn miles.	Cost of coal: First cost.	Haulage	Handling.	Total.
Present	6,158.3	176	1,084,035	$8,840.55	$2,168.07	$615.83	$11,624.45
Proposed	5,760.7	136	783,140	8,058.68	1,566.28	576.07	10,201.03
Difference	397.6	40	300,895	$781.87	$601.99	$39.76	$1,423.42

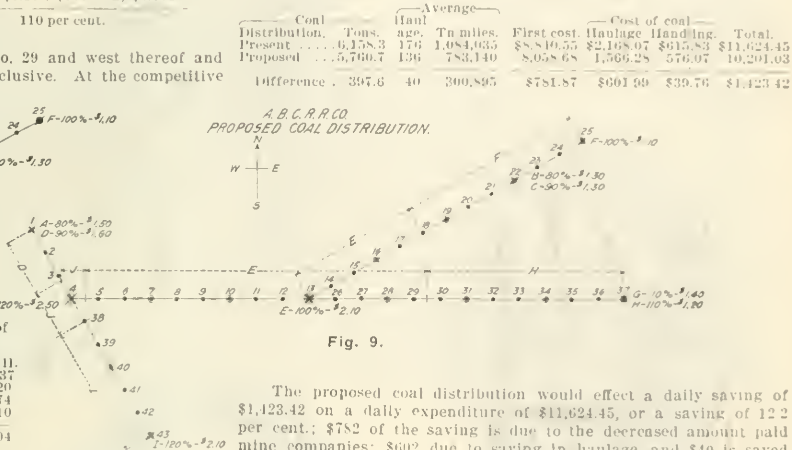


Fig. 9.

The proposed coal distribution would effect a daily saving of $1,423.42 on a daily expenditure of $11,624.45, or a saving of 12.2 per cent.; $782 of the saving is due to the decreased amount paid mine companies; $602 due to saving in haulage, and $40 is saved by having less tons of coal to handle, there being only 5,761 tons of coal used daily under the proposed distribution as against 6,158 tons under the present distribution. The table also shows the decrease in the average length of haul and the decrease in total tonmiles. It is not expected that every railroad company in working out a coal distribution would find that a saving of over 12 per cent. could be made by distributing the coal according to the methods herein outlined, but there is no doubt that considerable saving is to be effected on most systems.

The relative importance of fuel and oil economy has often been mentioned, but by way of comparison it may be said that a saving of less than 2 per cent. in the fuel bill would pay for the entire amount of oil and waste used for locomotive lubrication, and many railroads can save several times the amount of the lubrication bill by perfecting their system of coal purchase and distribution. During the last fiscal year the average cost of fuel for locomotives and lubrication for locomotives on five leading western roads was as follows:

		Per cent.
Fuel for locomotives	$6,042,266	13.2
Lubrication for locomotives	148,160	0.3
Total operating expenses	45,604,82[illegible]	. .

This shows that the cost of lubrication of locomotives amounts to only 2.5 per cent of the cost of fuel for locomotives and that at least 40 times the energy that is now spent in reducing the cost of lubrication should be expended on the fuel item.

It is not expected that any railroad can at all times distribute coal according to some predetermined plan, but the cost of fuel will be considerably less, when purchased and distributed according to its heat value and cost, than when purchased and distributed in a semi-haphazard manner. The greatest saving can probably be effected when the commercial demand is not at a maximum, which will prove beneficial to purchase and distribution by allowing more economical coals to be used and correspondingly less amounts of the less economical coals.

The Block Signal and Train Control Board.

The portraits shown on this page are those of the members of the "Block Signal and Train Control Board" which, acting under the authority of the Interstate Commerce Commission, is charged with the duty of investigating the subject of automatic train stops and other block signaling questions. The appointment of this board, under authority of a Congressional resolution, was noticed in the *Railroad Gazette* of July 19, last, page 58. The Chairman of the board is Professor Cooley, Dean of the Engineering School of the University of Michigan. He has been connected with that institution since 1885, previous to which time he was in the United States Navy. Professor Cooley has done expert engineering work in connection with railroads for the state of Michigan and for the city of Chicago.

Captain Ames is Signal Engineer of the Electric Zone of the New York Central & Hudson River, and has served on the Lake Shore & Michigan Southern and Boston & Albany, as well as on different divisions of the New York Central. His title as Captain comes from his service in the Engineering Corps of the United States Army during the war with Spain in 1898.

Mr. Ewald is Consulting Engineer of the Illinois Railroad and Warehouse Commission, and was formerly in the Engineering Department of the Atchison, Topeka & Santa Fe.

Mr. Adams is associate editor of the *Railroad Gazette*.

Concerning the work of this Board, the Commission, in its annual report, says that

M. E. Cooley.

Azel Ames, Jr.

F. G. Ewald.

H. H. Adams.

its attention has thus far been directed to an examination of inventions that have been presented in response to a circular letter issued by the Commission. Continuing, the Commission says: "As the block system proper is now in general use and information concerning it can be obtained with comparative ease the board has devoted its attention mainly to the question of automatic stops. In considering the desirability of such devices on railroads generally one of the first problems to be solved is the reliability of the apparatus when its operation is interfered with by snow, ice or accidental disturbances or obstructions. Another problem is the arrangement and regulation of the apparatus so as to provide against failure or inconvenience and delay caused by such irregularities as unusually long or short trains, varying rates of speed, train movements in the reverse direction, and the unexpected stoppage of trains.

"The questions to be determined by test are, first, the merit when used in general service of those devices which are already in use in exceptional situations, and, second, what merit there may be in the large number of inventions and alleged inventions which have not yet been developed and installed. Concerning the first class a number of concerns are now proposing to make experimental installations, and these, if ready, will be inspected by the board during the coming winter. As to the second class, all but a few of the devices that have been presented for consideration are from inventors who have little knowledge of the present state of the art of signaling and who appear to have taken little pains to secure the counsel of men experienced in railroad operation.

"The use of automatic stops necessitates special equipment on each engine traversing the line where the stops are installed. This is a radical innovation and involves questions which must be considered with great care. There are two principal methods of communication with the engine, namely, by mechanical trips and by electrical contacts. The relative desirability and reliability of these methods is one of the first questions to be settled. Under this head it will be desirable to investigate certain cab signal installations in Europe, some of which are of ten years' standing. Cab signals are not automatic train stops, but they use either the mechanical trip or electrical contact in the same way that an automatic stop would use it, hence the need of learning the lesson of this European experience through a visit by a member of the board or some other competent person to England and France.

"Up to date the board has examined descriptions of 495 devices or systems; 245 of this number have been laid aside as not coming within the terms of the joint resolution. They deal with devices intended to improve the condition of tracks, automatic car couplers, automatic steam and air hose couplers, safety cars, etc. Of the remaining inventions the board has been furnished with descriptions of 175 which relate directly to block signals, cab signals, or automatic train stops; 55 of this number have already been disposed of and 120 are now in the course of examination. In nearly all of the 55 cases which have been passed upon the board has unanimously decided that the alleged inventions have not sufficient merit to warrant further attention. In most of these cases the plans and specifications that have been furnished indicate that the inventors are manifestly unacquainted with the requirements of railroad service, their devices being merely repetitions of what has been previously invented."

Mallet Compound Locomotive for the Central of Brazil.

The American Locomotive Co. has recently built three Mallet articulated compound locomotives for the Central Railroad of Brazil, which, while not ranking in size and capacity with those built by the same company for the Baltimore & Ohio and Erie, are still of goodly proportions and have a capacity on a par with the heaviest consolidation locomotives in use on American roads. In general design the type built resembles the Erie engine, except that it is fitted with three pairs of driving wheels in each truck instead of four pairs. The boiler is rigidly attached to the rear frame and the flexible connections to the front cylinder and the exhaust are the same as those shown in the *Railroad Gazette* Oct. 4, 1907.

As in the case of the other locomotives the Walschaerts valve gear is used. There is one detail to which attention may be called, and that is the comparatively low position of the injector check. It will be seen to be just above the top of the main air reservoir and well down below the center line of the boiler, showing that despite all of the discussion on the subject that has appeared during the last year or so, the position of the part has not yet been definitely settled.

The following are some of the principal dimensions of these engines:

Cylinders, diameter, h. p.	$17\frac{1}{2}$ in.
Cylinders, diameter, l. p.	28 "
Piston stroke	26 "
Track gage	5 ft. 3 "
Wheel base, rigid	9 " 0 "
" " total	27 " 8 "
" " engine and tender	55 " $2\frac{1}{4}$ "
Weight on drivers	206,000 lbs.
Weight, engine and tender	304,300 "
Heating surface, tubes	2,195.2 sq. ft.
" " firebox	121.5 "
" " total	2,316.7 "
Grate area	41.0 "
Journals, engine	$7\frac{1}{2}$ in. x 9 in.
Journals, tender	5 " x 9 "
Steam pressure	200 lbs.
Fuel	Cardiff coal
Firebox, length	$90\frac{1}{8}$ in.
" width	$63\frac{1}{4}$ "
" thickness crown, sides, back sheets	$\frac{3}{8}$ "
" thickness tube sheet	$\frac{1}{2}$ "
" water space, front	5 "
" water space, sides and back	4 "
Tubes, material	Charcoal iron
" number	234
" diameter	2 in.
" length	18 ft.
Brake	Westinghouse
Stack, height above rail	13 ft. $9\frac{1}{2}$ in.
Tank, style	Water bottom
" capacity, water	4,500 gals.
" capacity, fuel	$8\frac{1}{2}$ tons
Valves, h. p.	Improved Piston
" h. p. travel	5 in.
" h. p. lap	$\frac{7}{8}$ in.
" l. p.	Allen Richardson
" l. p. travel	$5\frac{1}{2}$ in
" l. p. exhaust clearance	3-16 in
" lead	3-16 in.
Wheels, diameter, driving	50 in.
Wheels, diameter, tender	30 "
Wheels, type, tender	Rolled steel, 2 in. rim.
Tractive power	42,420 lbs.

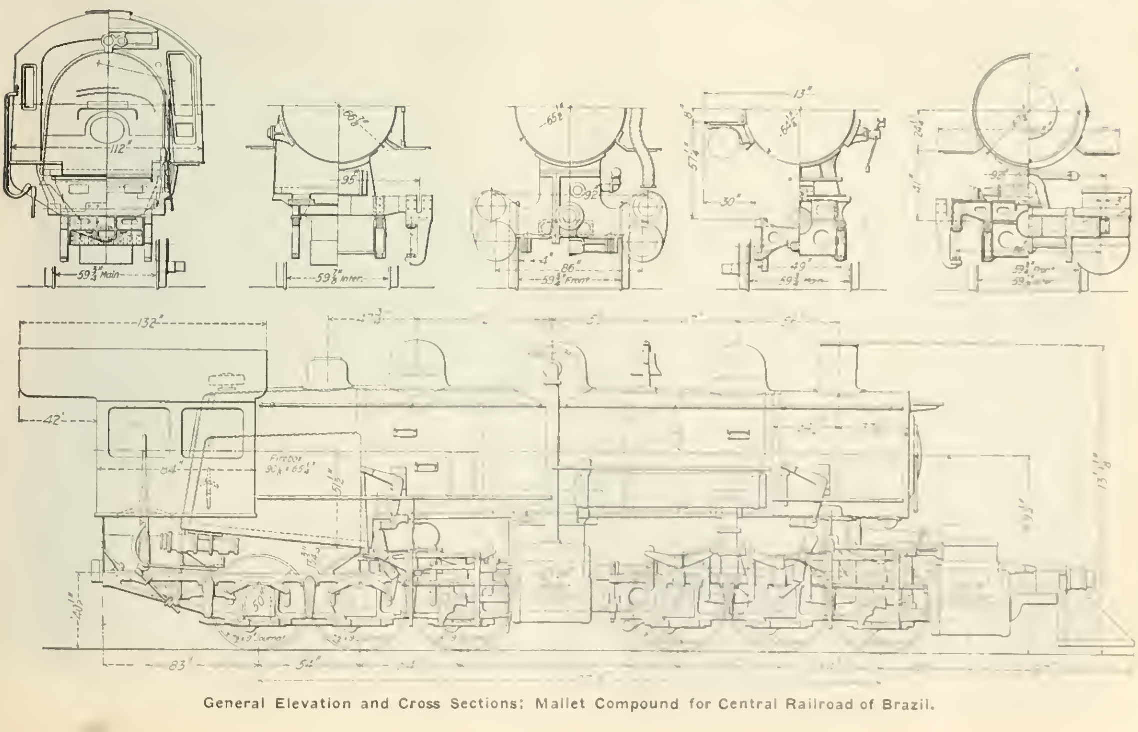
$$\frac{\text{Weight on drivers}}{\text{Tractive power}} \quad 4.85$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} \quad 924\ 16$$

$$\frac{\text{Heating surface}}{\text{Grate area}} \quad 56.50$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} \quad 5.25^{*}$$

Mallet Articulated Compound Locomotive; Central Railroad of Brazil.



General Elevation and Cross Sections; Mallet Compound for Central Railroad of Brazil.

Weight on drivers* / Total heating surface	[illegible]
Volume of 2 h.p. cylinders, cu. ft.	7.21
Total heating surface / Volume 2 h.p. cylinders	[illegible]
Grate area / Volume 2 h.p. cylinders	[illegible]
Area l.p. cylinder / Area h.p. cylinder	[illegible]
Tube heating surface equated to firebox heating surface (Vaughan formula), sq. ft.	517.7
Total equated firebox heating surface, sq. ft.	659.23
Total actual heating surface / Equated firebox heating surface	3.62

*Per cent.

The Galesburg Timber Preserving Plant of the Burlington.

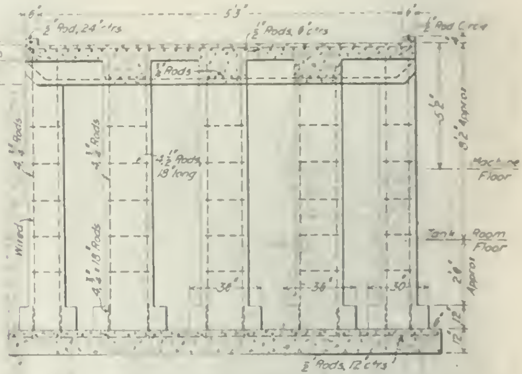
The Chicago, Burlington & Quincy built its first timber preserving plant in 1900. It was located at Edgemont, S. Dak., for treatment of Oregon fir and mountain pine cut in the vicinity. This plant, which was described in the *Railroad Gazette* of April 6, 1900, used the Burnettizing and Wellhouse processes. The following year it was moved to Sheridan, Wyo., to be nearer the sources of timber supply. There it has been in operation ever since. Its capacity is only 350,000 ties a year. The Burlington lately determined to build another and much larger plant embodying the most recent ideas in timber preservation. As the timber to be treated was the inferior oak, maple, gum, pine and other soft woods, coming principally from the southern states, the logical place for the location of the plant was some point in Illinois reached by the lines extending southward in that state. The plant was put at Galesburg where all of the lines in Illinois center.

A large new freight yard, described in the *Railroad Gazette* of Sept. 8, 1905, was built at Galesburg about a year ago. The timber preserving plant is located southwest of this yard on a cut-off built from its south end, which is adjacent to the Kansas City line, across to the Omaha line. The plant is about four miles from the city, on an 80-acre tract. There is storage space for 1,500,000 ties, which is the yearly capacity of the plant. There is also space for a considerable amount of piling and bridge timber. The tract is rectangular in shape and the storage yard is laid out with nine parallel sets of tracks, the three northerly of which will not be built at present. Four of the tracks are laid with three rails for narrow and standard gage cars.

The main building, which is 152 ft. x 115 ft. and has retort, engine, boiler and tank rooms, is built of reinforced concrete. The beams, roof and floor are crushed stone concrete of a 1:2:4 mixture, and the walls and foundations are gravel concrete of an equivalent 1:2:6 mixture. The side walls are 5 in. thick and reinforced with ½ in. corrugated steel bars, spaced 18 in. centers both ways. The floors, where reinforced, are in 15-ft. x 30-ft. panels with ½-in. corrugated bars spaced 3 in. by 8 in. on centers, every other bar being arched over the beam. The roof has ½ in. bars spaced 6 in. by 12 in. It was mopped with pitch and covered with a four-ply composition roofing. The retort room is ventilated with two monitors each 10 ft. wide and 30 ft. long made entirely of concrete. Their windows and all others in the building have steel sash and wire glass lights.

In excavating for the building water was encountered at a depth of 5 ft. This modified the method of erection somewhat. After putting in the foundation walls, the pilasters were built first and the intervening wall panels put in afterward suitably keyed to the pilasters. This was because of the possibility of unequal settlement between the loaded pilasters and the unloaded wall panels and was done to avoid cracking.

The retort room is 152 ft. long and 38 ft. wide. There are three retorts 132 ft. long and 6 ft. in diameter, made of ⅞-in. steel, with a capacity of 100 ties to the charge. The plant capacity per 24-hour day is 5,000 ties. The plant is equipped for either the Card, Rueping or Burnettizing process. The second and third of these have been fully described heretofore. The Card process is the zinc-creosote (Rutger) process adapted for use in this country at reasonable cost by an efficient and inexpensive method of agitating the mixture under pressure. Unless this is done, the use of a special imported oil is necessary to get a mixture that will not separate under pressure. In the Card process a centrifugal pump is used, with suction and discharge connected respectively to the top and bottom of the treating cylinder. The discharge pressure is distributed uniformly throughout the length of the cylinder by means of a perforated pipe. The pressures on the two sides of the pump are equalized, being the same as the cylinder pressure, and little power is needed to handle large quantities of the mixture. Thorough agitation is obtained and enables the use of any good grade of oil with the zinc chloride regardless of their respective specific gravities. Impregnation is effected at a pressure of 180 lbs.



Reinforced Concrete Foundation for Tank.

The boiler room, which is 46 ft. square, has three 150-h.p. boilers, one of which is extra for emergency use. The boilers are equipped with an induced draft system. The engine room, 30 ft. x 115 ft., contains an air compressor, fire pump, electric generator, three pressure pumps and an oil pump, with ample room for additional machinery. The valves for controlling the fluid in the headers in the basement also are worked from this room and all gages are under the eye of the engineer.

In the tank room, 39 ft. x 56 ft., is a 50,000-gal. steel working

New Timber Preserving Plant at Galesburg, Ill.; Chicago, Burlington & Quincy.

tank and a 100,000-gal. steel storage tank for creosote. This room was specially designed for these tanks, arched ceiling beams being used to permit the convex tank roofs to come close to the ceiling and thus avoid waste of space. Outside, close to the building, are the storage and measuring tanks. There is one 500,000-gal. steel tank for creosote storage and two 5,000-gal. steel creosote measuring

Reinforced Concrete Foundation for Tank; Galesburg Timber Preserving Plant.
Table for second foundation in form in foreground.

tanks; also two 50,000-gal. wooden tank for zinc chloride. The outside creosote tanks have steam heating coils.

All tanks are set on reinforced concrete foundations. These are of two types, one of which is shown herewith by a photograph and the other by a drawing. The foundation shown in the photograph is for one of the 50,000-gal. zinc chloride tanks. The concrete columns, which are 22 in. in diameter, rest on piers and are joined at the top by 12-in. x 16-in. beams. Columns and beams are reinforced and tied together by four ¾-in. corrugated bars near the bottom of the beams. The two inner bars are made continuous through all the beams, while the two outside bars in each beam are bent downward and run to the foot of the column. The table is 6 in. thick and is reinforced with ½-in. bars spaced 6 in. on centers. At first it was intended to make the tank foundations of plain concrete. But there is considerable vibration of the tank when the liquid is being forced in it: in fact, if care is not used when first opening the valves the sudden rush of the liquid will cause heavy shocks within and to the tank. For this reason reinforcing was put in the foundations.

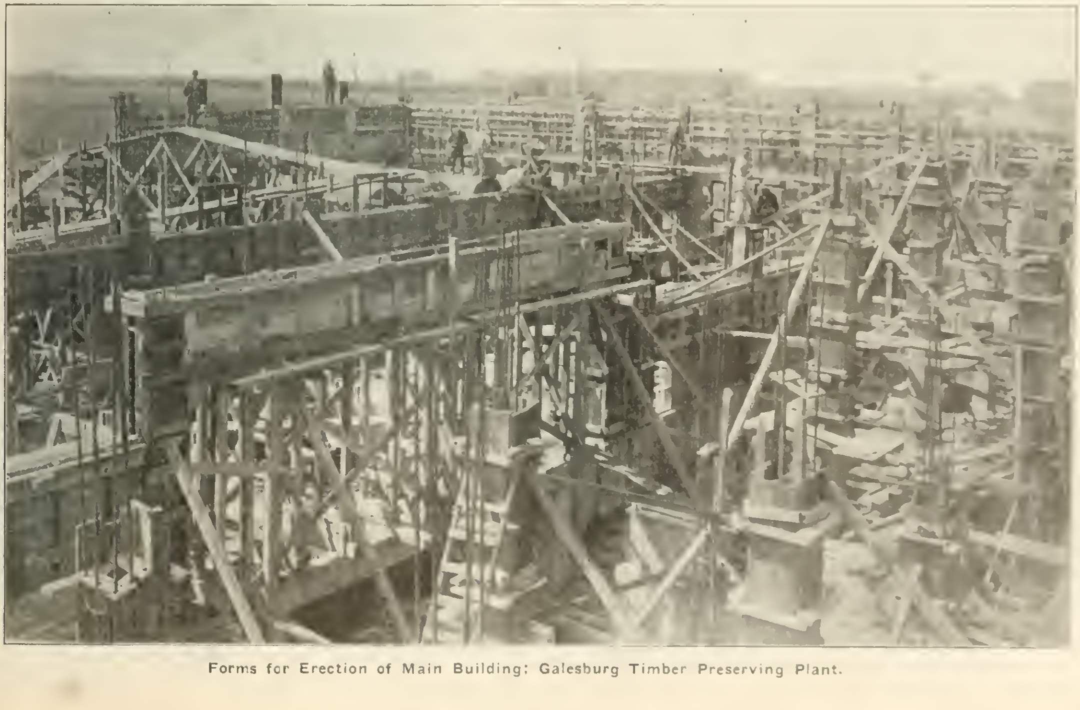
The drawing shows the foundation for the 15-ft. steel tank in the tank room. The columns are rectangular in section, those at the periphery being 18 in. x 24 in. and the others 21 in. square. All details are shown by the drawing.

There is a concrete loading platform 480 ft. long and 25 ft. wide in the yard. Narrow-gage tracks from the retort room run on top of it and there is a standard-gage track each side. The yard is piped for fire protection, with hydrants well distributed. The water for this and for the boilers is obtained from a well 1,200 ft. deep, yielding 6,000 gals. an hour. There is a steel storage tank of 100,000 gals. capacity.

Besides the four large rooms in the main building already mentioned, there is an experiment room, 16 ft. x 39 ft., fitted with a miniature tie treating plant, whose retort will hold two ties.

The preparation of the plans of the plant and its construction were in charge of W. J. Frein, Architect of the Burlington, under the supervision of T. E. Calvert, Chief Engineer. The buildings were erected by the Knickerbocker Roofing & Paving Co., Chicago. F. J. Angier, superintendent of the plant at Sheridan, has been put in charge of the new plant. The Sheridan plant is being renewed and modified to administer the Rueping process in addition to those previously used.

The English have built a railroad 36 miles long on the Island of Cyprus, which is large enough, populous enough and fertile enough to support much more than this; but this it supports ill. In the first eight months of its last fiscal year its gross earnings were $12,186 and its working expenses $31,179.



Forms for Erection of Main Building; Galesburg Timber Preserving Plant.

Interstate Commerce Report.

The following extracts are taken from the twenty-first annual report of the Interstate Commerce Commission, issued Jan. 6, which is of special interest because it covers the first year's work under the 1906 Rate Law.

Little more is attempted in this report than a general statement of the work performed by the Commission during the last year in the discharge of its official duties. A considerable part of the time has been occupied in giving administrative construction to various provisions of the law for the guidance of both shippers and carriers. To secure the best results of legislation with the least possible delay there was obvious need of a correct and uniform interpretation of the statute. Therefore, without reference to questions arising in particular cases, and to avoid unnecessary controversy, it has seemed our duty to construe the law in advance wherever it appeared obscure or ambiguous, so that the obligations of the railroads and the rights of the public might be promptly understood. This has resulted in numerous rulings explaining our view of the meaning and application of various provisions of the statute. These rulings have in practically every instance been accepted by the carriers, even in cases where their legal advisers were not entirely in accord with the opinion of the Commission.

The benefits of this course are beyond question. The Commission has endeavored to adopt a workable construction of the law in all cases, and has as a rule announced its conclusions in matters of importance only after conference and discussion with representative shippers and traffic officials. This is especially true with reference to tariff regulations. This matter is fundamental in any scheme of public regulation. There is scarcely a complaint or controversy which is not based upon the schedules of rates and charges established by the carriers. If those schedules are clear and definite in their statements, there is no excuse for disregarding them. If the rates and regulations are reasonable and plainly announced, the shipper knows his rights and the railroad official knows the obligations of his company. If the charges are claimed to be excessive or discriminatory, the question can be intelligently determined after the full hearing which the statute provides. It is believed that the efforts of the Commission in this direction have already been fruitful of good results and that they will prove of increasing value in the future.

The amended law has now been in force for upwards of 15 months, and some opinion may be expressed as to its operation and effects. The substantive provisions of the original act, forbidding the exaction of unreasonable charges and prohibiting discriminations between persons and places, were unchanged by the legislation of 1906. The main purpose of that legislation was to provide more adequate means for the enforcement of rights and duties already declared to exist. The vital principle of a right is found in the obligation to respect it. Without remedial procedure the declaratory portion of any law is little more than the statutory expression of a sentiment, but when efficient machinery for securing observance is provided the performance of definite duties and the recognition of definite rights may be expected to follow in ordinary conduct without resort to litigation. That this is true in regard to the amended act, and to an extent not generally appreciated, is confidently asserted. Just as the value of criminal laws is measured by the peace and security of society rather than the occasional conviction of offenders, so the salutary effects of the present statute are shown in the more general enjoyment of previously existing rights rather than by the number of cases in which the authority of the Commission has been invoked or the list of decisions and prosecutions which makes up the record of administration.

It is likewise true that the substantial and permanent benefits of this law are indirect and frequently unperceived, even by those who in fact profit by its observance. It means much for the present and more for the future than the principles of this law have gained greatly in general understanding and acceptance. The injustice of many practices which were once almost characteristic of railroad operations is now clearly apprehended, and an insistent public sentiment supports every effort for their suppression. By railroad managers almost without exception the amended law has been accepted in good faith, and they exhibit for the most part a sincere and earnest disposition to conform their methods to its requirements. It was not to be expected that needed reforms could be brought about with more or less difficulty and delay, but it is unquestionably the fact that great progress has been made and that further improvement is clearly assured. To a gratifying extent there has been readjustment of rates and correction of abuses by the carriers themselves. Methods and usages of one sort and another which operated to individual advantage have been voluntarily changed, and it is not too much to say that there is now a freedom from forbidden discriminations which is actual and general to a degree never before approached. As this process goes on, as special privileges disappear and favoritism ceases to be even suspected the indirect but not less certain benefits of the law will become more and more apparent.

An incidental respect in which equality of treatment has been greatly promoted is in such matters as switching, terminal, demurrage, reconsignment, elevation and other charges making up the aggregate cost of transportation. In the past it was often within the power of a carrier to waive charges of this nature in favor of particular shippers while collecting them from business rivals. Now the law and the rules of the Commission require all charges of this description to be plainly stated in the tariffs and to be applied with the same exactness and uniformity as the transportation rate itself. This is only one of the ways in which distinct advance has been made toward placing competing shippers in each locality upon a basis of equality in the enjoyment of a public service.

It is this general and marked improvement in transportation conditions that the Commission observes with special gratification. The amended law, with its enforceable remedies, the wider recognition of its fundamental justice, the quickened sense of public obligation on the part of railroad managers, the clearer perception by shippers of all classes that any individual advantage is morally as well as legally indefensible, and the augmented influence of the Commission resulting from its increased authority have all combined materially to diminish offensive practices of every sort and to signally promote the purposes for which the law was enacted.

Under the operation of the interstate commerce act the right to initiate interstate rates rests entirely with the railroad, which may, by giving 30 days' notice, put into effect any rate or any regulation or practice affecting a rate which it sees fit. The Commission is not required to approve these rates and has no authority whatever to condemn them. It can only act upon a rate so established by the railroad in case a formal complaint is filed attacking that rate and after a full hearing. This is the express provision of the statute.

In the majority of instances, perhaps, advances may properly be made before the reasonableness of the advanced rate has been finally passed upon by this Commission; but there are also many instances where great injustice must result unless matters can be kept in statu quo while proceedings are pending to test the reasonableness of the advance. Where a rate has been maintained for a considerable time and where business interests will be seriously affected by its change it is no undue hardship to require the carrier to continue that rate in effect until the propriety of the advance can be passed upon, and to finally make the advance itself at such time as will work no unnecessary injury. Certainly there ought to be some tribunal to which shippers can appeal, with authority, if such a course seems just, to prohibit the advance or the change until the general question can be considered.

At the present time it is not very clear whether such authority anywhere exists. Certainly the Commission does not possess it. It cannot itself by any order restrain the advance, nor can it, apparently, apply to the courts for such a restraining order unless the advance works such a discrimination as is forbidden by the so-called Elkins bill, and this is not usually true of a mere increase in the rate. In several instances courts of equity have interfered to prohibit advances pending proceedings before the Commission. In these cases an injunction has been issued in favor of the complainants alone, so that at the present time the general public is paying the advanced rate, while the complainants are being charged the old rate. These injunctions were granted upon the filing of a bond—$10,000 in one case and $250,000 in the other. It is evident that the application of any such practice must result in discrimination and hardship to the general public.

We suggest that when an advance in rates or a change in any regulation or practice is attacked by complaint to this Commission, the Commission shall have the power, in its discretion, after notice to and hearing of the parties, to prohibit the taking effect of the advance or change until the matter has been finally heard and determined.

At all events Congress should definitely understand that we, under the present law, are powerless to act in reference to these advances except upon the filing of a formal complaint and after a full hearing of the case.

RAILROAD INVESTMENTS.

The joint control of the Alton Railway by the Union Pacific and the Chicago, Rock Island & Pacific Railway Company has undoubtedly eliminated competition between the Alton and the Rock Island between Chicago, St. Louis and Kansas City.

These are conspicuous illustrations of the development of the theory of "community of interest" and "harmony of management" which Mr. Harriman suggested when he demanded representation upon the Santa Fe board.

If the policy of purchasing and controlling stocks in competing lines is permitted to continue, it must mean suppression of competition.

The function of a railroad corporation should be confined to the furnishing of transportation. Railroads should not be permitted to invest generally in the stocks, bonds and securities of other railroad and steamship companies, except connecting lines, for the purpose of forming through routes of transportation, including branches and feeders. It is in the interest of the public to facilitate the consolidation of connecting lines. The credit of a railroad company is founded upon the resources and prosperity of the country through which it runs. Its surplus funds and credit should be used for the betterment of its lines and in extensions and branches to develop the country contiguous to it. The testimony taken upon this hearing shows that about 50,000 square miles of territory in the state of Oregon surrounded by the lines of the Oregon Short Line Railroad Company, the Oregon Railroad & Navigation Company and the Southern Pacific Company are not developed, while the funds of those companies which could be used for that purpose are being invested in stocks like the New York Central and other lines having only a remote relation to the territory in which the Union Pacific system is located.

Railroad securities should be safe and conservative investments for the people. To this end the risks of the railroad should be reduced to a minimum. Every one knows that railroad securities fluctuate more or less, according to the prosperity of the times, and also by reason of the wide speculation in such securities. It therefore adds an element of hazard to a railroad's capital and credit to have its funds invested in the stocks or other companies, thereby endangering its solvency and its ability to pay reasonable dividends upon its own capital stock. It is a serious menace to the financial condition of the country to have large railroad systems fail to meet their obligations or go into the hands of receivers, and the object of legislation and administration should be to lessen the risks of railroad investments.

It is contrary to public policy as well as unlawful for railroads to acquire control of parallel and competing lines. This policy is expressed in the federal laws and in the constitutions and laws of nearly every state in the Union. We have examined the constitutions and laws of all the states, and find in about 40 of them prohibitions against consolidations of capital stock or franchises of competing railroads, or the purchase and acquisition by a railroad of competing lines. Competition between railroads as well as between other industries is the established policy of the nation. And while the acquisition of a small minority of the stock of a competing line might not decrease the competition, yet the acquisition of any considerable amount of stock, with representation on the board of directors of such railroad, unquestionably has the effect of diminishing competition and lessening to that extent its effectiveness. So long as it is the policy of the general government and of the states to maintain competition between naturally competing lines, the ownership of any stock by one railroad in a competing railroad should not be permitted, and such lines of railroad should be prohibited from having any common directors or officers.

The time has come when some reasonable regulation should be imposed upon the issuance of securities by railroads engaged in interstate commerce. We are aware that in the construction of new lines of railroad, developing new territory, it has been necessary in many instances to sell railroad securities at large discount, and to sell bonds with stock bonuses, and even in such cases it has many times been difficult to raise the necessary capital. Men will not invest their money and take the risk for small rates of interest.

But this principle does not apply to old fashioned railroad systems having good credit. Such railroads should be prevented from inflating their securities for merely speculative purposes. Railroads should be encouraged to extend their systems and develop the country. It is of the utmost importance, also, that railroad securities should be safe and conservative investments for the public and should yield good and ample return for the money invested. Reasonable regulation will tend to make them safer and more secure investments, and thereby benefit not only the railroad companies but the public.

VALUATION OF RAILROAD PROPERTY.

Reference has been made in previous reports to the importance of a physical valuation of railroad properties. The considerations submitted in favor of such a valuation need not be repeated at this time. It may, however, be proper to call attention to the fact that the introduction into operating expenses of a set of depreciation accounts brings prominently into view an added necessity for an inventory of railroad property. The chief purpose of the depreciation accounts is to protect the investor against the depletion of his property by an understatement of the cost of maintenance, and to protect the public against the maintenance of unduly high rates by charging improvements to cost of transportation. These accounts, which serve so important a purpose, require for their proper and safe administration complete and accurate information relative to the value of the property to which they apply, and this information can only be secured by a formal appraisal embracing all classes of railroad property.

Yet another reason may be submitted. Before the close of the present fiscal year the Commission will be in a position to prescribe a standard form of balance sheet. The purpose of a balance sheet is to disclose the financial standing of a corporation, and this it does by placing in parallel columns a statement of assets and of liabilities. But in the case of railroad companies the Commission is unable to test the accuracy of the assets reported, and there is no feasible means of providing such a test other than by a detailed inventory of the property which the assets represent. If Congress designed, by the provision which it made for a prescribed system of accounts, that the Commission should do what lies in its power to guarantee the sound financing of railroads, the necessity for making an inventory appraisal of railroad property cannot longer be delayed.

From whatever point of view this question of valuation be regarded, whether of reasonable capitalization, of a reasonable schedule of rates, of effective administration of the depreciation accounts or of the correct interpretation of the balance sheet, one is forced to conclude that an authoritative valuation of railroad property is the next important step in the development of governmental supervision over railroad administration.

The Commission cannot emphasize too strongly the significance of the supervisory work which, upon the authority conferred by the twelfth section of the act to regulate commerce as amended, has assumed such large proportions; and believing as it does that a comprehensive, systematic and authoritative valuation of railroad property is essential for the successful development of this work, as well as for other purposes named, it does not hesitate to submit to Congress a formal recommendation for the enactment of a law under which such a valuation can be made.

HOLDING COMPANIES.

The compilation of reports has been greatly embarrassed by the fact that certain "holding companies" have questioned the authority of the Commission to require the information sought.

Two illustrations, showing the character and effect of holding companies, may be noted.

The Rock Island Company was organized apparently for the purpose of securing a centralized control over operating properties. Its interest is confined to the Rock Island system of railroads. It has, so far as its reports to stockholders reveal the facts, no equities in any other industries nor in any other railroad systems than those generally regarded as a part of the Rock Island railroad system.

The Rock Island Company was chartered in New Jersey in 1902 as a holding company. It had outstanding, outside of the treasury, on June 30, 1907, \$49,047,390 of preferred stock and \$89,602,402 of common stock, a total of \$138,649,792. It has no debt.

The Chicago, Rock Island & Pacific Railroad Company, chartered in Iowa in 1902, is in fact a holding company intermediary between the operating companies and the Rock Island Company. Its entire outstanding stock, amounting to \$115,000,000, is owned by the Rock Island Company, which the latter corporation secured in exchange for its own stock. The Chicago, Rock Island & Pacific Railroad Company, using this Rock Island Company stock in combination with two issues of collateral trust bonds, has purchased more than 93 per cent. of the stock of the Chicago, Rock Island & Pacific Railway Company, and nearly 60 per cent. (practically the entire common stock issue) of the St. Louis & San Francisco Railroad Company stock, the stocks of these two latter corporations being deposited as security for the collateral trust bonds.

It should be noted further that the Chicago, Rock Island & Pacific Railway Company owned on June 30, 1907, 48 per cent. of the stock of the Chicago & Alton Railway, which amounts to virtual control; that the St. Louis & San Francisco Railroad Company owned 82½ per cent. of the stock (excluding treasury holdings) of the Chicago & Eastern Illinois Railroad Company, and that this latter corporation owns 60 per cent. of the stock of the Evansville & Terre Haute Railroad Company.

The voting right of securities is also pertinent. Holders of the preferred stock of the Rock Island Company have the right, to the exclusion of holders of the common stock, to choose the directors of the first class, such right to be surrendered only with the consent of two-thirds of the preferred stockholders. Furthermore, the amount of preferred stock cannot be increased, except upon affirmative vote of the holders of two-thirds of the entire preferred and two-thirds of the entire common stock. It therefore appears that a majority of the preferred stock of the Rock Island Company, or say, \$25,000,000 out of a total of \$49,000,000 of preferred stock of that corporation, dominates the situation and controls the vast network of railroad lines comprised in the Rock Island system.

Another striking instance of consolidated control through the medium of a holding company is that of the Atlantic Coast Line Company, of Connecticut, organized in 1889 for the purpose of consolidating under one ownership a series of Southern roads along the Atlantic coast. This corporation, with a capitalization on June 30, 1906, of only \$10,500,000 of stock and \$13,000,000 of certificates of indebtedness, owned more than 53 per cent. of the stock of the Atlantic Coast Line Railroad Company. The significance of this holding becomes clearer when it is observed that on June 30, 1907, the Atlantic Coast Line Railroad Company owned $39,600,000 out of $60,000,000, or 51 per cent., of the stock of the Louisville & Nashville Railroad Company, and that the latter corporation, jointly with the Southern Railway Company, owned 88 per cent. of the stock of the Chicago, Indianapolis & Louisville Railroad Company, and leased jointly with the Atlantic Coast Line Railroad Company the railroad properties of the Georgia Railroad and Banking Company. This holding company, with a comparatively small capitalization, which represents still less of actual investment, probably not more than $5,000,000, is in control of a railroad system more than 5,000 miles long, and with capital stock aggregating considerably more than $100,000,000.

It is not intended to discuss the economic justification of such holding companies, if, indeed, they can be justified from that point of view. The significant fact for the consideration of Congress is that companies of this class deny the jurisdiction of Federal supervision under the law, a contention which, if admitted and carried to its logical result, would exclude many important financial questions which affect public interests from the supervisory control of the Commission. It is the purpose of the Commission to bring this question to judicial determination, but in order to arrive speedily at some practical conclusion, to the end that the work undertaken be not further embarrassed, it is respectfully submitted that the act to regulate commerce be amended so as to make clear the responsibilities and the rights of the Commission as regards holding companies.

Massachusetts Railroad Commissioners' Report.

The state railroad commissioners of Massachusetts, W. P. Hall, G. W. Bishop and Clinton White, have issued the thirty-ninth annual report of the Board. The first part of the report is taken up with the usual statistics and with the report of the Bridge Engineer. Acting under the law passed in 1906 dividing railroads into three classes; "railroad corporations," "street railway companies" and "electric railroads," the board has issued one certificate of public convenience and necessity to an electric (interurban) railroad, has rejected two and has two others under consideration. The board has again investigated the locomotive smoke nuisance but finds nothing new to say. The principal difficulty is in unskilful firing. The board believes that before long electric motive power will have to be used in order properly to abate the smoke nuisance, and recommends that the whole question of electric propulsion be studied.

Eleven grade crossings have been done away with during the past year. Since 1890, when the state began to aid the towns in this work, over $29,000,000 has been expended; nearly 18 millions by the railroads, nearly eight millions by the state and the rest by the cities and towns.

Two years ago the board recommended a law providing for compulsory block signaling and the report gives a brief statement of the number of miles of track on each road now worked under the block system, but it does not appear that any mandatory orders have been issued. The board has formally approved the use of automatic block signals of different types now in operation on the three principal roads of the state, but does not appear to have approved manual signals anywhere except on the New York, New Haven & Hartford. The Boston & Maine intends to expend $370,000 on automatic signals in 1908 finishing the equipment of all its double-track lines in Massachusetts. The Boston & Albany proposes to equip 23 miles of track this year. The New York, New Haven & Hartford has no new work laid out for this year on its lines in Massachusetts. Speaking of block signaling generally, the board expresses satisfaction with the progress of the work and with the attitude of the officers of the railroads.

Over 25 pages of the report are devoted to the Boston & Albany, the legislature having directed the board to make a special investigation of that road on account of the poor service afforded. The improvements made during the past year are set forth in considerable detail and the commissioners seem to think that the managing officers are now doing their best to put the road in condition to give good service.

Concerning the ventilation of street cars, which was discussed in the last preceding report, the commission says:

The Board has recently changed its requirement with reference to the point of outside temperature at and below which companies are called upon to heat street cars, making that point 40 instead of 50 degrees above zero, the temperature to be then maintained to have a range that shall not be lower than 40 nor higher than 60 degrees. In making this radical change and certain other changes, the Board has had in view a rule that companies will find it possible to obey, and that the district police can enforce under the statute which makes them responsible for its enforcement.

It is a common thing that opinions differ as to what the temperature of a room in a private house ought to be, and that the same person entertains different opinions at different times according to condition of health or circulation of blood. Obviously, then, an attempt to always satisfy every occupant of a street car with the atmospheric conditions must be futile. Even if passengers were of the same mind, it is impracticable to constantly maintain air of a given quality and the temperature at a specific point in a car that is one moment really empty and the next crowded to the limit, now stationary, then in motion, with doors continually opening and shutting, and with an outside temperature varying between zero and 40 degrees above.

Companies are not, however, relieved from the obligation to keep the air in such reasonably warm and pure condition on account of the difficulties in the way of doing this to the satisfaction of every traveler. In fulfilling their obligations both management and employees must expect to deal with the old and young, with the robust and feeble, with those who thrive on draughts of cold air and with those to whom such draughts are fatal, with those who are dyspeptic and nervous, unsound as well as with the sane and cheerful.

The days of horse cars, with straw on the floor to keep the feet warm, and with no ventilation except that afforded through the doors, are within easy recollection. While to-day the electric heater exemplifies radical progress in heating, the ventilator commonly in use is about as crude as any device could be. Present discomfort is due fully as much to the failure to properly use means at hand for keeping the air pure and warm as to imperfection in apparatus. There is no reason why, for example, a movable ventilating window should be kept entirely open or entirely shut, or in any one position throughout a long journey in total disregard of the temperature outside and of the changing conditions inside the car.

It should be a part of the regular duty of those in charge of cars to regulate both heating and ventilating apparatus from time to time to meet varying needs. Admirable work of this kind is now done by individual conductors and there is no reason why their success in caring for the public should not become a general feature of the service. Co-operation, too, between passengers and employees is of great benefit to both, and the privilege of making suggestions ought not to be monopolized by the chronic complainant.

The Board must ask that companies adopt prompt measures for a larger experimental use of the more improved methods of ventilation and meanwhile enforce rules for adjusting all devices in use to existing conditions.

Possible Peace in Passenger Fares.

In South Carolina, which state has not followed its neighbors in taking radical action concerning railroad rates, the Southern Railway has announced a voluntary reduction in passenger fares. President W. W. Finley, in announcing the new rates, proposes that they shall be kept in effect for one year so as to give the scheme a fair trial. In detail the proposition, as sent by Mr. Finley to the Governor of the state, is as follows:

First—A flat rate of $2\frac{1}{2}$ cents a mile for interstate passenger travel, with an extra charge of 15 cents against persons boarding a train without a ticket except at stations where there are no agents, provided that no charge shall be less than 10 cents, and in the event that a charge at the said rate of $2\frac{1}{2}$ cents a mile shall aggregate a sum between two multiples of five, such charge may be made that multiple of five to which it is nearest.

Second—Two thousand mile books, intrastate, interchangeable with such of the solvent roads of the state as will consent, at 2 cents a mile, good for heads of firms and employees not exceeding a total number of five, the names to be furnished at the time of the purchase of mileage book and entered thereon.

Third—One thousand mile books, intrastate and interchangeable with such of the solvent roads of the state as will consent, limited to one individual at 2 cents a mile and good only in the hands of the purchaser, the name of the purchaser to be furnished at the time of the sale of the book and entered thereon.

Fourth—Five hundred mile books at $2\frac{1}{4}$ cents a mile, good for heads of families and dependent members thereof, intrastate and non-interchangeable, the names of the families to be furnished at the time of purchase and entered thereon.

All of such mileage books to be limited to one year from date of purchase and redeemable, charging for the part used at $2\frac{1}{2}$ cents a mile.

It is reported in Atlanta that the State Railroad Commission of Georgia, acting in line with the recent propositions made by the Southern Railway, will soon order the establishment of a uniform rate of $2\frac{1}{2}$ cents a mile for passenger fares throughout the state of Georgia, the change to go into effect April 1. If this should be done there are a few lines on which the present rates would be increased. On the Atlanta & West Point and the Western & Atlantic the present rate is 2 cents.

It is reported that the Virginia Commission also will issue an order in consonance with President Finley's offer.

Opening of New York Subways.

The subway under the East river from the Battery, in Manhattan, New York City, to the Borough Hall, in Brooklyn, was put in use for regular traffic on Thursday morning, January 9. This subway is operated by the Interborough Rapid Transit Company, the same as the Manhattan subways, and trains are run through from the northern termini in the borough of the Bronx to the Brooklyn Borough Hall.

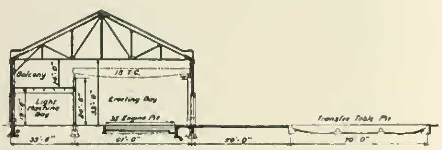
The tunnel of the Hudson & Manhattan Railroad, beneath the Hudson river, from Hoboken, N. J., to Christopher street, New York City, which will be open for business within a few weeks, has been so far completed that a special train, carrying officers and guests, was run through on January 4. The trip was made in about seven minutes.

Arrangement of Railroad Shops.*

Railroad repair shops cost money, both to build and to operate. Just at this time it may be of interest to approach the subject of their design, arrangement and equipment from a financial standpoint. There is hardly a better field for demonstrating that "engineering is the science of making a dollar go the farthest" than the art of designing and building railroad repair shops, and, as nearly all work of this character must start with an "authority for expenditure," or perhaps an "appropriation," it will be instructive to inquire just how great an investment in repair shops will ordinarily be justified.

The original cost of an average modern locomotive may vary from $14,000 to $17,000. The actual expense for labor and material to maintain this locomotive in first class condition will range from $1,500 to $3,000 per year, each road, of course, having its own individual conditions that influence this cost, and which make it impossible to establish an absolutely definite figure. For our present purposes, however, it may be said that a locomotive costing $15,000 will involve a maintenance cost of about $2,250 per annum, and this expenditure should go far toward overcoming the natural depreciation of and wear on the equipment, and thus keep the locomotive in first class running order.

The original investment in a complete new locomotive repair shop, fully equipped to efficiently make these repairs, will depend on the location, the size, the design, the selection of the equipment and the cost of labor and material entering into the buildings. These factors are so variable that it is impossible to determine an average that can be regarded as an exact standard. Even an approximate estimate for any given case can only be obtained after a detailed study has been made of the conditions surrounding the particular problem in hand. The following figures must, therefore, be used with judgment, or they may be misleading. These figures have been taken from the records of the actual cost of a number of repair shops with the design and construction of which the writer has been connected. The fact that there is such a wide variation emphasizes the danger of deriving a general law from any particular experience, or even of drawing a conclusion for a particular case from a general experience.



Cross Section of Oelwein Main Shop—Chicago Great Western.

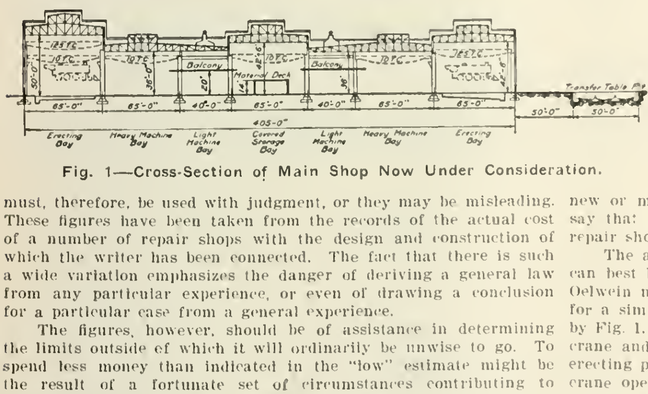


Fig. 1—Cross-Section of Main Shop Now Under Consideration.

The figures, however, should be of assistance in determining the limits outside of which it will ordinarily be unwise to go. To spend less money than indicated in the "low" estimate might be the result of a fortunate set of circumstances contributing to economy, but every precaution should be taken to insure that the saving accomplished is not at the expense of a false economy. To spend more money than indicated by the "high" estimate may be desirable, or even necessary in certain cases, but ordinarily the higher figures are sufficient to cover all repair shop needs, unless it is the intention of those in charge of the work to erect a monument.

The writer has purposely approached this subject of cost with considerable caution, and it is only because the literature of shop building is so meagre of actual cost data that the risk has been taken of having the figures misunderstood, and therefore the information misapplied.

Our records show that locomotive repair shops which are laid out on a basis of the number of pits required equal to 6 per cent. of the number of locomotives served can be built and equipped complete for an expenditure ranging between $50,000 and $65,000 per pit. If one pit will serve $16\frac{2}{3}$ engines per year, the cost of repair facilities will fall some place between the limits of from $3,000 to $4,000 per locomotive. An investment amounting to the lower limit is absolutely necessary if the engines are to be kept on the road. Just how much more than the lower limit should be spent in order to secure the minimum cost of locomotive maintenance, including all the items of not only actual repair expenses, labor and material, but also interest, depreciation, insurance and taxes upon the plant provided, is a question that should have the most careful consideration.

The following analysis of the total cost will serve to indicate the relative importance of the decisions that must be reached in order to give each dollar expended a maximum earning capacity. The sum total of the "low" and of the "high" figures shown will result in grand totals which will show a wider range than the $33\frac{1}{3}$ per cent. variation indicated by the unit figures of $3,000 to $4,000 per locomotive but as it is improbable that any shop would be built using either the lowest or the highest estimate for every one of its parts it will be found that only in exceptional cases will the actual total cost fall outside of the limits first given.

Table of Cost Limits for Locomotive Repair Shops.
On the Basis of 25 Erecting Pits.

Divisions. Shop Yards.	Limits of cost per pit — Low.	Limits of cost per pit — High.	Approx Proportion of total cost per cent
Tracks, crane runways, transfer or turntables	$1,400	$3,000	4
Water and sewer system	1,000	1,800	2
Piping and wiring tunnels and tunnel piping	500	1,000	1
Buildings.			
Machine and erecting shop	8,000	12,000	17
Boiler and tank shop	3,000	5,000	7
Forge shop	1,500	2,400	4
Storehouse and offices	1,000	2,500	3
Locomotive carpenter shop	500	1,000	1
Power house	1,200	2,100	3
Oil house and equipment	400	600	1
Misc. bldgs.: scrap bins, material sheds, &c.	500	1,000	1
General Equipment for all Departments.			
Power-house equipment	5,000	8,000	11
Traveling cranes	1,500	3,000	4
Tool equipment	10,000	15,000	22
Heating system	1,200	2,500	3
Power and lighting systems*	1,500	4,500	5
Plumbing and lockers	300	1,000	1
Air, water, steam and oil piping in buildings	600	1,200	2
Incidentals, organization and engineering	2,000	7,000	8
			100

*Including yard wiring and lighting

Note.—These figures do not include items for real estate and preparation of the shop site, which cost necessarily varies between wide limits. The foundry building and equipment are not included in these figures.

The history of "modern" locomotive repair shops may be considered as beginning with the use of what has been called "the electric drive." The use of the electric motor makes possible (a) the arrangement of departments independent of the line shaft requirements; (b) the use of electric cranes, and (c) the construction of all power producing equipment in one central power plant from which may be distributed heat, water, compressed air, light and power. One of the first shops to make use of the electric motor for both individual machines and groups of tools, as well as the electric crane and the central power plant, was the Oelwein, Iowa, shops of the Chicago Great Western, which were put in commission in 1900. Since that date there have been over 70 shops either built entirely new or modernized from previously existing plants. It is safe to say that more than $80,000,000 has been expended upon railroad repair shops and their equipment within the last 10 years.

The advance that has been made in the art during this period can best be illustrated by a comparison of the cross-section of the Oelwein machine and erecting shop and the cross-section of a shop for a similar purpose which is now under consideration, as shown by Fig. 1. The Oelwein erecting shop was equipped with one 80-ton crane and one 15-ton crane, both upon the same runway over the erecting pits. The second and more recent example has one 120-ton crane operating over the erecting pits on a runway above the two 10-ton messenger cranes, while the machine shop is supplied with two 10-ton cranes over the heavy tools, and an additional crane is provided over the covered yard.

It is needless to say that the more elaborate equipment of the latest development in repair shops cost more than the more modest shops which first adopted the electric system, but at the same time locomotive equipment has been gradually increasing in size and cost in such a way as to make these more extensive repair shop facilities an absolute necessity. Care must be exercised, however, to insure that the repair facilities provided are not greater than the needs of the equipment to be served, which brings us at once to the question of the size of the shops.

Some of the first shops designed to use a central electric power plant were handicapped by the use of the 220-volt direct current electric system, which made it desirable to limit the radius of distribution to about 1,000 ft. from the generating plant. The development of the induction motor and the alternating current system soon removed this limitation, but as it was still necessary to use the direct-current motor to obtain satisfactory electric speed control on many of the independently motor-driven tools, a mixed electric system was adopted by many shops. It is still the practice in a number of recent installations to provide both direct and alternating current throughout the shop—using direct current for the

*A paper presented at the January meeting of the Canadian Railway Club by Geo. A. Damon, Managing Engineer, The Arnold Co., Chicago.

cranes, variable speed motors and perhaps the mercury vapor lamps and alternating current for the constant speed motors, incandescent lights, and the yard lighting system. The recent improvements in mechanical speed-changing devices, the development of the alternating current crane, and the reduction in cost of the induction motor are creating a decided tendency toward the elimination of the direct current system. By these improvements it is possible to distribute power from a central plant over a larger area and also remove the old limitations of the amount of ground covered by the shop plant.

The size of a locomotive repair shop will depend primarily upon the number of locomotives to be repaired each year, and the number of days each locomotive under repair must occupy an erecting shop pit. To the pits required for "heavy" repairs must be added a number of pits for "light" repairs, for emergency work and for future growth. The ratio of the number of pits to the number of locomotives will vary with the assumptions as follows:

Pits Required in Erecting Shop.

Let A = number of locomotives served by shop.
B = Percentage of locomotives to undergo "heavy" repairs each year.
C = average number days each locomotive occupies an erecting shop pit.
D = Number of working days each year.
P′ = number of pits required for "heavy" repairs.
P″ = number of pits required for "light" repairs.
P‴ = Total number of pits required.

Then

$$P' = \frac{A \times B \times C}{D}, \text{ and}$$

$$P''' = P'' + P'$$

The effect of the different assumptions as to the percentage of the total number of locomotives to be repaired each year and the length of time on a pit are shown by the following table, which was prepared for a shop serving 400 locomotives at present, with a probable increase to 500 within the next five years.

No. of locos. A	Per cent. repaired. B	Days in shop. C	Working days in year. D	Pits: Heavy repairs. P′	Pits: Light repairs. P″	Pits: Total. P‴	Per cent. P″/P′	Per cent. P‴/A
500	80	20	288	28	7	35	25	7
500	70	17	288	21	9	30	43	6
500	60	11	288	15	10	25	66	5

From this table it will be seen that the number of pits may vary from 5 per cent. to 7 per cent. of the total number of locomotives, which variation corresponds with actual practice. Individual conditions will govern the assumptions for each road, and there are, fortunately, a number of other methods of checking these calculations.

The size of the machine shop space per pit depends largely upon the methods adopted for operating the shop. The work on the pit can be crowded, and the erecting output under normal conditions can be doubled during rush periods, but the output of the machine tools cannot be increased in the same ratio. The tendency at present is to favor the amount of floor space allowed for machine tools. On the other hand, the use of high-speed tools is rapidly increasing the output of each machine, and this development is contributing to the output efficiency of each foot of machine tool space. The space per pit for machine tools varies from 1,500 to 2,500 sq. ft. This result is often largely influenced by the demands made upon this space for manufacturing new work, or for supplying repair parts to other shops.

An average rule for the size of the boiler shop is to allow one-third as much space for this department as is allotted to the machine and erecting shop, but this rule is affected by the character of boiler repairs to be made. The kind of coal, the conditions of the water supply, and whether or not new boilers are to be constructed must be known before a final decision can be reached.

The blacksmith shop is ordinarily one-third the size of the machine and erecting shop, but local conditions must again be carefully considered before reaching conclusions. The safest way for all shops is to canvass the requirements for output and the capacity and floor space required of each machine, and then design the shop to fit the machines, rather than crowd or spread out the machines into a space the size of which has been too hurriedly determined.

The preliminary considerations which must have attention before the problems of relative arrangement of the buildings can be approached involve so much of the personal equation that only tendencies of recent practice can be noted, and no hard and fast rules can be established. It is not the province of this paper to discuss the advantages and disadvantages of the various points which must be thoroughly canvassed in order to reach consistent preliminary conclusions, as these subjects have been already covered by special books and technical papers which are available to those who are interested enough in these subjects to study them in detail. To indicate briefly the problems which must be considered and decided upon by the shop designer early in his work on any particular layout will, however, be of value.

For instance the question of "transverse shop versus longitudinal shop" for the erecting bay must be settled before much progress can be made. The tendency appears to be in favor of the transverse shop, but the writer must admit that his own personal equation enters into this conclusion.

Whether or not the boiler shop shall be under the same roof with the machine and erecting shop is a question that is usually settled by the experience and preferences of those who are to operate the shop.

The use of a transfer table or a turntable as a means of getting locomotives into the shop is a subject upon which volumes have been and can be written, but this question is usually decided in favor of the desires of the operating official who is to have charge of the shop after it is completed.

The use of yard cranes, telphers or locomotive cranes for handling materials outside of the buildings is being given more careful attention than formerly, with the result that these auxiliary transportation systems are having a marked influence upon the arrangement of shops. There is a tendency to cover a portion of the yard with a crane, and locate the lye vats and tire furnaces in this covered yard.

The location of the storehouse and the oil house will depend upon their individual use, whether it is the intention for them to serve the entire system or not.

Fireproof concrete construction is having an effect upon bringing the storehouse closer to the various departments to be supplied, the tendency apparently being to locate the storehouse contiguous to the machine and erecting shop, as was originally done at Oelwein.

Whether to locate the car repair department contiguous to the locomotive repair department is a question of policy for the management to decide, and the answer depends largely upon local conditions of operation and organization. The location of the car repair tracks, the desirability of having the common power house near the planing mill to burn refuse, and the location of the forge shop convenient to both departments has a marked influence on the general arrangement of the shops.

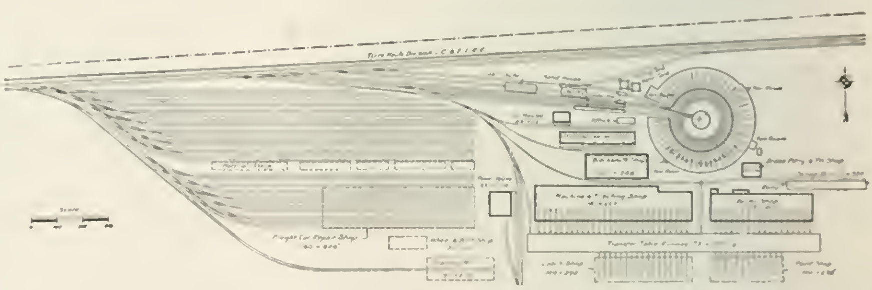


Fig. 2—Oaklawn, Ill., Shops, C. & E. I. Ry. Plan No. 2.

The location of the shop itself, as influenced by traffic conditions of the system, and the selection of the shop site after the general location has been decided, are questions in the solution of which serious mistakes have been made. Recent decisions seem to indicate a tendency to locate shops as near as possible to favorable labor markets, instead of in smaller towns, or at some inconvenient distance from the larger cities.

Certain fundamental principles should be recognized before attempting a railroad shop arrangement, and as far as possible the arrangement should be worked over until it satisfies these requirements, always recognizing exceptions due to individual conditions.

(1) Liberal space (say 100 per cent.) should be allowed for the extension of each department.

(2) The storehouse (with administrative offices in one of the upper floors) should be central, convenient to all departments and easy of access on two tracks from the main line service track.

(3) The forge shop should be convenient to both the locomotive and car repair departments.

(4) The power house should be central and near the planing mill and repair tracks in order to burn refuse.

(5) Yard cranes should be arranged to serve between the storehouse platforms and all departments.

(6) The roundhouse should be very near the shop, or located

far enough away to justify a separate machine shop for light repairs.

(7) Tracks, cranes, telphers and storage spaces should be arranged to insure the movement of materials with the greatest economy of time and labor.

(8) Some consideration should be given to the appearance of the shops and accessory storage facilities, lumber yards, etc., from the main line.

(9) The advantages of a short tunnel of ample cross-section for the use of the various steam, air and water piping systems should not be forgotten.

(10) The possibilities of the adoption of longer and heavier engines should be considered, and some provision made for present or future repair facilities for these larger engines.

(11) The cost of the shops should be consistent with not only the actual necessities, but in proportion to the refinements which the road can afford. All expenditures over and above those required for actual needs should be capitalized and made to show a satisfactory return on the investment.

Actual examples of shop arrangements can be studied to advantage; in fact, a designer of a new shop should make himself conversant with existing plants, and thus make every effort to improve present practice. Advances in any art are usually made step

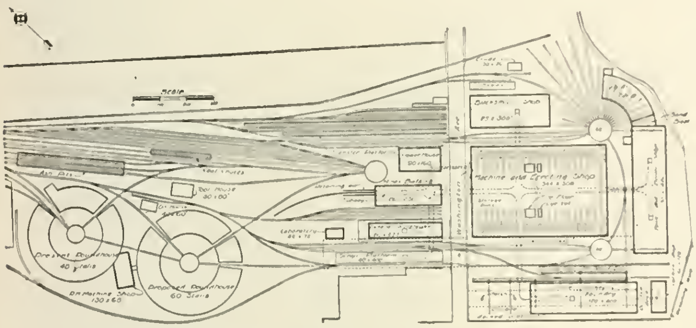


Fig. 3—Proposed Arrangement, Superseded by Layout in Fig. 4.

In this arrangement the boiler and tank shop are separated from the machine and erecting shop, and two turntables have been located to facilitate the transfer of boilers and other material from one department to another. The disadvantage of the open pits will be overcome by extending the decking of the turntable over the entire pit.

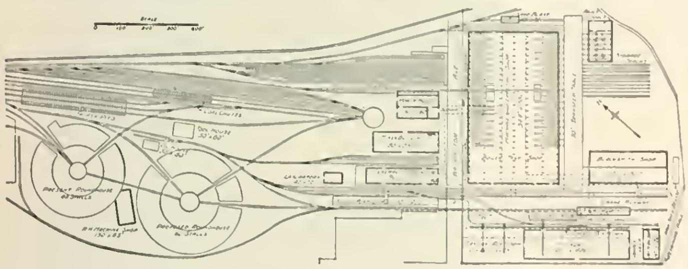


Fig. 4—General Arrangement of New Plant Now Under Construction.

In this arrangement the machine and erecting shop is served by means of a transfer table extending along one side of the shop. The boiler and tank shop is located in the extension of the main shop, it being the intention to maintain the same sections of the building throughout.

by step, and progress in the right direction can be made with much more certainty if there is a familiarity with the ground already covered by others.

The shop arrangements described in this paper are examples taken from recent practice. None of the plans are advanced as ideal, but each one is the result of at least 20 preliminary studies, and the reasons for their selection may be of interest. In two cases the shops are not yet built, and therefore, their location cannot be disclosed.

The Ivorydale Shops of the Cincinnati, Hamilton & Dayton (*Railroad Gazette*, Sept. 21, 1906).—These shops were designed to provide facilities for the storage and care of locomotives lying over at Cincinnati between trips, and also for the necessary light running repairs upon engines running in and out of this division point. This shop is, therefore, an example of a terminal locomotive repair plant to take care of light repairs only as an auxiliary to the main repairs shop where all heavy repairs are made. The unique feature of this arrangement is the longitudinal engine house, sometimes called a "square roundhouse." This engine house is served by the same transfer table that serves the erecting shop, the two buildings being directly opposite one another across the transfer table pit. The yard tracks form a "Y," thus obviating the necessity of a turntable. Incoming engines pass onto the transfer table over one of two ash pits. There is one outgoing track. Engines can take coal and water either on the way in or out. The engine house is built of reinforced concrete, and is designed for simply the care and storage of locomotives, no drop pit being provided on the engine house side of the transfer table. The machine and erecting shop has two drop pits in a separate section devoted to light repairs, while the erecting shop proper has a drop table to unwheel engines undergoing more extensive overhauling. One track without a pit is reserved for boiler repairs, which has sufficient space to work on two boilers at one time. This arrangement makes the most economical use of the space available. It would have been impossible to have introduced the usual turntable plan with a round engine house on the property.

The Oaklawn Shops of the Chicago & Eastern Illinois (*Fig. 2*).—The remarkable thing about this plan is that in 1901 the first machine and erecting shop was built with 11 pits, and the provision made for doubling the shop was considered to be ample for years to come. In 1907, however, the shop was doubled, a fact which emphasizes the necessity of allowing ample room for growth.

In this plant the locomotive department may be said to have been grouped around the engine house from which a shop track running between the machine shop and the boiler shop leads directly onto the transfer table, thus providing a convenient means of transportation to and from all departments. The coach shop and the paint shop have not yet been constructed, but eventually the transfer table will also serve these two buildings of the car department. The boiler shop is separate from the machine and erecting shop, and is served by the same transfer table. The blacksmith shop is convenient to the car repair tracks, as well as to the roundhouse and machine shop. The storehouse is central and handy to the main line. The power house is located between the two departments, and serves the locomotive shop through a pipe tunnel that connects all departments.

Too little space was originally allowed in the machine shop for machine tools, but this defect has been remedied to a certain extent in the recent additions. The general layout has proven so satisfactory in actual use that recently the management has had under consideration the reproduction of the entire plant at another point on the system.

In the main shop of this plant the larger individual motor-driven tools are located in the erecting bay, that is made extra wide for this purpose. The disadvantage of this arrangement is the necessity of increasing the span of the traveling cranes and thereby adding to their cost.

The Battle Creek Shops of the Grand Trunk.—The distinguishing feature of this arrangement is the efficient use of the yard crane idea, extending over the storehouse tracks and part of the storehouse platforms. This crane serves all of the ends of the bays of the machine and erecting shop; the foundry, forge shop and frog shop, and eventually can be extended over the car repair tracks. The "midway" space under the crane, which will be used partly for storage of materials, is provided with a system of industrial tracks which are a part of a network extending throughout the entire plant. The boiler and tank shop in this arrangement are located at one end of the machine and erecting shop, but these departments are at right-angles to one another, so as not to interfere with the entire plant being doubled at some future date. Ample openings are left in the wall between the boiler and the erecting shops, so that a boiler can be conveniently passed from one department to another.

The 100 per cent. extension to the main shop will be accomplished by practically duplicating the present shop, leaving a common machine shop twice the size of the existing one between two parallel erecting shops. This arrangement will eventually provide for 50 erecting pits, and all departments can be extended to meet this maximum requirement. For the present the locomotive shop will be served by two tracks, but when extensions are made two turntables can be installed.

The Beech Grove Shops of the Big Four (*Railroad Gazette*, Nov. 29, 1907).—In this layout even more extensive use has been made of the idea of a storage yard served by a high-speed overhead crane. The midway may be said to be the main avenue of travel between all departments, and the space between the buildings may be compared to side or cross streets. This crane serves practically every building except the tank shop, the wheel shop and the freight car repair shop, but all of these shops can be reached easily by industrial tracks.

The second feature of importance in this arrangement is the turntable serving the boiler shop, the tank shop and the main shop of the locomotive department. Tracks have been provided into each of these buildings independent of this turntable, but for intercommunication or the transfer of parts from one department to another this turntable will be in constant demand. This turntable arrangement was adopted after the most careful consideration of an alternative plan having a transfer table along each side of the main shop, with the boiler shop on the opposite side of one transfer table and the tank shop on the opposite side of the other table.

On one side of the yard crane nearly all the buildings extend away from the runway, thus allowing for future extension, while on the other side of the crane the buildings are arranged with their greater length parallel to the main line of travel. The freight car repair department is located along the main line tracks and convenient to the classification yards.

The Springfield (Mo.) Shops of the Frisco System.—In this arrangement the yard crane is a prominent feature, and the midway and cross street idea has been developed still further, as all buildings are at right angles to this main avenue of interdepartment travel.

The striking feature of the Frisco shop arrangement, however, is the use of the transfer table serving one side of the erecting shop only. The erecting bay next to the transfer table is single decked, i.e., the heavy crane used for unwheeling locomotives is not placed on an upper runway, so that it will be impossible to lift one locomotive over another in this shop, and reliance must be placed in the transfer table to put the locomotives on their pits. Eventually, however, when the shop is doubled, the future erecting bay on the other side of the shop will be double-decked, and the locomotives will be delivered to their respective pits on this side of the shop by an overhead 120-ton crane, instead of by a transfer table. When the shop is extended to its full capacity, no doubt the transfer table side of the shop will be devoted largely to light repairs and the double-decked crane-served side will take care of the heavier repairs.

The storehouse is at one end of the transfer table and near the center of the yard crane runway, so that material can be conveniently collected from or delivered to any building on the ground. The power house is located exactly in the center of the site. Every department can be increased at least 100 per cent. without unduly extending the lines of travel for men and material.

Shops Under Construction.—The arrangements indicated in Figs. 3 and 4 are good examples of shops located on a congested site, which makes it impossible to secure an efficient layout of buildings, or make any liberal allowances for future extension. The advantage of locating the shop plant near the center of the city, however, is thought to offset the disadvantage of having the shop site cut in two by a city street. Fortunately the ground is high, and the drainage is good, making possible a subway under the street, and connecting all departments. This feature adds much to the convenient handling of materials.

The yard crane is again the determining feature of the arrangement, serving nearly all departments, and arranged to take or deliver material from and to the subway and also the street, which fortunately is on a grade, so that it can be bridged.

The location of the foundry was determined by the fact that this department was the only one which could be placed along the retaining wall which in lower part of the site. The heavy cranes in the erecting shop and the steam hammers in the forge shop make it desirable to locate these latter departments on solid ground.

The transfer platform, one roundhouse and the accessory ash pits and coal chutes were in place at the time the new shop arrangement was taken up, but even with these handicaps a fairly satisfactory arrangement of buildings has been worked out.

Shops Under Consideration.—The layout of shops in Fig. 5 is now under consideration and provides for a complete locomotive repair shop combined with a proposed terminal car repair plant. The main car department is located elsewhere.

This plan shows a crane-served covered yard extending through the center of the main shop. This yard is not to be heated, and besides furnishing storage facilities for material, it will provide a convenient location for fan rooms, toilet rooms, locker and wash rooms, which often occupy valuable room inside the shop.

The outside storage yard is served by a locomotive crane instead of an overhead crane, and this same locomotive crane can be used at all other points in the yard where it can be worked to advantage.

The transfer table serves one side of the machine and erecting shop, as in several of the other plans, two cross tracks being provided to transfer engines into and out of the erecting bay on the further side.

As the main shop becomes crowded, it is possible to erect a separate boiler and tank shop along the transfer table as shown, but for the present all locomotive repair departments will be under one roof.

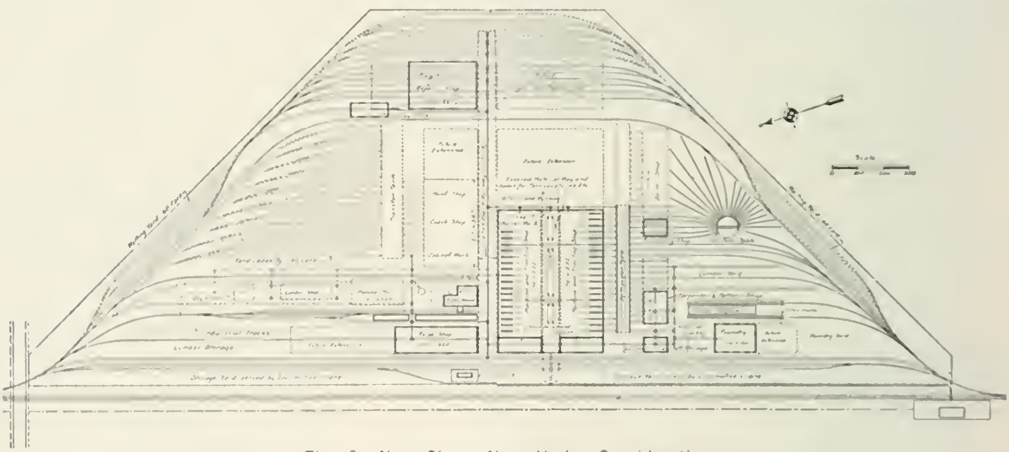


Fig. 5—New Shops Now Under Consideration.

The usual precautions have been taken to locate the blacksmith shop and the power house convenient to all departments.

The cross-section of the main shop (see Fig. 1) shows the covered yard between the two shops as well as the transfer table serving one side of the building.

Will the results to be expected with new shops justify the investment? This is a question very often asked, particularly in view of the fact that apparently some of the new shops are not showing any better economy as far as actual cost of locomotive maintenance is concerned than is obtained with comparatively older and poorly equipped shops. As a matter of fact, there is no reason why a new shop handicapped with an undeveloped organization and a lack of an efficient system, should do any better work, or even as good, as an old shop with a harmonious corps of workers equipped with a full complement of jigs, templets and methods of operation.

The logical developments in cutting down the cost of engine repairs upon any road would appear to be (a) make the best use of the repair equipment at hand by perfecting shop kinks and systems for handling the work adapted to the outfit available; (b) to wear out the old tool equipment in the old shop as far as possible, so that when the building of the new shop cannot be postponed longer there will be little, if any temptation to economize by using the old tools; and (c) with the coming of the new shop, old methods of operation should be improved to fit the changed conditions and new systems developed and adopted. A new shop should not be considered complete until every man, tool, accessory and system is doing its most effective work. Under these conditions the new shops will show ample results to justify the investment.

opment of the induction motor and the alternating current system

W. A. Gardner to the Traveling Engineers.*

Having accepted office, you have doubled your responsibilities. Heretofore, you have served two interests—your family and your master mechanic; now you have four interests to consider—your family, the public, your subordinates and the shareholders that own your company. * * * A higher standard of zeal and accuracy maintains in railroad service than elsewhere. In all ordinary business, an error or over-sight is speedily corrected, generally without personal injury or financial loss, but in engine or train service an error or over-sight is quite likely to result in fatalities, and there is no business on earth where the opportunities for mistakes are so numerous. Happily, the employees are so instinctively alert and have been so trained and drilled until it is a part of their every day life to be ready for emergencies all the time, that comparatively few mishaps occur. So while we read of medals being awarded to people for devotion to duty in their particular line, we must be content with the approval of our immediate associates and our own conscience until such time as some impartial historian analyzes railroad service without prejudice and records the fact that railroad employees, as a class, embrace a very large number of the highest types of manhood, conspicuous equally for efficiency and modesty.

* * * Very few men are fit to govern unless they have been governed, and it is very easy on a railroad to detect those who are trying to boss without ever having been bossed themselves. * * * I take it for granted that a traveling engineer, before he accepts promotion, has agreed with himself that he has come to a parting of the ways—a peaceable and self-respecting parting, however. Of course, the old man you fired for will look askance at your suggestions as to how he might do better work. Those who fired when you did will possibly wonder what the company saw in you that they thought could be made over into a general manager, and the young fire eaters may wait for a chance to test your nerve, but not a one of them that does not really wish you well at heart and not a difficulty that you cannot overcome by exercising tact. I do not believe it is possible for any man, however honest and square he may be, to do justice to himself or anybody else if he tries to look with one eye at the Brotherhood of Firemen or the Brotherhood of Engineers, and with the other eye at the superintendent or master mechanic. Either one or other of the optics will be pretty badly strained in the course of time, and eventually, both would become entirely useless.

I would not have you misconstrue my position as to labor organizations on railroads. I believe the particular orders which you are naturally affiliated with, are composed of honest men; that they are honestly conducted. I do not think they are a menace to the railroads; on the contrary, they are of assistance in asserting the sacredness of contract, in raising the standard of service, and in many other ways.

Now all this is commendable, I grant you, and it is not because I mistrust the motives of organization that I suggest you should withdraw from them, but otherwise you will be misjudged, and forced eventually to pay more attention to politics than to your legitimate duty, and I believe that once a traveling engineer, your next aim should be master mechanic, or superintendent, and one way to insure going ahead is to cut off all the avenues for going in any other direction. Some way should be provided for organizations to perpetuate your insurance; possibly, that is already done, and mark you this, more men would be promoted from organized labor, if organized labor offered more encouragement and support to their members who have ability and ambition. You are one of the first lieutenants of the army, if you please. You are expected to understand the rules and regulations and to exact obedience thereto—not with an ax—because it is one of your duties to educate before you admonish and admonish before you resort to harsher measures. Give confidence; trust the men and they will trust you; be square.

A great many changes have taken place in the manner of conducting negotiations between officers and men on a railroad. Individuality seems to be at a discount. About the only things our men ask for, personally, are passes or to be placed on the pension rolls, or to see that the payroll equals the record of their time slips. Everything else is done through a committee, and of late, the committee gets as far away as it can by delegating its desires to a general conference. One month we meet a federated body, and the next month the two parts of that same body notify us that they have hands and feet of their own and are liable to grow horns. Then, on the other side of the house, the officers associate, confer, look as wise as their salaries will justify, talk about the Declaration of Independence and the Battle of Bunker Hill, but in the end, I notice that human nature has endowed us all with a good many things in common. So over in the particular household that I hail from, we still cling to the belief that the personal factor never dies, although it seems to go to sleep and require a little shaking to wake up. I can recall the day when the general superintendent of the North-Western knew, personally, four-fifths of the employees; that is no longer possible, and the relations that were established directly, now have to be carried on through traveling engineers, trainmasters, superintendents, etc., and whatever may be the policies of your respective companies—and I will wager that they are alike humane, pacific and solicitous of the welfare of their employees—it is no small part of your duty to impress this policy upon those with whom you come in contact. I see men here to-day with whom I have been associated all my life, they have seen my hair grow gray, and I have seen theirs grow gray. Perhaps at odd times we have both done things that added to the other fellow's gray hair; but I would rather have their good will and confidence than the greatest office in the gift of any railroad, and I flatter myself they feel the same way toward me—or would if I did not make an occasional speech—and that is a condition, gentlemen, that I recommend you to nourish and cultivate on behalf of yourself as well as your company. * * *

Do not let your job overtake your education. You have read about great public men who obtained a start by teaching school, and they always had to study at night to keep ahead of their classes. Perhaps, some of you have had occasion to look up a few things in advance so as not to appear in an unfavorable light before your children. The art of anticipation is a great thing. If you keep one day in advance of the class, you can really make them believe you are a very wise man. I have tried that and recommend it highly. The company cannot afford to educate you as an officer only to go part way on the journey; they want and are entitled to the maturity of your judgment. You cannot afford to go through hardships of a subordinate officer's life only to fail by lack of education when you have nearly in your grasp that which always comes to him who toils and labors hard. Keep up your study, associate with those who know more than you do; do not confine yourself to technical things; inform yourself on business methods in general; be an all-around fellow, have visions of what you will be when you are general manager; prepare yourself to perform the duties of that office, and after awhile you will do some of those very things you dreamed about. Regard the company's material as if it were your own, your coal, your oil; see that they are used economically. Don't be afraid to be called a company man, nor a family man; there is no stigma about either one of them. People generally think well of a man who thinks well of his family, and they likewise respect a man who realizes his responsibility as trustee for the owners of a railroad, or anything else.

I have not pictured an ideal. A great many people fulfill all that I have said, and more too, and positions of great trust and adequate compensation will always be at the command of him who is honest, faithful and zealous.

*From an address by W. A. Gardner, Vice-President of the Chicago & North-Western before the National Association of Traveling Engineers, at its annual convention in Chicago.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

In the space of a century and a decade from the time of our first census, 1790, to the last in 1900, the United States rose from a string of feeble commonwealths with a population of 3,929,214 to a world power of nearly 80 million people. That amazing 20 fold growth of the nation may serve as a parallel by which we can get some concept of the development that has taken place in the ship that served us at the two periods, but there is this difference, the ship has advanced faster than the nation; the present ship is 60 times bigger and several times faster than the prototype of George Washington's day. Taken on the even basis of ton for ton, the shipping of the present is five or six times as efficient as that at the beginning of the period under review.

This remarkable improvement is the result of a rapid evolution produced by the competition of sail and steam for motive power, and wood, iron and steel for material of construction. This double competition has made a rather complex result as an improvement in one of these fields often reacted in the other, and both have conduced to improvements in design that cannot be easily classified under either heading. One peculiarity of the century of progress is the fact that we have had revolutions without the destruction of the old type. As material for great vessels iron has replaced wood and steel has replaced iron, but wood continues to be used. Steam may be said to have vanquished sail but sailing vessels are still being built. The steps in the progress of this competition merit attention.

The rivalry between steam and sail is distinctly a rivalry between the modern and the old. For a thousand years man has hoisted a sail to be filled by the winds of nature which took him across the sea with all the fickleness and uncertainty for which the wind is famed. This motive power is cheap but it is variable, uncertain, may be adverse if there are zones of calms. The sailing vessel may make a short journey between Saturday and Monday, and on repeating the trip she may not reach port until Monday week. The fact that Providence furnishes the power gives the sailer cheaper costs of construction than the steamer and more space to stow freight The space taken by equipment is but one twentieth in comparison to the steamer's one third The building of engines gives greater initial cost, their repair requires greater maintenance cost, their operation gives a fuel bill unknown to the sailer, and the operation of the mechanical ship requires a crew at least three-eighths larger than that of the sailer, and examples of best modern types would show crew rolls with variation of 100 per cent. between the two types But the steamer has speed and a regularity that gives small heed to the ordinary whims of wind

The object of the ship is transportation and the users of transportation usually want to be able to know in advance the date of its performance By this standard the slow and irregular sailer is found wanting for all exacting service A few years ago it was declared that "the ratio of four to one" is "the present measure of the efficiency of steam tonnage compared with sail tonnage."* In this contest low cost and low efficiency is giving way to high cost and high efficiency.

A century ago the steam vessel was a dream of ridiculed enthusiasts and the world's commerce was using blocky old tubs with blunt ends and a width sometimes one-third as great as their length. Some of them had high bows and sterns, relics of the mediaeval fighting towers, and the average vessel was probably below 200 tons register. A few vessels were much larger than this; for example the "Grand Turk," 1791, with 561 tons, was a record breaker for American builders

The rapid increase in our commerce during the period of the Napoleonic wars led to great increase in American shipbuilding, and Yankee ingenuity made great improvements in design. The decks were flattened and the vessel narrowed.

The period of the war of 1812 saw two suggestive changes in shipping technique. The almost constant danger of capture at sea by either French or British vessels made speed an essential for the American merchantman that was eventually to market its cargo. The war made privateering profitable and if the small privateer could catch a big merchantman or elude a big man-of-war, the returns of the business were likely to be good. Spurred by this impetus the American shipbuilder made astonishing improvements in speed. Baltimore seems to have been the leader in this and was long famed for her fast clippers. Two hundred and nine of these vessels went to sea as privateers during the war of 1812 and not one was captured.

Parallel with this came the general adoption of the steamboat to river use. Fulton's "Clermont" began on the Hudson 1807, the Delaware was shortly provided with a similar service; in 1812 the great Father of Waters was redeemed from its one-sided commerce that could only go downstream with the flat boat and the raft; and in 1814 there were five steamers on the Thames. The general adoption of steamers on rivers was almost immediate. During the 25 years 1815-1840 the steamer, feeling her way behind the protection of the shore, was gaining the necessary experience and receiving the needed perfection to sally forth upon the high seas and challenge the sail to the final contest for maritime supremacy. In 1809 the American flag was the first to be steam bourne upon the high seas, flying at the masthead of the "Comet" as she journeyed from New York to Philadelphia In 1816 there was a line established from New York to New London, Conn., and one across the English channel from Brighton to Havre. The mail route from Ireland to Wales was a very important one, and the distance between Holyhead and Dublin is only 65 miles, but the sailing vessel service there often took three or four days and sometimes seven or nine days. In 1821 steamers were tried with such signal success that they were promptly used in various services to the continent and in British coasting trade. A Parliamentary report of 1822 showed that upon 30 coasting routes the average speed by steam was eight or nine knots per hour, and the voyage was completed in one-half to one-sixteenth the time required by sailing vessels

It is interesting to note that at this time the steamers sailing upon the ocean were using the same side-wheel propellers that were in use on river boats, and they had the hulls of sailing vessels. The adaptation of the steam engine to marine use and its improvement in efficiency were slow The "Savannah," a sailing vessel with auxiliary engines, crossed the Atlantic in 1819 using her engines a part of the time. This mixed effort is commonly hailed as the beginning of ocean steam navigation, but the practical difficulties with such weak and heavy engines as then existed were such that it was 1838 before transatlantic steam navigation in a commercial sense may be said to have had its beginning in the repeated and successful voyages of the "Sirius" and "Great Western," which vessels, both British, one from Bristol, the other from Liverpool, practically had a race to New York and arrived within a few hours of each other.

In the meantime the sailing vessel had experienced great technical progress The American shipbuilders had been stimulated to produce a fast boat by the dangerous commercial conditions existing between 1790-1815 and upon the return of peace and the increase of trade and travel after 1815 they began to study ship design in a scientific manner As a result of experiment and copying the lines of fast swimming fish we soon evolved the packet ship, which was the finest seagoing vessel in the world Until the middle of the century the maximum size of these vessels was about 1,000 tons register and they could carry from 600 to 1,000 persons. The time to Europe was 15-20 days which was two or three days better than the English vessels did, and there were records of crossing the Atlantic in 12 or 13 days. This superiority of the American packet over its rivals from other countries was so marked and so well recognized that it had a practical monopoly of the passenger, mail and express traffic This superiority of the American sailor and his vessel is yet held in speed contests as witnessed by all the international yacht races of a half century.

The supremacy of the American and his sailing vessel was challenged by the British steamer Nature made England maritime Being set down in the sea within sight of the continent and of Ireland she had had excellent opportunity to practice in the steamer business in short journeys to neighboring lands. Twenty two years of this, from 1816, when the first English channel line was established, to 1838 served for the accumulation of enough experience for the successful mastery of the problem of crossing the Atlantic in a real steamer. The Atlantic race of the "Sirius" and the "Great Western" mentioned above was the real beginning of transatlantic steam traffic which has, with very short breaks during the first winters, been continuous from that time. The "Great Western" kept right on, and while the "Sirius" returned to her old work in British coasting trade other vessels were quickly built to get a share in the novelty traffic for the rates on the new steamers to New York were high. The British Government became convinced of the feasibility of the Atlantic steamers for the mail service, and having been long in the habit of advertising for private offers for the mail service, a mail subsidy was offered by the government and taken by Samuel Cunard, the founder of the Cunard line. Steam vessels and lines rapidly multiplied, but mechanical and architectural improvements had to come first.

The paddle wheel is admirable for river traffic but it is ill adapted to the ocean, where the rolling vessel often has one wheel clear of the water and the other deeply buried There was at the same time dissatisfaction with wood as a material for the larger vessels that were desired in the transatlantic trade There had been some occasional experiments with iron vessels from 1777, but they had their practical beginning about 1830, and one of 600 tons was built in 1837. These experimental vessels easily overcame the idea that an iron boat being of heavy material must sink. Iron boats not only float but are actually lighter than wooden vessels of same size, and therefore have more buoyancy. The iron vessel can be strengthened at the desired point easier than the wooden one, and the comparison of a few wrecks soon proved that the iron vessel could stand more pounding and had a stronger hull than a wooden vessel. The fact that the iron of the hull disarranged the compass was an effective barrier to an open sea journey until 1839, when an improvement in the compass made that invaluable instrument workable on iron ships. The way was now open for the use of iron on any vessels, and in 1840 the famous engineer, Brunel, designed the "Great Britain," an iron giant of that day, built for the New York trade. This vessel of 2,984 tons was an innovator in size, in material and in mechanical equipment, for she was driven by the screw propeller a device that had been proved efficient in 1836 by John Ericsson. The "Great Britain" was a success, but Brunel was rather ahead of his time. He had seized upon new processes that had, like most improvements, to make their way gradually As late as 1859 the same Brunel built the "Great Eastern," which had both screw and paddle wheels The slow adoption of iron was due in part to the conservative influence of the Cunards, the leading line of Britain, and the one enjoying the government subsidy This company built wooden paddle-wheelers while Brunel built the "Great Britain" and the Cunards only adopted iron hulls in 1856 The screw came into general use about 1850. In 1853 iron was the material used in building one quarter or more of the vessels built in Great Britain and one-quarter were propelled by steam.

The American Civil War developed the ironclad and introduced iron to the war fleets of the world. The economic situation in Great Britain made that country the leader in iron merchant vessels. She was devoid of forests and supplies of timber, but was the world's leader in the manufacture of iron Consequently the transfer to iron ships was rapid and in less than half a century the disappearance of wooden ships in British yards had become complete. A similar period served for the disappearance of iron as building material, for in 1875 experiments showed the suitability of steel, which is merely a better form of iron In four years the new material was used in one-tenth of the new vessels built on the Clyde, and in 10 more years its virtue was so widely recognized that its use in new vessels was well nigh universal, amounting to 97 per cent.

*Report of U. S. Commissioner of Navigation, 1903, p 181.

The change from wood to iron did not come so rapidly in the United States as in Great Britain. We were exporters of wood and importers of iron; we had the equipment for building the wooden ship, and our wooden ship was the best in the world. During the civil war the industry of the country was paralyzed, and since that period our merchant marine has been in a state of low development when it was limited largely to the coasting and sailing vessel trades. Here wood had its stronghold, and when Great Britain had entirely ceased to build wooden vessels they still outnumbered iron in this country $1\frac{1}{2}$ to 1.

The accompanying table of materials shows the progress of the different materials in the world's needs since 1890. That is a period during which new building has been predominantly of steel, as is shown by the 560 per cent. increase in tonnage. Wood and iron have decreased respectively 52 and 40 per cent. These are not exact measures of the virtue of the two materials, for wood has been used as material of construction much more than iron, so that vessels of wood have been replenished while those of iron have not been affected much by any factor except the natural reduction of tonnage existing in 1890. The life of a wooden ship is short in comparison to iron. There are some cases of wonderful longevity of wooden ships, the century mark even having been reached, but the East India Company had a general rule that the life of the ship in their business was eight years, and that she was then sometimes worth repairing for four more years of service. The life of an iron ship has scarcely been determined on the basis of life of material,* but they are steadily being broken up because they are obsolete and incapable of competing with the newest types embodying the results of a half century of progress in motive power and design. These improvements in power and design have been made in both steam and sail.

Materials of World's Merchant Marine.

(From annual report Commissioner of Navigation, 1904, p. 253.)

Year.	Power.	Wood. No.	Wood. Tons.	Iron. No.	Iron. Tons.	Steel No.	Steel Tons.
1890.	Steam	902	360,147	7,719	8,495,920	2,343	4,086,555
	Sail	18,924	6,693,738	1,879	2,021,593	248	348,653
		19,826	7,053,885	9,598	10,517,513	2,591	4,435,208
1895.	Steam	1,007	306,911	7,099	7,432,890	4,994	9,038,000
	Sail	14,526	5,173,766	1,671	1,778,671	801	1,185,101
		15,533	5,534,677	8,770	9,211,561	5,795	10,223,101
1900.	Steam	1,158	382,131	6,262	5,915,714	8,286	15,999,406
	Sail	9,970	3,627,491	1,386	1,482,388	1,082	1,509,298
		11,128	4,009,622	7,648	7,398,102	9,368	17,508,704
1904.	Steam	1,289	419,956	5,684	5,067,025	11,299	23,072,876
	Sail	8,201	3,035,654	1,195	1,280,293	1,352	1,792,974
		9,490	3,455,610	6,879	6,347,318	12,651	24,865,850
Per ct., 1904 to 1890			48	.....	60	......	560

The marine engine has been improved more than the hull since the first vessel steamed across the Atlantic. In 1899 an old steamer was torn up and her engine weighed 17 times as much per horsepower as the then best type. The Atlantic racers of 1840 had a boiler pressure of 13 lbs. per sq. in., and passed the steam from the cylinder where it did the work directly to the condensers. The compound engine passes the steam from the first cylinder, where it has great pressure, to a second cylinder with greater size and less pressure per unit of area. The pistons from both cylinders drive a common shaft, but the connecting rods exert their pressure upon it at different angles and there is an interval of time between the strokes of the two pistons. The available power from a given amount of steam is not doubled but it is considerably increased. The compound engine was applied in Glasgow in 1856, was put into vessels in China trade in 1865, and was generally adopted about 1870. Boiler pressures were raised until 200 lbs. per sq. in. became common in the last decade of the nineteenth century; the compound or double-expansion engine was followed by the triple-expansion, and it in turn by the quadruple-expansion engine. In the 65 years from 1840-1905 the improvements just mentioned, along with better combustion by forced draught, the return of heated water to boilers and many minor improvements have reduced the coal required for the horse-power hour from $5\frac{1}{2}$ lbs. to about 1 lb., and the end is not yet. Theoretically the best engines are yet getting but one-fifth of the power from coal.

The turbine is apparently opening a new epoch in steam navigation. With the new Cunarders it leads the world in size and speed of vessels. It makes no great saving in coal but it uses its power advantageously. It is smaller and takes up much less space. It is simpler, occasions less friction, less wear and repair. Its operation is quiet. Like an electric motor, the parts are balanced.

Another improvement of great value has been the division of the ship into water-tight compartments, of which one could be filled with water and the ship, buoyed by the remaining seven-eighths or eleven-twelfths of her hull, still float in safety. This also enables the ship to have separate engines and engine rooms, so that one of these may be flooded and the other run steadily onward. Double engines mean twin screws, which under all circumstances are great guardians of the ship's safety. The modern steamer dependent upon one screw is helpless with a broken shaft. With twin screws she proceeds at something more than half speed and a calamity is turned into a mishap. The twin screw is therefore the usual thing on passenger ships; the new turbine Cunarders have four screws.

*The career of the "Great Britain," the first iron Atlantic steamer is interesting proof of this fact. She was launched in 1843, spent the winter of 1846-7 ashore on the rocks of the Irish coast, was re-engined, spent 22 years in the Melbourne trade, and was converted into a sailing vessel in 1882, and in 1895 she was reported as doing service as a coal hulk at Falkland Islands.—See Henry Fry's "History of North Atlantic Steam Navigation," p. 43.

During the two-thirds of a century that have elapsed since the "Sirius" and "Great Western" raced to New York in 1838 the designers of sailing vessels have not by any means been idle. The sailing vessel is still with us and during the first 50 years of the oceanic competition she held her own numerically at least, and it is only in the last 15 years that she has had to go down ingloriously before her steaming sister.

The steamer with hull and machinery has a greater field in which to perfect improvements, and it is really remarkable how much the sailing vessel has been improved under the goading competition of advancing steam. Iron and steel were found to be quite as usable in the construction of sailing vessels as in steamers, and these materials have been adopted, although it did not come as promptly as was the case with steam vessels. The spreading of sails to the wind seems to be a simple process, but it has been improved almost as fast as the devices for harnessing steam. The typical sailing vessel of 1850 was a square rigged ship—a vessel with several spars at right angles to each of several masts and many square sails high aloft. Much rigging held this complex harness together, and the numerous sails were set and reefed by many men far aloft at the risk of their lives. The thousand-ton "East Indiaman" of 1850 had a crew of 80 hands, a 2,500 four-masted barque of 1900 had 33 hands. Taking the figures for the British merchant marine for 21 years it appears that the sailing vessel has actually reduced her crew faster than the steamer. For British vessels engaged in the foreign trade the number of crew per 100 tons net register has been as follows:

	1880.	1890.	1898.	1901.	Per cent reduction.
Sailing vessel	2.32	1.96	1.65	1.61	31
Steamer	2.95	2.73	2.32	2.22	25

These figures from the British marine are but averages of many vessels of all ages and do not cover the case as accurately as would figures which described only the most modern types.

The British figures refer too much to the fast disappearing square rigged ship which promises to disappear from the competition of the typical American sailing vessel, the schooner. The advantage of this rig* lies in the absence of the yards and spars. The sail being fastened on one side of the mast only and supported by booms and gaffs that swing upon the mast as a pivot. Each mast has a small top sail and one great sail which can be hoisted by a rope from the deck. This is a safe process and one in which men can work to good advantage. This vessel was evolved by the Gloucester fishermen about 1745. In 1800 these fishing schooners were of from 20 to 40 tons, and soon after they began to be used in the American coasting trade. By 1860 the typical coasting schooner had two masts and was of about 250 tons burden. If she were made larger the raising of anchor and sails required more men than were needed at any other time.

A three-masted schooner had been built in 1831. By 1850 they had passed the experimental stage, and by 1870 they were the prevalent type, ranging from an average size of 300 tons to 700 for the largest. Then followed one of the most striking of modern ship developments. The masts began to be multiplied. In 1880 a four-masted schooner was built; in 1888 came the five-master. A representative of this pattern, built in 1899, carries 4,000 tons of cargo. In 1900 came a six-master carrying 5,500 tons. All these were of wood and the center of construction was the coast of Maine. In 1902 the present climax was reached in the launching of the "Thomas W. Lawson," a seven-masted schooner built of steel and carrying 7,500 tons of cargo with the amazingly small crew of 19 men. Of this vessel, recently wrecked, three decks were of steel, 135 ft. of the 193 ft. of mast was of steel; the standing rigging was of steel, and the sails were hoisted by steam. The steering gear was steam-driven. In this steam crew lies the secret of the small force of men aboard, and the ultimate value of the American schooner, if she is to have any ultimate value, lies in the fact that she is of such a design that she can use auxiliary steam to harness the wind as she spreads her acre of sails. The net result of the working of all these factors in the competition for the motive power is shown in the accompanying statistics of the world's merchant marine for a period of 32 years.

Table I. shows that since 1873 the steam tonnage of the world

*Any good unabridged dictionary gives cuts of the various and numerous varieties of sailing vessels which are named in accordance with the method of sail arrangement, i. e., the rig.

and of all countries has increased enormously and steadily. The average for the world being 336 per cent. for a quarter of a century, average of over 100 per cent. for each of the three decades. During the time of this great absolute increase in steam tonnage, the sail tonnage as shown in total in table II, or in detail in table III., declined absolutely. This decline of 40 per cent. in the world's total was not relieved by a gain in any single country, nor did any country hold its own. Norway having her forests and her lumber trade held out the longest, but with the new century her sail total fell. Table IV shows that most of the relative and absolute decline of the sailer has come since 1890. Before that time the efficiency of sailing vessels as cheap freight carriers enabled them to outrank steamers in total tonnage, but the latter half of the decade, 1880-90, was the period of the general adoption of steel hulls and triple-expansion engines. With these improvements in the steamer the sailing vessel could not compete and building fell off in favor of the improved steamer. The relative proportions of steam and sail at different periods show the newness of steam predominance. In 1871 sailing vessels were to steamers as 1.7 to 1, in 1890 1.2 to 1, in 1901 .34 to 1. Expressing it in percentages, it appears that 18 per cent. of the world's shipping was propelled by sail. From the standpoint of work done, the application of the old rule of efficiency of 4 to 1 in favor of sail, shows that sailing vessels are now doing but 5.3 per cent. of the world's ocean carrying.

In 1901, 1902 and 1903 steamers carried many cargoes of Pacific coast grain to Europe. It was, it is true, done at a loss, but such periods come rather frequently in the shipping industry. It is not being claimed here that the steamer promises immediately to replace the sailer in this trade, but it has already competed for full cargoes. Much more significant is the consolidation of all sailing lines between the two coasts of America and the sale of these vessels and their replacement by high type steamers. Freight carrying perfection is illustrated in the new American steamers that have been built to replace the sailing vessel line from New York to San Francisco. Some of these vessels can carry 10,000 tons dead weight of freight and 2,500 tons of coal. If the Panama canal were open it is expected that they would make the 5,000-mile voyage from New York to San Francisco at nine knots per hour with 1,000 tons of coal, or one ton of coal for 10 tons of freight. With coal at $3 per ton, the coal cost of a ton of freight carried 5,000 miles would be 30 cents. Small wonder that a man interested in these steamers exclaimed when comparing them with sailers, "Oh, the coal is a bagatelle." Upon the opening of the Panama canal the sailer will probably be entirely displaced in the Atlantic-Pacific trade by the apparently impossible task of competing around Cape Horn with a steamer passing through the canal, and saving more than half of the distance.

The route from New York to Australia was claimed by Lieutenant Maury, the great ocean expert of 40 years ago, as the perpetual home and exclusive possession of the sailer. The route is long, the winds are fair and coaling stations for the rival steamers are scarce and expensive. But when the trade turned against the sailers this stronghold was also invaded. In the year 1896 several lines added steamers to their service, and have maintained them for 11 years and are shipping a large part, indeed the greater part of the freight by them.

TABLE II. *Seagoing Steam Tonnage of the World.*
Répertoire Générale of the Bureau Veritas for 1904-'05.

Countries.	1873-'74 Tonnage	1873-'74 Per cent	1878-'79 Gross tonnage.	1878-'79 Per cent.	1888-'89 Gross tonnage	1888-'89 Per cent	1898-'99 Gross tonnage	1898-'99 Per cent	Inc. per ct. 1873-'74 to 1898-'99.	1904-'05 Gross tonnage
Great Britain	2,624,431	60.4	3,465,187	62.4	6,873,552	62.3	10,993,111	58.5	311	14,880,175
United States	483,040	11.2	609,101	10.8	535,345	4.8	810,800	4.2	68	1,720,176
France	316,765	7.4	335,219	5.9	752,028	6.8	952,682	5.1	200	1,266,486
Germany	204,894	4.8	253,667	4.5	662,331	5.9	1,625,521	8.3	693	2,887,1[illegible]
Spain	138,675	3.3	152,708	2.7	296,685	2.5	520,847	2.7	275	714,775
Italy	85,045	1.9	84,421	1.5	276,326	2.5	420,880	2.2	395	735,212
Holland	72,753	1.7	116,149	2.0	197,748	1.8	362,200	1.9	399	651,690
Russia	67,522	1.6	104,702	1.8	163,556	1.5	358,415	1.8	430	627,114
Norway	41,602	0.9	53,331	0.9	160,558	1.4	628,193	3.3	1,410	1,040,637
Japan	....	..			115,088	1.0	439,500	2.3		645,998
All others	293,166	6.8	120,690	7.5	913,720	8.3	1,773,674	9.5	504	2,713,171
Total	4,328,193	100.0	5,595,175	100.0	11,045,937	100.0	18,887,132	100.0	336	27,900,457

TABLE III. *Seagoing Sail Tonnage of the World.*
(Same authority as table No. II.)

Countries.	1873-'74.	1878-'79.	1888-'89.	1898-'99.	Per ct. dec. 1874-'99.	1904-'05.
Great Britain	5,320,089	5,596,018	4,215,634	2,910,555	45	2,080,243
United States	2,132,838	2,075,832	1,913,090	1,285,859	40	1,465,819
Norway	1,137,177	1,374,824	1,328,296	1,141,482	0.6	749,354
Italy	1,126,032	963,625	718,889	463,767	59	523,910
Germany	893,952	914,674	737,028	535,937	40	506,101
France	768,059	565,933	352,418	279,412	64	494,123
All others	2,807,689	2,796,524	2,370,934	2,073,757	26	1,993,498
Total	14,185,836	14,317,430	11,636,289	8,693,769	40	7,812,957

TABLE IV. *The World's Merchant Marine.*
[Recorded in Lloyd's, 100 tons or over.]

Year	Steam No.	Steam Net tons.	Sail No.	Sail Net tons.
1890	11,108	8,295,514	21,190	9,166,279
1893	12,588	9,622,610	19,452	8,983,957
1894	12,907	10,111,769	17,814	8,503,294
1895	13,256	10,573,642	17,112	8,219,661
1896	13,652	11,027,603	16,228	7,876,264
1897	14,183	11,531,829	14,168	7,300,839
1898	14,701	12,073,074	13,351	7,019,958
1899	15,324	12,935,994	12,866	6,795,782
1900	15,898	13,856,513	12,524	6,674,370
1901	16,528	14,874,253	12,563	6,591,627
1902	17,156	16,026,372	12,472	6,577,776
1903	17,761	16,822,466	12,182	6,459,766
1904	18,467	17,682,141	10,823	6,156,505

This decline has been general, not local; it has affected the shipping of all countries, the trade of all oceans and of almost all commodities.

The claim is often made that there are special commodities and particular routes that belong exclusively to the traffic of the sailing vessel. Conspicuous among commodities supposed to belong to the sailer are nitrate of soda from Chile, lumber in the American coasting trade and elsewhere, and wheat from San Francisco. Within the past decade the shipment of full cargoes of nitrate by steam has become common, and several lines of steamers regularly carry it as a large part of their return cargo. Special steamers have been built to carry Carolina pine to New York and New England, and the shipments* of pine lumber and ties from the port of Savannah, Ga., for seven months, April 1-Nov. 7, 1905, show the following results:

	Steam Million ft., B. M.	Sail Million ft., B. M.
Foreign	4.74	0.6
Baltimore	10.13	1.93
Philadelphia	5.26	1.95
New York	23.82	15.91
Boston	3.16	1.81
Other ports		7.40
Total	47.11	40.66

*N. Y. *Lumber Trade Journal*, Nov. 15, 1905, p. 22.

It appears from the statistics of 1904-5 that there has been a pause in the downward course of sail tonnage. During the five years, 1899 to 1903, the total decline was not much greater than the annual decline from 1890 to 1899. This halt was due largely to the great boom of 1898 and 1899, which made every kind of vessel profitable in the extreme, and produced the greatest increase of steam shipping ever known. Steam and sail alike were profitable, and were built wherever the equipment was available, and the decline of the sailer was stayed, but the figures for 1904 show that the boom influence is over and that the upward march of steam and the downward march of sail tonnage has begun again.

The multimasted schooner with minimum crew and steam, sail and steering gear is spectacular, and has been heralded as the beginning of a renascence of the sailer. These vessels are not being built very rapidly, and in the steamers there is the counterbalancing improvement of oil-burning engines which require less space and less crew. There is also a mechanical stoker in use and the turbine is apparently coming. There does not appear to be any contrivance in sight to increase the force of sail competition with steam, and increasing disadvantage appears likely.

The extinction of the commercial sailer is not predicted here. For a long period to come there will be some distinctly sailing vessel work, but further decline of tonnage seems evident. She cannot hold her paltry twelfth part. In 1902 the British steam tonnage increased 708,000 tons and the sail tonnage declined 65,000 tons. The traffic upon which the sailing vessel has the strongest hold is some irregular and spasmodic trade, both coasting and foreign, which cannot be organized and handled as line traffic. The beginning of a new trade may be the occasional departure of a sailing vessel. Such a trade is now arising between the Gulf ports of the United States and the La Plata ports. If it grows, a line of steamers will take it over and most of the sailers will be displaced, giving another reduction to sailing tonnage.

There are times when the sailing vessel is desired because the low speed and consequent long voyage enable the shipper to save storage expenses at one of the termini, but the competition of a seaworthy ship as a mere storage warehouse is not a strong foundation for continued prosperity.

(*To be continued.*)

GENERAL NEWS SECTION

NOTES.

The New York, New Haven & Hartford is now running stateroom sleeping cars between New York and Boston.

At Jersey City, N. J., last week a street railroad company was fined $50 for violating the city ordinance requiring that every passenger be furnished with a seat. The case will be appealed to the Supreme Court.

The application of the railroads of Mexico for permission to increase their rates on ores is to be granted but, according to reports, the government will not permit the higher rates to go into effect until April 1.

The Pennsylvania Railroad has discontinued sending through freight trains over its Portage line, and, according to press despatches, the result will be the dismissal of several hundred men at East Hollidaysburg.

The Cincinnati, Hamilton & Dayton last week ran an "Agricultural special" over its line, making a three days' journey and stopping at the principal towns where farmers could be gathered. Lectures were given on the best corn to plant in Ohio and on the value of alfalfa.

The Long Island Railroad Co. has notified the New York State Public Service Commission that demurrage charges on cars at Long Island City and at certain other stations would be at once abolished. There is now no serious congestion of freight and consignees will be allowed to take their time in unloading their goods.

The New Jersey State Railroad Commission in its first annual report recommends the granting of increased power to the commission in certain directions, but does not favor granting to a commission the power to regulate rates. On this last point Commissioner Whiting dissented and made a minority report advocating the passage in New Jersey of a law similar to that now in effect in New York.

By lengthening 21 passing tracks between Roseville, Cal., and Truckee, the Southern Pacific has increased the capacity of its main line eastward from Sacramento almost 50 per cent., these passing tracks, now 2,600 ft. long, being able to accommodate 45-car trains, whereas before trains were limited to 30 cars each. The company has during the past year increased its freight car capacity 20 per cent. and its locomotive power capacity about the same.

The attempt which was made at Pittsburgh last week to require street car passengers to pay their fare on entering, broke down before the end of the second day. Many passengers offered $1 and $2 bills and insisted on stopping for their change, and the tracks were blocked with cars for long distances. One conductor, who encountered a woman holding a nickel between her teeth, is said to have succeeded in pushing the coin down her throat; and several conductors threw up their jobs.

The Committee on Car Efficiency of the American Railway Association, Arthur Hale, Chairman, has issued a statement of car surpluses and shortages on December 11, showing an aggregate surplus of cars amounting to 119,339 and an aggregate shortage of only 4,520. As there is now a surplus of cars everywhere the committee will discontinue detail bulletins, but will issue, fortnightly, condensed bulletins; and the Chairman will, on request, furnish details for particular roads, where desired.

According to a press despatch from Chicago the Atchison, Topeka & Santa Fe has changed 200 oil-burning locomotives into coal burners because the Interstate Commerce Commission rules that one railroad must not carry fuel for another without compensation. This apparently is meant to be taken as indicating that some other company (the Southern Pacific?) has such a warm interest in the prosperity of the Atchison that it is willing to carry fuel for it without charge. Thus the Government at Washington by its cold and unfeeling decision, chilling the milk of human kindness in the breast of a corporation, dries up the springs of the oil traffic in southeastern Texas.

President Roosevelt has awarded a railroad life saving medal to Edward A. McGrath, of Milwaukee, station agent of the Chicago, Milwaukee & St. Paul at Beecher street, in that city. He is a cripple, his left leg being about 8 in. shorter than the right one, making it necessary for him to wear a piece of wood on the bottom of his shoe to make his legs of even length. On the 26th of August while he and others were standing on the platform, the crossing gates being closed for the passage of a train, a six-year old girl attempted to cross the track in front of the approaching train. McGrath shouted to her to stay back, but she did not heed his warning. McGrath at great risk to himself ran to her aid and succeeded in lifting her from in front of the approaching train just as it rushed by. McGrath was struck by the pilot beam of the engine, but escaped serious injury. The child was entirely uninjured.

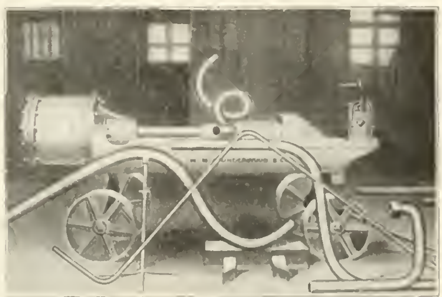
Southern Pacific Orange Traffic.

Besides buying this year 6,600 of the best refrigerator cars for its California fruit traffic, the Southern Pacific has taken up the problem of cooling the fruit before it is loaded. The company has begun building pre-cooling plants, and also ice-making plants to supply its cars. When pre-cooling comes to be general a large amount of fruit will be saved that now becomes spoiled, and fruit can remain on the trees longer. It is expected that pre-cooling will add from 10 to 20 per cent. to the value of California's citrus fruit production, which, in the season just closed, brought $34,000,000, and made the total fruit crop of the state worth twice as much as her gold production.

All-the-year-round demand for oranges has increased to such an extent that California growers have found it necessary to propagate more very early and very late varieties, until now there is hardly a day in the year in which citrus fruit shipments are not made from this state. The bulk of the crop, however, is handled between January 1 and July 1. For the fruit season ending Nov. 30, the total number of cars of oranges shipped was 23,981, and the increase for all citrus fruits was 2,000 cars for the year.

Pneumatic Pipe Bending Machine.

The accompanying illustration shows a portable pneumatic pipe bending machine made by H. B. Underwood & Co., Philadelphia, Pa. It has been in use for some months in a large railroad repair shop, where it does all the pipe bending required in equipping



Pneumatic Pipe Bending Machine.

locomotives, including the air-brake piping. It makes a right angle bend in a 2-in. pipe in two minutes and does not flatten or injure the pipe in any way. Dies of standard radius for locomotive work are furnished for pipe from ½ in. to 2 in. diameter, while special dies of any required radius or shape can be made to order.

New York City Slow.

Three thousand suburban travelers living along the line of the Western Railroad of France, exasperated by continued delays in transit through which, they allege, they lose hours in pay daily and sometimes even are dismissed by their employers, wrecked the offices at the St. Lazare terminus of the railroad Jan. 3, and for an hour held the police at bay. They were finally dislodged by the Fire Department, which played on them streams from two lines of hose.

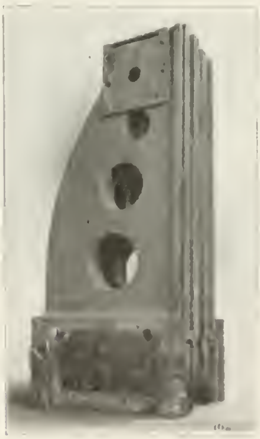
Supply and Demand in the Labor Market.

Mr. Gompers is reckoning without his host when he says that the wages of organized labor will not have to come down along with the prices of raw materials in the present general business and financial depression. The inexorable law of supply and demand will make itself felt in the case of organized labor, as well as in all other branches of business, Mr. Gompers notwithstanding. Labor has been at a premium for the last four years, and it has also been less efficient that ever before. All classes of employees have pointed to the heavy earnings and, in consequence, have received their share in the shape of higher wages. Mr. Gompers overlooks the axiom that when labor is at a premium the employee is in a position to make terms with the employer, but when labor is at a discount, as it is now, the employer is the dictator. In the immediate future employers will have more to say about the scale of wages than for several years, provided the present business recession obtains, as now. The price of unskilled labor has already declined.—*Interview with F. D. Underwood.*

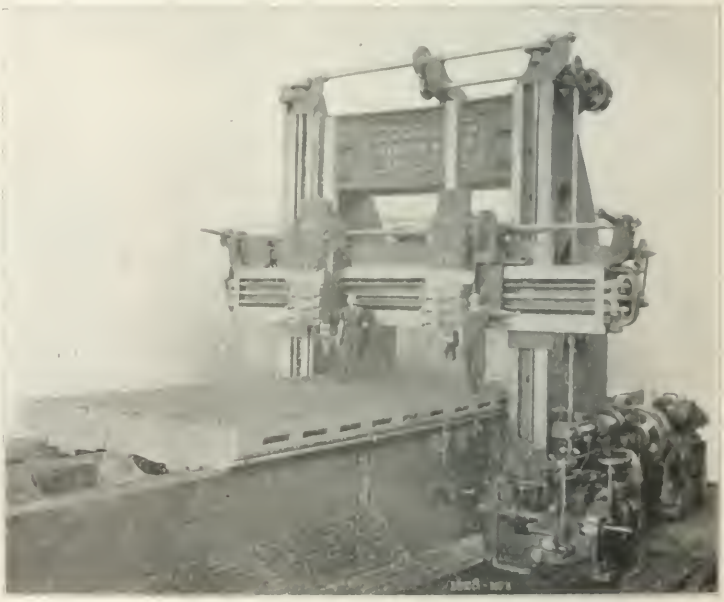
An Enormous Planer.

The planer shown in the accompanying illustrations was recently built at the Bement Works of the Niles-Bement-Pond Co., New York, for the Mackintosh-Hemphill Co., of Pittsburgh, Pa. It weighs 815,000 lbs., and the motors used to drive it aggregate 207½ h.p. It is 14 ft. 4 in. wide between uprights, and the distance from the top of table to the under side of the cross rail is 12 ft. 2 in. The stroke of the table is 30 ft. The main drive is by a 100-h.p. motor attached to the base of the right hand housing. It has a slight variation in speed and further changes can be made by the gears. Power is transmitted by gearing from the motor to reversing multiple disc pneumatic clutches. A small valve controls the starting, stopping and reversing, the valve being tripped by table-dogs for automatic reverse. Inside of the bed is a part of the driving mechanism, consisting of two large steel bull wheels, which engage with two racks on the table. The pinions driving the bull wheels are cut directly on the forged shaft with teeth spaced half pitch apart. Faces of pinions, bull wheels and racks are 15 in. wide.

In general the machine is of the usual type, but has several unusual features, in addition to the reciprocating table motion. Slotter bars, with 8-ft. stroke, are carried in the rail heads. One of the heads also has a power reversing cross motion for transverse planing, while both have quick power traverse on the rail, as well as tool slides in heads for quickly bringing them to approximate positions. When slotting certain classes of work the table has to be intermittently fed as on a regular slotting machine. The motor for the slotting and cross planing motion is 50 h.p. It has a slight speed variation, and there are change gears to further alter cutting speed the same as for the table driving motor. This smaller motor is near the base of the left hand housing, and drives pneumatic clutches of smaller size, but similar to those on the driving side. Power is transmitted through bevel gearing to a vertical shaft, which is made square to eliminate the use of sliding keys under great torsional strain. Above the motor is a disc driven from the main train of slotter gearing. It has adjustable stops on its circumference which are set to control the length of stroke just as dogs on a planer table.



The Two Uprights of Niles Planer.



Planer; Niles-Bement-Pond Co.

The short vertical column attached to the right hand side of the bed consists of an inner shaft and a sleeve. On the upper end are two sockets, in one of which is a handle. The upper socket is attached to the inner shaft, which connects with the rod for controlling valve and pneumatic clutches for slotter bars. The lower socket is attached to the sleeve, which controls the movement of table for regular planing, and is connected by lever and rods to the automatic reversing dogs on both sides of the bed. This control is duplicated on the other side of the planer. Only one handle is provided for each side, and thus mistakes arising from operating the wrong lever are avoided.

The uprights are massive castings 25 ft. high, 12 ft. deep, where bolted to bed, and with vertical faces 30 in. wide. Mounted on the uprights is a cross rail 5 ft. high and long enough to allow full traverse of either head between uprights. On this rail are heads with counterweighted tool slides 7 ft. 8 in. long having a vertical traverse of 4 ft. The tool aprons are of steel 28 in. wide, with three slots for clamp bolts and are arranged to swivel in the usual manner. Horizontal quick power traverse of heads on rail or vertical traverse of tool slides is operated by a 7½-h.p. motor, placed on the right hand end of the cross rail. A 20 h.p. motor for raising and lowering the cross rail is at the top of the right hand upright.

Pneumatic feed was adopted because of the great weight of the work and the table which must be fed across the bed when slotting or cross planing. On the side of the right hand upright is a cylinder, whose piston rod connects with a rack which meshes with a gear near the bottom of the vertical feed shaft. The feed shaft has on its lower end a bevel gear meshing with another bevel gear on a horizontal shaft which transmits motion to the vertical feed shaft on the left-hand upright. The movement of these feed shafts is constant at all times, and amount and direction of head feeds is controlled by adjusting the connecting rod in the slotted cranks on the ends of the cross slide. Feed cranks are graduated, so that definite cross and vertical feeds can be obtained and by using the cranks on both sides at the same time an angular feed can be given to the tool, which is at times desirable, as the complete heads were not designed to swivel. The feed mechanism for table necessary when slotting or transverse planing is directly in front of and at the base of the right hand upright. This feed works much the same as the feed for the cross head, except that variation in stroke or amount of feed is obtained by an adjustable stop, which regulates the movement of the piston. The machine has its own air compressor, driven by a 30 h.p. motor.

The table is 32 ft. long, 11 ft. wide and slides on three ways each 15 in. wide, the center way being V-shaped and outside ways flat. The bed is 60 ft. long, 13 ft. wide and 73 in. deep at center. Because of the great weight and large dimensions, it was impracticable to make the bed or table in one piece. The central section of the bed is divided longitudinally into three parts, and the two end sections into two parts each. The weight of the bed is about 275,000 lbs. The table is made in two sections, divided longitudinally in the center, and weighs about 110,000 lbs.

INTERSTATE COMMERCE COMMISSION RULINGS.

Beer and Water Not to be Mixed.

In an opinion rendered by Chairman Knapp the Commission has announced its decision in the case of the Milwaukee-Waukesha Brewing Company against the Chicago, Milwaukee & St. Paul and others. Defendants refused to apply carload rates on carloads made up of less than carload lots of mineral water and beer. Upon the facts disclosed, and principles announced in the recent case of Paper Mills v. Pennsylvania Railroad, the Commission decided that the refusal of defendants has not been shown to be unlawful. The complaint was dismissed.

Railroad Papers to be Preserved.

An order has been issued by the Commission to the effect that until further notice all records, documents and papers bearing on the statistics and accounts of railroads, with certain exceptions, shall be kept as a permanent file and in such manner as to make them easily accessible at all times for inspection by a properly accredited examiner of the Commission.

Certain papers that may be destroyed are indicated in the order. Among these are tissue copies of statements, waybills or reports, duplicate detached reports, used or canceled tickets, waybills dated before January 1, 1889, and conductors' and waiters' checks. Among the papers that may be destroyed after having been retained in the files for three years are train conductors' reports of train and car movements, detached papers relating to labor and material and papers subordinate to payrolls, including time checks and excepting time books.

Dining conductors' trip reports, daily reports of service of mechanical department employees and daily reports of service of transportation department employees may be destroyed at the expiration of six months after a carrier which has given previous notice of such purpose in writing to the Commission shall have received formal acknowledgment of such notice.

TRADE CATALOGUES.

Engineers' Hand Book on Rolling Doors.—This is catalogue No. 34 of the James G. Wilson Manufacturing Company, No. 3 West 29th street, New York, and it can be obtained free; nevertheless the title given it is a correct one. It contains 31 large pages of detail drawings which the engineer can ill-afford to do without in planning locomotive roundhouses, sheds and shops, car barns, freight houses, pier sheds and the like—wherever openings are to be covered and uncovered by fireproof or other construction efficiently and without waste of space. There are also about 60 good photographs, valuable in showing the varied applications in many kinds of building construction. Rolling doors are made of wood, bronze, iron or steel, and are flexible, so as to easily lift and coil in a roll over the opening. The engineer is more directly interested in two forms: The corrugated steel, a solid sheet, but flexible enough to roll up, and with malleable-iron clips which prevent wear in the guides; and the interlocking slat doors, with the same malleable-iron protection, more flexible and easier worked. It is out of place here to attempt giving more than a notion of the variations in details in making these applications to meet differing conditions. For example the Northern Pacific shed, at Seattle, has bays with shutter-covered openings 19 ft. wide; one at Baltimore 24 ft. wide; a car barn at Mt. Washington, Pa., with an opening 30 ft. wide. These involve considerable weights in the broad steel shutters to be lifted and lowered. They are counter-weighted or spring balanced. They are commonly operated by a winch, conveniently located, but small electric motors are frequently used. The methods of automatic closing of fireproof doors, when unusual heat comes from an accidental fire, are interesting. Indeed the whole catalogue is interesting.

The Union Pacific passenger department has made up a brief statement regarding the irrigation projects on and tributary to that road and its related lines under consideration and construction by the U. S. Reclamation Service; also concerning irrigable lands in public and private ownership which will eventually be reclaimed by means of proposed systems. It is printed in circular form for general distribution. A handbook relating to the operation of the Reclamation Act, prepared in the form of questions and answers, has also been issued by the Union Pacific for the information of the public generally.

Small Electric Motors.—Bulletin No. 4545, of the General Electric Company, Schenectady, N. Y., describes single-phase motors, type I. S., form K. G., ranging in size from ¼ h.p. to 15 h.p. The usual full dimensions and other information are given.

MANUFACTURING AND BUSINESS.

The plant which the Chicago Railway Equipment Co., Chicago, has been building at Grand Rapids, Mich., is nearly completed.

The name of the India Rubber & Gutta-Percha Insulating Co. has been changed to the Habirshaw Wire Co., 253 Broadway, New York.

L. W. Barber, Secretary of the Standard Car Truck Co., Chicago, was killed on the South Side Elevated Railroad in that city on January 5.

The Anderson-Lacy Electric Headlight Co., Houston, Tex., has shipped four locomotive headlight equipments to the Union Pacific for experimental use.

Charles F. Pierce has been appointed Manager of the railroad department of the New York & New Jersey Lubricant Co., New York, maker of non-fluid oils.

E. S. Nethercut, Chief Engineer of the Buda Foundry & Manufacturing Co., Chicago, has resigned. Mr. Nethercut will be in California for several months and expects to form no business connection until his return east.

E. M. Hedley, who has been in the experimental railroad department of the General Electric Co., Schenectady, N. Y., has been appointed General Superintendent of the Hudson & Manhattan, which is soon to start operation through its tunnels under the Hudson river.

C. W. Martin, Assistant General Manager of Jenkins Brothers, New York, died on December 31 of pneumonia. Mr. Martin was 37 years old. He had been with Jenkins Brothers for a number of years and in 1905 was Chairman of the Executive Committee of the Railway Supply Men's Association.

Robert W. Hunt & Co., inspecting and consulting engineers, Chicago, New York and Pittsburgh, have established a branch office and chemical laboratory at St. Louis, Mo., under the charge of Charles W. Gennett, Jr., M.E., formerly with the Baldwin Locomotive Works and the Southern Railway and lately Western Sales Agent of the Atha Steel Casting Company at Chicago.

A plan has been made public looking to the termination of the receivership of the Westinghouse Machine Co., Pittsburgh, Pa. It includes the issue of $7,200,000 three-year 6 per cent. notes secured by about $8,500,000 in bonds of the company. Claims of less than $1,000 are to be paid in cash and the others in notes. No dividends are to be paid until provision has been made for retiring the outstanding notes.

F. J. Cole, Mechanical Engineer of the American Locomotive Co., New York, has been appointed Consulting Engineer, with headquarters at Schenectady, N. Y. The office of Mechanical Engineer has been abolished and its duties will be included in those of William Dalton, Chief Engineer, whose headquarters are at Schenectady. Carl J. Mellin, Designing Engineer, has also been appointed a Consulting Engineer, with headquarters at Schenectady.

The E. H. Mumford Co., Philadelphia, Pa., has acquired all the patent rights, molding machines and equipment of Ph. Bonvillain and E. Ronceray in the United States and has added these machines and pattern processes to its molding machine line. The offices of the company will be moved from 17th and Callowhill streets, the present location, to 1315 Race street, where the French machines have been installed as a working exhibit for some months.

OBITUARY NOTICES.

John F. Fanning, a pioneer railroad builder of the Northwest, died in Chicago January 5, age 81 years. Mr. Fanning built parts of the Chicago, Rock Island & Pacific, the Northern Pacific and the Union Pacific lines.

Samuel Carpenter, formerly General Eastern Passenger Agent of the Pennsylvania, died at his home in New York on January 7. When he retired, a year ago, Mr. Carpenter had served on the Pennsylvania for 49 years.

Albert A. Folsom, Treasurer of the Eastern Railroad Association, died at his home in Brookline, Mass., December 24, at the age of 73. Mr. Folsom was for many years Superintendent of the Boston & Providence before it was merged in the Old Colony, having entered the service of that road in 1854.

Arthur G. Stanwood, Assistant Treasurer of the Chicago, Burlington & Quincy, died at his home in Boston, Mass., December 31, at the age of 58. Mr. Stanwood had spent the whole of his business life in the service of the Burlington road, having begun as a clerk in the Boston office. From that position he was rapidly promoted until he became Auditor. He had been Assistant Treasurer seven years.

Enos H. Tucker, who was a prominent figure in railroad life in Massachusetts for over 40 years, died at Needham, Mass., December 30, at the age of 93. Mr. Tucker began his railroad service on the Norfolk County Railroad in 1849 and had served on the Boston & Providence and on the New York & New England under its various names. He was for many years Superintendent of the Woonsocket division, retiring about 10 years ago.

Elmer E. Hill, Commissioner of the Colorado Car Service Bureau, died at his home in Denver last week Wednesday after a brief illness. He is survived by a widow and three children. Mr. Hill was born at Pleasant View, Ohio. He had been demurrage commissioner at Denver about ten years. Before that he was at Omaha. The Omaha demurrage bureau, established in 1888, was the first important institution of the kind in the country, so that Mr. Hill was the pioneer manager in this important reform.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society, January 8, the subject for discussion was the Use of Reinforced Concrete in Engineering Structures.

Canadian Society of Civil Engineers.

At the meeting of this society January 9, there was a discussion on Water Wheels in continuation of the discussion on the paper by W. Kennedy, Jr., which was read November 14.

International Master Boiler Makers' Association.

The Secretary wishes us to announce that the International Railway and Master Steam Boiler Makers' Association having consolidated, there is now only one association, the International Master Boiler Makers' Association, which will hold its next convention in Detroit, Mich., May 26-28, 1908. The officers are: George Wagstaff, President (N. Y. C.), Buffalo, N. Y.; E. S. Fitzsimmons, First Vice-President (Erie), Galion, Ohio; E. J. Hennessy, Second Vice-President (N. Y. C.), Depew, N. Y.; W. M. Wilson, Third Vice-President, Chicago, Ill.; E. W. Rogers, Fourth Vice-President (Am. Loco. Co.), Paterson, N. J., and Peter F. Flavin, Fifth Vice-President (Standard Ry. Co.), St. Louis, Mo. The Executive Committee is composed of: G. W. Bennett (N. Y. C.), West Albany, N. Y., D. G. Foley, Green Island, N. Y.; P. J. Conrath, St. Louis, Mo., A. N. Lucas, Milwaukee, Wis., and James J. Fletcher, Toronto, Ont. Harry D. Vought, Secretary, 62 Liberty street, New York, and Frank Gray, Treasurer, Bloomington, Ill.

Railway Signal Association.

The next meeting of this association will be held in lecture room No. 6, Engineering Societies building, 29 West 39th street, New York City, on Tuesday, January 14. At the morning session, 10 a.m., the subject to be discussed is the report of Committee No. 4, Automatic Block Signals, as presented at the annual meeting, at Milwaukee, and there accepted as a progress report without discussion. At the afternoon session, at 2 p.m., there will be a paper by F. R. Cook on Economical Operation of Electric Signals and Care and Maintenance of Storage Batteries; also the report of Committee No. 3, Electric Interlocking, beginning at No. 60, page 23, Advance Notice No. 5, 1907.

At the Executive Committee meeting on December 2, 1907, it was voted that dues for representative members for 1908 should be $1 per vote per annum. Instructions to committees are to be published in the annual proceedings. Proceedings for 1908 are to be published as follows: Subjects for March meeting to be mailed February 25; subjects for May meeting to be mailed May 1; subjects for September meeting to be mailed August 15. Advance notice of annual meeting to be mailed two weeks in advance of date of meeting; discussion at annual meeting to be mailed December 20. The September meeting is to be devoted to reading of papers presented and accepted by the Executive Committee; no reports of committees for annual meeting to be discussed.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Astoria & Columbia River.—F. B. Clarke has been chosen President in place of C. M. Levey.

Boston & Albany.—See New York Central & Hudson River.

Cincinnati, Hamilton & Dayton.—A. J. Anderson has been appointed Comptroller, with office at Cincinnati.

Cuba Eastern.—Edgar VanEtten, who has resigned his position on the New York Central, has been appointed President of the Cuba Eastern. The chief operating office of this road is at Guantanamo, Cuba.

Georgia & Florida.—F. Q. Brown has been elected First Vice-President; office at New York City. E. L. Bemiss has been elected Second Vice-President; office at Richmond, Va. W. H. Alexander is Auditor; office at Augusta, Ga.

Grand Trunk.—N. J. Power, Assistant Auditor, with office at Montreal, Que., has been appointed General Auditor, in place of H. W. Walker, who has been retired on pension after over 50 years in the company's service.

New York Central & Hudson River.—Edgar VanEtten, Vice-President in charge of operation of the Boston & Albany, has resigned. See Cuba Eastern.

New York Central Lines.—Alexander S. Lyman has been appointed General Attorney of the New York Central & Hudson River and of its leased and operated lines east of Buffalo, except the Boston & Albany. Clyde Brown has been appointed General Solicitor of this company and of its leased and operated lines east of Buffalo, and also of the Lake Shore & Michigan Southern, the Michigan Central, the Cleveland, Cincinnati, Chicago & St. Louis, the Chicago, Indiana & Southern, the Indiana Harbor Belt and the Lake Erie & Western. He will have charge of legal matters relating to interstate commerce and traffic. Charles C. Paulding has been appointed Solicitor of the N. Y. C. & H. R. and of its leased and operated lines east of Buffalo, except the Boston & Albany. He will have charge of legislative matters. Messrs. Glennon, Cary, Walker & Howe have been appointed General Attorneys of the Lake Shore & Michigan Southern and the C. C. C. & St. L., with office at LaSalle street station, Chicago. They will have charge of legal matters at Chicago and in its vicinity. Leonard J. Hackney has been appointed General Counsel of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Cincinnati. Henry Russell has been appointed General Counsel of the Michigan Central, with office at Detroit.

New York Public Service Commission, First District.—George S. Coleman has been appointed Counsel to the Commission, in place of A. E. Blackmar. Office at New York City.

New York State Public Service Commission, Second District.—William A. Sutherland, of Rochester, has been appointed Counsel, with office at Albany, N. Y.

Pere Marquette.—J. L. Cramer has been appointed Vice-President and Comptroller, with office at Detroit, Mich. J. E. Howard has been appointed Secretary and Treasurer. While the P. M. and the Cincinnati, Hamilton & Dayton were operated jointly these men held similar positions at Cincinnati.

Portland & Seattle.—F. B. Clarke has been elected President, instead of Assistant to the President, as previously reported.

Seaboard.—S. L. Kamps was on December 27 appointed Assistant to the President, with office at Norfolk, Va.

Seaboard Air Line.—S. Davies Warfield and R. Lancaster Williams, appointed last week Receivers of this road, have designated President W. A. Garrett as Chief Executive Officer for the Receivers.

South Side Elevated (Chicago).—C. V. Weston, Chief Engineer, has been elected President and General Manager, succeeding M. Hopkins, deceased.

Toledo Terminal Railroad.—This company, successor of the Toledo Railway & Terminal Co., was organized at Toledo December 31. The President is H. B. Ledyard, of the Michigan Central. General Manager, Thomas B. Fogg, is reappointed.

Operating Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

Atchison, Topeka & Santa Fe.—W. F. Buck, Mechanical Superintendent, at Topeka, has been promoted to the position of Superintendent of Motive Power, with office at Chicago, succeeding Alfred Lovell, resigned.

Atchison, Topeka & Santa Fe Coast Lines.—J. Kinnucan has been appointed Superintendent of Terminals at San Francisco, Cal.

Baltimore & Ohio.—Thomas Fitzgerald, General Manager, has resigned, but reports are uncertain as to whether he is to retire from the service of the company or is to be appointed to some other position.

Brookhaven & Pearl River.—W. H. Sullivan has been appointed General Manager, with office at Brookhaven, Miss., succeeding E. C. Enochs.

K. A. Smith has been appointed Assistant General Manager, with office at Bogalusa, La. F. L. Curtis is Superintendent; office at Brookhaven.

Canadian Northern Ontario.—C. W. Spencer, General Manager of this road and of the Canadian Northern Quebec and other Mackenzie & Mann lines east of Fort William, has resigned. See Halifax & Southwestern.

Canadian Northern Quebec.—See Canadian Northern Ontario.

Canadian Pacific.—R. R. Jamieson, who was recently appointed General Superintendent of the Central division of the Canadian Pacific, with office at Winnipeg, Man., was promoted to that office from the General Superintendency of the Western division, which he had held since 1903. Mr. Jamieson was born in Wentworth county, Ont., and began his railroad service on the Great Western of Canada as telegraph operator in 1873. He subsequently went to the Grand Trunk and afterward for two years was engaged in the construction of telegraph lines in Indiana. After that he returned to Canada as agent and subsequently as despatcher on the Credit Valley road.

R. R. Jamieson.

That road was absorbed by the Canadian Pacific and from 1890 to 1896, Mr. Jamieson was Assistant Superintendent on the C. P. He was successively promoted to the positions of Superintendent of the Eastern division and of the Crow's Nest branch, and in 1903, as before stated, to the General Superintendency at Calgary.

Chicago & Alton.—C. A. Goodnow, General Manager, has resigned and the position has been abolished. The authority of P. Houlahan, General Superintendent of the Toledo, St. Louis & Western, has been extended over the Alton, and his office will be at Chicago.

E. V. Dexter, General Inspector of Fuel, Equipment and Material, has resigned.

Detroit, Toledo & Ironton.—J. H. Fraser, heretofore Superintendent at Springfield, Ohio, has been appointed General Superintendent of this road and of the Ann Arbor Railroad and Steamship Lines, with office at Toledo, Ohio.

Grand Trunk.—James McCowan has been appointed General Car Accountant, with office at Montreal, Que., in place of W. H. Rosevear, retired on pension after 53 years in the service of the company.

W. H. Farrell has been appointed Superintendent of Terminals at Toronto, Ont.

Halifax & Southwestern.—W. B. Barclay has been appointed General Manager, with authority over the Mackenzie & Mann lines in the Maritime Provinces, including the Inverness Railway & Coal Company's line.

Houston Belt & Terminal.—J. R. Dillon has been appointed Superintendent.

Hudson & Manhattan.—Edward M. Hedley, heretofore with the General Electric Company, has been appointed General Superintendent of the Hudson & Manhattan. This company will soon open a line beneath the Hudson river between Hoboken and New York.

Mexican Central.—J. S. Reddoch has been appointed Superintendent at Aguascalientes, in place of J. H. Clegg. R. M. Elliott has been appointed Superintendent at Gomez Palacio. J. J. Lewis has been appointed Superintendent of Terminals at Tampico.

Northern Pacific.—G. A. Goodell has been appointed General Superintendent of the lines between Mandan, N. Dak., and Trout Creek, Mont., with office at Livingston, Mont.

Peoria & Eastern.—Thomas Hayes has been appointed Trainmaster at Bloomington, Ill., in place of W. F. Schaff.

Toledo, St. Louis & Western.—J. F. Clement, heretofore Superintendent of Telegraph, has been appointed Superintendent, with office at Frankfort, Ind. P. H. Houlahan, General Superintendent, who now has charge of the Chicago & Alton also, has moved to Chicago.

Tonopah & Tidewater.—W. W. Cahill, Assistant Superintendent, has been appointed Superintendent; office at Ludlow, Cal.

Washington, Idaho & Montana.—J. D. Morrissey has been appointed Superintendent, in place of J. D. Sullivan, office at Potlatch, Idaho.

Traffic Officers.

Brookhaven & Pearl River.—H. C. Homeyer has been appointed General Freight and Passenger Agent, with office at Brookhaven, Miss., in place of W. J. Helmick, resigned.

Chicago, Peoria & St. Louis.—C. W. Galligan has been appointed General Freight Agent. Office at St. Louis, Mo.

Chicago, Rock Island & Pacific.—A. D. Murray has been appointed General Agent at St. Louis, Mo.

Evansville & Terre Haute.—D. H. Hillman, General Freight and Passenger Agent, has resigned.

Gulf, Colorado & Santa Fe.—J. R. Dillon, Assistant General Freight Agent, has resigned. See Houston Belt & Terminal.

Mississippi Central.—R. D. Reeves has been appointed General Freight Agent, with office at Hattiesburg, Miss., in place of W. P. Emerson, resigned to become Secretary of the New Orleans Traffic Association.

Missouri, Kansas & Texas.—J. L. West, Assistant General Freight Agent, with office at St. Louis, Mo., has been promoted to the place of F. A. Leland, with the same title, Mr. Leland having resigned to become Chairman of the Southwestern Tariff Committee. W. W. Miller, Assistant General Freight Agent at Kansas City, succeeds Mr. West at St. Louis, and R. F. Campbell, heretofore commercial agent at Joplin, takes the place of Mr. Miller at Kansas City.

R. W. Hockaday has been appointed General Freight and Ticket Agent in Kansas, with office at Parsons.

Missouri Pacific.—B. Howard Payne has been appointed General Passenger and Ticket Agent, with office at St. Louis, Mo., in place of H. C. Townsend, resigned. W. H. Blssland has been appointed Assistant General Passenger and Ticket Agent, with office at St. Louis, succeeding Mr. Payne.

Southern.—L. A. Emerson, Assistant General Freight Agent at Charleston, S. C., has resigned and the office is abolished.

Engineering and Rolling Stock Officers.

Arkansas, Louisiana & Gulf.—E. G. Courtney has been appointed Master Mechanic of this new road, which has been built from Monroe, La., to Wardville, 30 miles.

Canadian Pacific.—Grant Hall has been appointed Superintendent of Motive Power of Western Lines, with office at Winnipeg, Man.

Chicago, Burlington & Quincy.—Joseph W. Cyr has been appointed Master Mechanic at Hannibal, Mo., in place of Isaac N. Wilber, resigned.

Chicago Great Western.—W. P. Chrysler, Master Mechanic at Oelwein, Iowa, has been appointed to the new office of Superintendent of Motive Power, with office at Oelwein, Iowa, succeeding to the duties of J. E. Chisholm, General Master Mechanic, resigned.

Grand Trunk.—James Coleman has been appointed Superintendent of the Car Department, with office at Montreal, Que., in place of William McWood, retired on pension after 52 years in the service of the company.

Illinois, Iowa & Minnesota.—H. S. Rogers, Engineer of Maintenance of Way, has resigned to go to another road, and the office has been abolished.

International & Great Northern.—O. H. Crittenden, Resident Engineer at Palestine, Tex., has been made Consulting Engineer.

Lake Shore & Michigan Southern.—O. M. Foster has been appointed Master Mechanic of the Michigan Southern division, with office at Elkhart, Ind., in place of M. J. McCarthy, resigned to go to the C., C., C. & St. L. as Superintendent of Shops at Beech Grove. John T. Carroll has been appointed Assistant Master Mechanic at Elkhart, succeeding Mr. Foster.

Mexican Central.—W. J. Dempster has been appointed Master Mechanic of the Monterey division, in place of J. A. Lewis, transferred. R. N. Millice has been appointed Master Mechanic of the Aguascalientes division in place of R. D. Gibbons, transferred. L. G. Wallace has been appointed Acting Master Mechanic at Guadalajara in place of R. N. Millice, promoted.

New York Central & Hudson River.—George H. Haselton, heretofore Division Superintendent of Motive Power at West Albany, has been appointed Assistant Superintendent of Motive Power, with office at New York City. Eben A. Walton, hitherto Division Superintendent of Motive Power at Oswego, succeeds Mr. Haselton at West Albany.

Rio Grande, Sierra Madre & Pacific.—J. M. Barnes has been appointed Master Mechanic, office at Ciudad Juarez, Mex.

Texas Midland.—N. L. Smitham, formerly Master Mechanic of the

Texas Central has been appointed Master Mechanic of the Texas Midland, with office at Terrell, Tex., in place of O. W. Lewis, resigned.

Purchasing Agents.

Buffalo & Susquehanna.—B. D. Falsett has been appointed Purchasing Agent, with office at Buffalo, N. Y.

Chicago, Peoria & St. Louis.—E. A. Williams, General Passenger Agent, will henceforth have charge of purchases also, C. H. Besler, Purchasing Agent, having resigned.

Waterloo, Cedar Falls & Northern.—A. I. Breckenridge has been appointed Purchasing Agent, with headquarters at Waterloo, Iowa.

LOCOMOTIVE BUILDING.

The Delaware, Lackawanna & Western was recently in the market for 52 locomotives, but has postponed the order.

CAR BUILDING.

The Chicago Consolidated Traction is in the market for 500 or more cars.

The Little Rock & Pine Bluff has ordered 15 closed electric cars from the Jewett Car Co.

The Lehigh & New England is asking bids on 1,000 thirty-ton box cars and 250 forty-ton gondolas.

The Colorado & Southern is figuring on 12 interurban combination baggage and passenger cars for the Denver & Interurban.

The Chicago-New York Electric Air Line has ordered two electric cars from the Danville Car Co. for March delivery. These cars will measure 40 ft. 6 in. long and 8 ft. 5 in. wide.

The Waterloo, Cedar Falls & Northern, as reported in the *Railroad Gazette* of January 3, has ordered two interurban and ten 10-bench open cars from the McGuire-Cummings Co. for January and May delivery. The interurban cars will weigh 46,000 lbs. and will measure 52 ft. long and 8 ft. wide, inside measurements. The open cars will weigh 30,000 lbs. and will measure 31 ft. long, inside measurement. The special equipment for all cars includes:

Heating system, for interurban	Baker
Paint	Sherwin-Williams
Trucks, for interurban	McGuire-Cummings
Trucks, for open cars	Taylor
Wheels	Griffin

The New York, New Haven & Hartford, as reported in the *Railroad Gazette* of December 27, has ordered 10 blind end baggage cars, 10 unvestibuled baggage and smoking cars, five vestibuled smoking cars, three unvestibuled smoking cars, 27 unvestibuled passenger cars and one mail and letter car from Osgood Bradley & Sons for 1908 delivery. The blind end baggage cars will measure 60 ft. long, 8 ft. $11\frac{3}{8}$ in. wide and 9 ft. high, inside measurements, and 63 ft. $3\frac{1}{2}$ in. long, 10 ft. $\frac{1}{4}$ in. wide and 14 ft. high, over all. The unvestibuled baggage and smoking cars will weigh 78,000 lbs. and will measure 60 ft. 2 in. long, 8 ft. $11\frac{1}{2}$ in. wide and 9 ft. high, inside measurements, and 68 ft. 8 in. long, 10 ft. $\frac{1}{4}$ in. wide and 14 ft. high, over all. The vestibuled smoking cars will weigh 83,500 lbs.; the unvestibuled passenger cars, 77,700 lbs.; and the unvestibuled smoking cars, 78,000 lbs. All these cars have the same measurements as the unvestibuled baggage and smoking cars. The mail and letter car will measure 61 ft. $10\frac{3}{8}$ in. long, 9 ft. $\frac{5}{8}$ in. wide and 9 ft. high, inside measurements, and 64 ft. 10 in. long, 10 ft. $\frac{1}{4}$ in. wide and 14 ft. high, over all. Bodies and underframes of all cars will be of wood. The special equipment for all cars includes:

Bolsters	Commonwealth
Brake-beams	Diamond special
Brake-shoes	Diamond S steel back, flanged
Brakes	Westinghouse
Brasses	Magnus metal
Couplers	Buhoup 3-stem
Curtain fixtures	Forsyth
Curtain material	Pantasote
For unvestibuled baggage and smoking cars, vestibuled smoking cars, unvestibuled passenger and unvestibuled smoking cars.	
Draft rigging	Sessions Standard, friction
Dust guards	Harrison
Heating system	Gold direct steam
Light	Commercial Acetylene
Platforms	Standard Coupler Co.
Roofs	Canvas
Trucks	Four-wheel
Vestibules	Buhoup blind end (for blind end baggage cars and mail and letter cars), Buhoup wide (for vestibuled smoking cars)
Wheels	Paige plate, steel tires

The New York, Chicago & St. Louis, as reported in the *Railroad Gazette* of December 27, has ordered 1,000 box cars of 80,000 lbs. capacity from Haskell & Barker, for February delivery. These cars will weigh 35,500 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The special equipment includes Janney couplers and Haskell & Barker bolsters, brake-beams, brake-shoes, brasses, door fastenings, doors, draft rigging and dust guards.

RAILROAD STRUCTURES.

BEAVER, PA.—Plans have been made by the Pittsburgh & Lake Erie for building a steel bridge over the Beaver river.

BIRMINGHAM, ALA.—The Southern Railway, it is said, is double-tracking from Decatur Junction, for three miles and will build two new steel bridges over the Tennessee river. The Louisville & Nashville has the joint use of this track. The cost of the improvement is about $500,000.

DENVER, COLO.—Action will soon be taken by the city authorities towards building the 19th street viaduct.

EDMONTON, ALB.—It is estimated that the cost of a proposed steel bridge for the Grand Trunk Pacific over the Pembina river west of this place will be about $250,000.

ELKHART, IND.—The Lake Shore & Michigan Southern, it is said, has bought about 25 acres of land as a site for new shops here.

FORT WILLIAM, ONT.—Contract is reported let to Barnett & McQueen at about $600,000 for rebuilding the Canadian Pacific elevator here.

KAYLOR, PA.—New car shops, it is said, are to be built by the Western Allegheny Railroad.

MINNEAPOLIS, MINN.—The Chicago, Milwaukee & St. Paul will put up a 16-stall steel addition to its engine house here.

NEW WESTMINSTER, B. C.—The plans for the steel bridge to be built over the north arm of Fraser river provide for a combined highway and street railway bridge.

OWENS, WIS.—The Fairchild & North-Eastern has given a contract to the Hennepen Bridge Company for putting up a steel bridge here.

PITTSBURGH, PA.—The Pittsburgh & Lake Erie is planning to put up a new freight station here.

ROCHESTER, N. Y.—Announcement is made by Mayor Cutler that the New York Central has appropriated $1,500,000 for a new passenger station here. About seven acres and a half of land adjoining the present station in Central avenue have been bought, so that the entire site will comprise $11\frac{1}{2}$ acres. The plans provide for a building to cost $1,100,000 east of Clinton avenue. The present station is west of Clinton avenue.

TOPOLOBAMPO, MEX.—It is stated that the Mexican government will join the Kansas City, Mexico & Orient in converting Topolobampo into a first-class port. It is estimated that more than $15,000,000 gold will be spent in making the improvements planned, of which the K. C., M. & O., under the terms of the concession for which it has made application, agrees to furnish two-thirds. The railroad has bought Momocahui Island, at the entrance of the port, on which great terminal yards will be situated. Six steel piers will be constructed and the road will fill in the low places on the northern side of the harbor for about three miles.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—This company recently began operating a new track known as the Alberton cut-off on the old main line, from Davis, Md., east to Hollofields, four miles, completing the rebuilding of the old main line and making it a low grade line from Relay, Md., to Washington Junction. About three-quarters of a mile was saved and about 542 deg. of curvature eliminated. The maximum curve between these two places was reduced from 12 deg. to 7 deg., and westbound grade was reduced from .9 to .5 per cent., the eastbound to .3 per cent. The work, which took about two years to finish, cost about $750,000, and included a tunnel at Dorsey's, 1,025 ft. long, double-tracked and lined with brick, with stone portals; also a tunnel at Davis 498 ft. long, also double-tracked and lined with brick, with stone portals. Two deck girder bridges were also built on stone piers and abutments. The bridge at Davis has two spans, one of 90 ft. and one of 98 ft., and the bridge at Alberton three 90-ft. spans, one 100-ft. and one 26-ft. span. T. A. Shoemaker & Co., Philadelphia, were the contractors.

All trains will soon be operated over the new double-track line now building between Sterling, Ohio, and Nova, on the New Castle division, 15 miles. Over 2,000,000 yards of grading has been done in constructing this new line, and some 10,000 yards of stone arch and bridge masonry erected. All the bridges and viaducts are arched and have ballasted tops. Double-track passing sidings are located just east of Lodi and at Homer. The new double-track between Nova and Sullivan and between the point of divergence east of Lodi and Sterling has been in operation for some time.

Brooklyn Rapid Transit.—During the year 1907 this company added 4,150 ft. of double track as follows: From Livingston and Court streets, in the Borough of Brooklyn, to Flatbush avenue, 3,400 ft., and on Lafayette avenue from Flatbush to Fulton street, 750 ft. On the Brighton Beach line the company has laid third and fourth tracks from Church avenue to Neptune avenue, 24,215 ft.

Cairo & Kanawha.—An extension of this road is projected from MacFarlan, W. Va., to Smithville, eight miles.

Canada West Coal Companies Railroad.—Announcement is made that this company, the head office of which is at St. Paul, Minn., will build a line to haul coke from Butte, Mont., north to the smelters at Calgary, Alb.

Central Ontario.—Contracts have been given by this company to build an extension from Maynooth, Ont., to Lake St. Peter, eight miles; also from Lake St. Peter to Whitney, 19½ miles.

Grand Trunk Pacific.—This company, which has given contracts for building its entire line from Winnipeg, Man., west to Edmonton, Alb., 789 miles, and which finished track laying on 325 miles of main line and 28 miles of sidings on this section in 1907, is pushing the work. Much delay was experienced last fall on account of bad weather and scarcity of ties. Near Drumague, Sask., 160 men are at work. Mild weather permits good progress to be made. It is hoped to have this section finished by spring.

Great Northern.—Contract is reported let to F. P. Howard, of Maroon Valley, B. C., for work on the Vancouver, Victoria & Eastern, near Hedley, B. C.

Greenville & Knoxville.—This company is building an extension from Marietta, S. C., to River Falls, 11 miles, and has projected a further extension from River Falls to the North Carolina state line, 22 miles.

Ilwaco Railroad.—See Oregon Railroad & Navigation.

Kingsport & Bristol.—Surveys are reported made and contracts are shortly to be let for building this proposed line from Kingsport, Tenn., east about 30 miles to Bristol. F. A. Cothran is Chief Engineer.

Little Rock, Maumelle & Western.—This company, which built 16 miles of road last year in Arkansas, is making surveys for a 12-mile extension from Douglas.

Louisville & Atlantic.—Contracts have been given to Mason, Hanger & Coleman, of Richmond, Ky., and to the Canton Bridge Company, of Canton, Ohio, for building three miles of line for this company from Heidelberg, Ky., to Elk City. C. W. Moorman, Engineer Maintenance of Way, Richmond, Ky.

Louisville & Nashville.—The work on the Cumberland division reducing grades between Barbourville and Flat Lick, 3.10 miles, in Knoxville county, Ky., is about finished.

On the Kentucky division grading has been finished and second-track laid from Livingston to Berth, 2.60 miles; from East Bernstadt to Pittsburgh, 2.70 miles; from Little Laurel River to Frantz, 3.10 miles, and also from Lynn Camp Creek to mile post 172, one mile all in Kentucky.

During 1908 grading work and second track is to be laid on the Kentucky division from Perth to East Bernstadt, nine miles, and a new double-track line is to be built between Pittsburgh and Little Laurel River, 6.80 miles. A new double-track line is also to be built between Frantz and Lynn Camp Creek, 6.50 miles.

On the South & North Alabama between Graces, Ala., and Hardy, 17 miles, work is under way reducing grades and revising the line. A second track is also to be added, which will probably be finished early this year.

On the Pine Mountain Railroad between Clear Fork River, Ky., and Gatliff coal mines, 17 miles, it is expected to have grading work and track laid this year; also a branch diverging from this line at Yost to Mahan, 2.30 miles.

The Swan Creek Railway has laid track from Mount Pleasant, Tenn., for about four miles, leaving 13½ miles yet to be built to complete the line to Flanagan. It is expected to have the work finished early this year.

Nevada-California-Oregon.—This company is building with its own men an extension from Likely, Cal., to Alturos, 20 miles. A further extension is projected from Alturos to Lakeville, 60 miles.

New York, Auburn & Lansing (Electric).—This company, which is building an electric line from Auburn, N. Y., to Ithaca, 39 miles, has track laid from Auburn to Genoa, 19 miles, and during 1907 finished the section from Myers to South Lansing, 10.9 miles, and from Ithaca to McKinneys, 1.1 mile. Work is under way by the Auburn Construction Company from South Lansing to McKinneys, 4.1 miles. (July 26, p. 111.)

New York Subways.—The New York State Public Service Commission, First district, has approved the building of a subway from the south end of Manhattan Island northward, most of the way through Broadway as far as Eleventh street then under private property to Lexington avenue and thence northward to the Harlem river; beyond which the line branches; the western arm going to Woodlawn by way of Jerome avenue, and the eastern to Pelham Bay Park. The Commission has ordered plans and estimates prepared, but has taken no further definite action.

Oregon Railroad & Navigation.—Work is under way by this company finishing extension as follows: Between Elgin, Ore., and Joseph, on the remaining 56½ miles, and between St. John and Woodlawn on 1.80 miles;

On the Oregon, Washington & Idaho, between Riparia, Wash., and Lewiston, Idaho, 37 miles.

On the Ilwaco Railroad, between Ilwaco, Wash. and Knappton, 9.10 miles.

Oregon, Washington & Idaho.—See Oregon Railroad & Navigation.

Osceola, Little River & Western.—An extension has been projected by this company from Youngs, Ark., to Little River, seven miles.

Pine Mountain Railroad.—See Louisville & Nashville.

Pittsburgh, Shawmut & Northern.—This company has finished relocating its line from Paine, Pa., to Detsch, five miles. On this section the ruling grades have been reduced and 1,000 deg. of curvature have been eliminated.

Salt Lake & Ogden.—This company is building an extension from Ogden (Utah) city limits to Canyon, 5.60 miles.

South & North Alabama.—See Louisville & Nashville.

South & Western.—This company, which last year added 22 miles to the line it is building from Elkhorn, Ky., south to Bostick, N. C., expects to finish all the work from Dante in Russell county, Va., south to Bostick, during 1908. On this section grading is 70 per cent. finished, also the tunnel and masonry work.

Swan Creek Railway.—See Louisville & Nashville.

Vancouver, Victoria & Eastern.—See Great Northern.

Versailles & Sedalia.—This company has projected an extension from Ouachita, Mo., to Sedalia, 24 miles.

Virginia Air Line.—This company, which last year built 17 miles of railroad between Lindsay, Va., and Palmyra, has work under way on 13 miles. J. N. H. Cornell & Co., Gordonville, Va., are the contractors. W. Washabaugh, Chief Engineer, Charlotteville, Va.

Washington, Westminster & Gettysburg.—This company, which built 25 miles of its line between Washington, D. C., and Laytonsville, Md., last year, is making surveys to build three miles additional in the District of Columbia, with a terminus at 15th and H streets, N. E. The line will probably be operated by gasolene motor cars. J. B. Colegrove, President, Washington, D. C.

Wisconsin & Northern.—An extension is being built from Crandon, Wis., south three miles. Surveys made to extend the line from Van Ostrand, Wis., north to a point south of Crandon, 28 miles.

Woodville Railroad.—This company, which last year built four miles in Florida, has projected an extension from Lavender to Crawfordville, 10 miles.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—Gross earnings of the system increased slightly in November. Operating expenses were $1,250,000 larger, leaving a decrease of $1,180,000, or 37 per cent in net earnings; this with an increase of 151 miles in mileage operated. This decrease in net earnings followed a decrease of $1,210,000 in the month of October. For the five months ended November 30, gross earnings increased $2,800,000 and net earnings decreased $3,260,000.

Baltimore & Ohio.—See Chicago Terminal Transfer.

Boston & Maine.—This company has $1,000,000 5 per cent one-year notes outstanding which mature on January 15. Through R. L. Day & Co. these have been renewed at 6 per cent until January 6, 1909. Another $1,000,000 notes mature on February 15 and a third block of the same size on March 15.

Canadian Pacific.—An issue of $24,826,000 additional common (ordinary) stock is to be offered at par to stockholders of record January 14 on the basis of one share of new stock for each five shares held. Payments of 20 per cent each are to be made on or before February 19, April 21, June 19, August 19 and October 19. This issue was approved by the shareholders in special meeting on December 30.

Chicago & Illinois Western.—This road which has 17 miles of line in operation in the outskirts of Chicago and 37 miles under construction has made a mortgage covering $1,000,000 40-year 6 per cent. bonds. The proceeds are to be used for new construction.

Chicago Great Western.—A. B. Stickney, President of this company, and Charles H. F. Smith, of St. Paul, were on January 8 appointed receivers. This action was taken as a direct result of Mr. Stickney's failure to make arrangements in London to fund about $1,400,000 five-year sterling 5 per cent. notes which fall due this month. There are also about $2,000,000 more of these notes maturing this year and $1,000,000 notes maturing in 1909. Frank B. Kellogg, of St. Paul, who asked for the appointment of the receivers, said that notes to the amount of $515,000 had already gone to protest. There are no mortgage bonds issued on the 818 miles of the Chicago Great Western proper. It is the intention to create a $20,000,000 first mortgage bond issue on these main lines with which to fund the notes and other obligations outstanding and to double-track and improve the road, whose facilities have been insufficient for its traffic. Including the Mason City & Fort Dodge and the Wisconsin, Minnesota & Pacific component parts of the system, the Chicago Great Western operates 1,176 miles of road.

Chicago Terminal Transfer. The stockholders' protective committee has announced that the Baltimore & Ohio has not yet ratified the arrangement by which the committee was to sell not less than $1,500,000 of the $17,000,000 preferred stock of the Chicago Terminal Transfer at $25 a share. The committee, which represents upwards of $6,500,000 of the preferred stock, believes that the Burlington owns or controls about $7,500,000 of it. The offer of the Baltimore & Ohio has not been rescinded.

Cincinnati & Muskingum Valley.—See Pennsylvania Company.

Cincinnati, Hamilton & Dayton. A special meeting of the stockholders is to be held on February 7 to authorize an issue of $11,286,000 five-year 4 per cent. purchase money notes, whose proceeds are to be used for retiring the refunding mortgage 50-year 4 per cent. bonds of 1954, of which $11,557,000 are outstanding. The maturity of these bonds is to be changed from 1954 to 1913. Interest on them is not in default. This is a step toward the termination of the receivership.

Cleveland & Marietta.—See Pennsylvania Company.

Colorado & Southern.—With an increase of 178 miles, gross earnings for the month of November, 1907, were $1,422,241, an increase of $272,526; net earnings $546,139, an increase of $169,685. Gross earnings for the five months ended November 30 were $6,152,976, an increase of $898,204; net earnings $2,311,218, an increase of $386,538.

Gulf & Chicago.—See New Orleans, Mobile & Chicago.

Louisville & Nashville. Net earnings for the month of November decreased 45 per cent. from the net earnings for November, 1906. Gross earnings for November, 1907, were $3,900,000, a decrease of $171,000; operating expenses increased $450,000, leaving net earnings of $753,000, a decrease of $624,000. The operating ratio was 80.75 per cent., against 66.3 per cent. in 1906. For the five months from July 1 to November 30, 1907, the loss in net earnings was $735,500, only a little more than the decrease for the month of November alone.

Mobile, Jackson & Kansas City.—See New Orleans, Mobile & Chicago.

New Orleans, Mobile & Chicago. This is the name of a company which is to take over the Mobile, Jackson & Kansas City and the Gulf & Chicago, probably some time during the present month. Most of the bondholders of the two companies which are to be taken over have agreed to this action under a plan of reorganization by which securities of the old roads will be exchanged for those of the new company. The interest payments due January 1 on the bonds of the Mobile, Jackson & Kansas City and the Gulf & Chicago were not paid, but are to be funded with securities of the new company.

New York Central Lines. Gross earnings for the month of November were as follows:

	1907	Change	
New York Central & Hudson River	$7,876,736	Dec.	[illegible]
Lake Shore & Michigan Southern	3,717,084	Inc.	281,[illegible]
Lake Erie & Western	391,671	Dec.	[illegible]
Chicago, Indiana & Southern	[illegible]	Inc.	[illegible]
New York, Chicago & St. Louis	866,891		[illegible],787
Michigan Central	2,[illegible],998	Dec.	[illegible]
Cleveland, Cincinnati, Chicago & St. Louis	[illegible],068,060	Inc.	[illegible]
Peoria & Eastern	[illegible],718	Dec.	18,[illegible]
Cincinnati Northern	79,687		2,[illegible]
Pittsburgh & Lake Erie	1,277,367	Inc.	[illegible]
Rutland	260,277		[illegible]

New York City Railway. Frederick W. Whitridge was on January 6 appointed Receiver of the Third Avenue Railroad. In March, 1900, the Metropolitan Street Railway acquired control of the Third Avenue, then in the hands of a receiver, and shortly afterward leased it for 999 years, at the same time agreeing to pay, beginning in 1901, annual dividends of from 5 to 7 per cent. on its stock. In the course of the present receiverships of the New York City Railway and its leased company, the Metropolitan Street Railway, this guaranteed dividend has been defaulted. In December the receivers of the two controlling companies made a report on the condition of the Third Avenue Railroad, which showed that no charge had been made for depreciation of the property and that in consequence it was in bad condition.

New York, New Haven & Hartford.—The steamer lines running on Long Island Sound in which the New York, New Haven & Hartford is interested are now operated by two companies. The New England Steamship Company operates the lines which are directly owned and the United States Transportation Company operates the lines of which the New Haven's control is not so definite. The New England Steamship Company on January 1 opened an all-water freight line between New York and Boston. There are to be three sailings a week from each city, and the trip is to be made in 20 hours. The steamers "Bunker Hill," "Old Colony" and "Massachusetts" are to be used on this route.

Ohio Connecting.—See Pennsylvania Company.

Pennsylvania Company.—In the table published in the *Railroad Gazette* of January 3, 1908, page 11, showing new railroad capital authorized or issued during the calendar year 1907, through a mistake, the Pennsylvania Company was shown to have issued $50,000,000 three-year 5 per cent. collateral improvement notes, which refunded a like amount of 4½ per cent. notes due November 1. The Pennsylvania Company, however, did not issue any obligations during the year 1907, and the $50,000,000 collateral improvement notes which matured November 1 of that year were paid off and canceled. The $50,000,000 notes maturing November 1, shown to have been refunded by the issue of $60,000,000 notes by the Pennsylvania Railroad, were the Pennsylvania Company's notes already referred to, which matured November 1.

Increased annual dividends on stocks of subsidiary companies were declared at the end of 1907 as follows: Cincinnati & Muskingum Valley, 4 per cent., the rate having been 2 per cent. since 1900; Ohio Connecting Railway, 7 per cent., rate in 1906 being 5 per cent.; Cleveland & Marietta, 4 per cent., rate in 1906 3 per cent.; Toledo, Walhonding Valley & Ohio, 2 per cent., none paid in 1906.

Seaboard Air Line. On application of the attorneys of this company in a bill stating that there was due on January 1, 1908, on bonds and equipment notes $765,000, and for taxes, traffic balances, pay-rolls, supplies and other claims, many of them overdue, more than $2,000,000, besides a floating indebtedness of about $3,000,000, all of which the company was without funds to meet, the United States Circuit Court for the Eastern district of Virginia on January 2 appointed S. Davies Warfield and R. Lancaster Williams, receivers of the Seaboard Air Line Railway. Mr. Warfield is President of the Continental Trust Company of Baltimore, which is trustee under the first mortgage, and probably represents the Ryan-Blair interests, which have controlled the company. Mr. Williams is a brother of John Skelton Williams, formerly president, and for the past three years a bitter critic of the company's policies. The receivers have been given authority to borrow money to pay the bond interest and the amount due on equipment notes. The object of the receivership was to maintain the system intact pending reorganization. The company had no funds nor credit on which to borrow, and therefore a receivership was necessary in order to protect it from disintegration.

Southern.—Gross earnings for November decreased slightly and net earnings showed a decrease of 9 per cent. The December results are understood to have been still more unfavorable, but the current month shows better results both in gross and net earnings.

Tallulah Falls.—W. S. Irwin, General Manager, and J. R. Adams were on January 7 appointed temporary receivers of the Tallulah Falls Railway, on application of H. H. Dean, of Gainesville, Ga., in a bill alleging that there are current floating debts amounting to over $10,000. The road runs from Cornelia, Ga., on the Southern Railway, north to Franklin, N. C., 57 miles.

Third Avenue Railroad.—See New York City Railway.

Toledo & Indiana (Electric). This company has postponed payment of the semi-annual interest due January 1 on its $1,650,000 first mortgage 5 per cent. bonds. Many of the bonds are held by the directors of the company and it is therefore believed that a receivership will be avoided.

Toledo, Walhonding Valley & Ohio.—See Pennsylvania Company.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

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The most striking feature in the railroad situation of the country, viewed on its financial side, is its reversion, during the last few weeks of stress in the money market, from abnormal to normal symptoms with the inexorable laws of political economy now asserting themselves. Men were wondering a few months ago at steadily falling prices of railroad securities in the face of a great volume of business and increased railroad earnings, both gross and net, coupled with a general condition of prosperity throughout the country, and actual failures few and insignificant. Corporation "baiting" but partly explained the anomaly. It was an element, but an insufficient cause. But a brief period of semi-panic has brought us back to the natural and logical sequels of such a period. Prosperity has somewhat receded. Railroad earnings have dropped in gross, and roads not returning a positive decrease have failed to maintain a normal gain; and net earnings, owing to rise of operating expense, have decidedly fallen. The two things that differentiate the situation from earlier epochs of sudden depression are, first, its impact at a time of high expense and large loans for improvements, and, secondly, its recovering just after a general increase of railroad wages. The problems ahead are: how can improvements be held up or curtailed? how can imperative improvements be financed? and how can fixed charges and dividend requirements be met without the risk of labor troubles by reducing wages at a time when labor is highly organized and assertive. But the gloom is far from encircling, and rational optimism has also its kindly lights. It can point to financial conditions at the New York center oscillating upward where they were lately downward; to the few defaults in interest and dividends and only a small proportion of those defaults in railroads; to the fact that past prosperity has also made operating economy more feasible in such matters, for example, as more concentrated train service; to the facts that, even if later the question of reduced wages must be faced, it will be after labor has had its warnings and may be amenable to a situation, if not to reason, while the halting of improvements is far easier when the traffic that calls for them is ebbing than when traffic is "balled up" for lack of rolling stock or a second track. Finally, in the list of benign forecasts, is the chastened spirit to be observed at one end of Pennsylvania avenue.

A letter from a subscriber who is a car foreman on one of the large roads says the majority of passenger car repair shops are not up to the times for handling work. This was after a trip, taken something more than a year ago, in which the shops of a number of roads and manufacturing concerns were visited. No one will be inclined to dispute this assertion with regard to any but the newer shops, which doubtless constitute the minority that by inference our correspondent considers up-to-date. In this connection a glance at the latest practice, which is probably best exemplified in the Union Pacific car department at Omaha, now being rebuilt, will be of interest. Its arrangement and equipment were planned to minimize waste of time and labor, and to establish a system of routing work to avoid unnecessary handling and have a continuous forward movement. The department will have the sub-store feature to facilitate delivery of material. The coach shop has a 60-ton overhead traveling crane for removing and replacing trucks beneath cars. The wheel and truck shop has overhead traveling cranes for handling trucks and heavy material. There are electric trolleys and electric derrick cars for moving wheels and axles to and from the storage platforms and in the shops. A 10-ton electric crane spanning three tracks will be used for unloading wreckage and handling heavy material. The transfer table has the unusual length of 90 ft., which is 15 ft. greater than present general practice. The shop equipment will include the latest machinery to effect all possible saving in the cost of producing finished material and turning out work. As compared with the locomotive department, the car department problem is a simple one. Paramount considerations are: rapid and efficient distribution of material, and a continuous forward movement of the work. Yard cranes, telphers and overhead shop cranes are effective agents in the accomplishment of these objects, and have been employed in the Union Pacific plant more fully than in any previous instance. This does not, however, imply the neglect of industrial tracks for the movement of material. With these features well worked out, and suitable planing mill, forge shop and storage facilities, the rest is largely a matter of organization and methods.

The Great Central and the Great Northern are two English railroads which serve almost exactly the same territory and for the past 14 years have been strong competitors. They are now to be united under a working agreement which, according to the English custom of great publicity in such matters, is to be submitted to the shareholders of each company and after being there approved, to the Railway and Canal Commission. This consolidation—for apparently it amounts to nothing less—is brought about by the simple device of appointing the boards of directors of the two companies as a joint committee to manage the two properties. A working arrangement has been in force since the beginning of 1905 between the London & North Western and the Lancashire & Yorkshire which has resulted in greater efficiency and economy of operation to the railroads and better service to the public. Judging from similarity of their territories, a like arrangement between the Great Central and the Great Northern should also be effective in producing these same results. Both roads run from London north to York, each with a network of branch lines reaching very much the same points, including Sheffield Manchester, Liverpool, Leeds, Lincoln and the port of Grimsby on the east coast. There are in fact only four important towns on each system which the other does not reach either directly or by trackage rights. The Great Central has 1,072 miles of line and the Great Northern 1,257. The Great Central has gross earnings of \$10,700,000 and net earnings of \$3,600,000, against gross earnings of \$11,800,000 and net earnings of \$5,000,000 for the Great Northern. The history of the two companies is strikingly different. The Great Central was built about 1846 and was originally an east and west line running from Liverpool on the west coast across the country to Grimsby. The Great Northern was built from London north to Doncaster, which is on this cross-country line of the Great Central, in 1850. As long as the two lines were thus distinctive in their functions—one an east and west, the other a north and south railroad—they were close allies, but in 1891 the Great Central, under its then name of the Manchester, Sheffield & Lincolnshire, began to promote an extension to London, which was opened for passenger traffic in 1899. As a result of this move in 1893 the close alliance between the two companies was broken and the Great Central and the Great Northern became sharp competitors. The Great Central, however, under its old charter granted in 1858 when it was an east and west line only, was specifically authorized to unite with the Great Northern. Meanwhile the recent competition of the two roads resulted in duplication of facilities, particularly freight facilities, in a number of important towns. Recently, however, the Great Central has built a short line connecting with the Great Northern at a point not far north of London over which through trains are now being run between the southwest and the northeast of England. This evidence of co-operation has been followed by the announcement of the proposed consolidation of the two companies.

Statistics of the freight carried on the German railroads give striking evidence of the growth of productive industries in the Empire; a growth which has been surpassed probably only in this country. We discussed the growth of freight traffic in the United States in the *Railroad Gazette* of Sept. 27 last, when it appeared that the number of ton-miles increased from 173,221 millions in 1903 to 215,878 millions in 1906—24.6 per cent.—within three years. The German statistics give tons shipped and not ton-miles, which are sufficient as statistics of production, and in that country, where the average distance carried does not vary much from year to year, is sufficiently accurate as statistics of transportation. This increase in tons was from 315 millions in 1903 to 379 millions in 1906—64 millions, or 20 per cent., in the same three years. That this increase should be so near ours may seem surprising. It has not, however, been nearly so difficult for the railroads to handle as the growth here, for the reason that it has been much more regular. The increase here was less than 1 per cent. from 1903 to 1904; in Germany it was full 4 per cent. The next year freight traffic grew 7.4 per cent. here and 6 per cent. there; while from 1905 to 1906 we had to provide for an increase of 15.9 per cent.; the German railroads for one of 8.9 per cent. In the two years since 1904, the German railroads had an increase of 15.5 per cent., and ours an increase of 23.7 per cent., the growth here being greater in the later year than in Germany for the two years. Of course the absolute quantities carried are enormously greater in this country than in Germany, and if we go back to 1902, we find that the *increase* in four years in tons (not ton miles) shipped by rail in the United States (431 millions) exceeded the *total* carried in Germany in 1906 (379 millions). This little problem, to provide in four years for a new freight traffic greater than that of the whole German Empire, is what our railroad managers have had to worry over. Doubtless they would have solved it much more satisfactorily if the growth had been at a somewhat regular rate, instead of 1 per cent in one year and 16 per cent. in another The average haul being longer here, a given amount of production causes an amount of transportation larger in proportion than in Germany But compared with population, the number of tons shipped is astonishingly large here, where about 86 millions of people shipped 1,631 million tons of freight in 1906, which in Germany 60 millions shipped 379 million tons—19 tons per inhabitant here against 6.3 tons there. In both countries, the same ton is doubtless often counted twice A through shipment over several connecting railroads is now counted but once here as well as there; but there is a large amount of freight which is shipped to a distributing point, there held in store, and later re-shipped to the consumer. A vast amount of grain in this country is so marketed Iron ore shipped from the mines to the lakes, forwarded by lake, and then forwarded by rail to the blast furnace counts twice. Altogether it is probable that there is more of such traffic here than in Germany, and that we do not actually produce three times as much weight per individual as the Germans do. In both countries an enormous proportion of the whole tonnage is furnished by mines, furnaces and manufactures of metal—in Germany just about two-thirds of the whole tonnage

MATTHIAS NACE FORNEY

Mr Forney became attached to the *Railroad Gazette* during the first year of its existence as a serious newspaper He had been for some time in the service of the Hinckley Locomotive Works, of Boston, but was then endeavoring to introduce an invention of his own, the "Forney locomotive," which had its chief career many years later on the elevated railroads of New York The *Railroad Gazette* at the time was desperately in need of an editor with practical technical training, but, though the young man from the first made the impression of integrity, earnestness and highmindedness, no one guessed then that here was a man whose character outweighed the highest technical accomplishments His career had been a struggle upward from modest beginnings. From his father's tanyard, after some schooling, he had gone into a Baltimore machine shop as an apprentice. He took drawing lessons, attended debating societies, read and studied, became an expert draftsman, and through this door entered the engineering profession His tastes were as refined as if he had sprung from a long line of aristocrats. His senses were painfully acute, and his conscience was as acute as his senses

During the first year of his connection with the *Railroad Gazette* Mr. Forney continued his professional work as consulting engineer, and thereafter gave the whole of his time to the paper The great Chicago fire drove the *Railroad Gazette* to New York, which was the occasion of Mr. Forney's becoming one of its proprietors and directing its policy on the technical side for more than twelve years, until 1884, when he retired.

It is hard for railroad men of this day to appreciate what a task this was. There was then scarcely any literature on railroad mechanical engineering in America, and little other railroad literature. There were good engineers, and some of extraordinary ability, but few of them could write, and most of those who could write thought they couldn't; and moreover, there seemed to be a general feeling that a railroad man ought not to write for publication. The technical societies were unborn or in their swaddling clothes. Both the Master Mechanics' and the Master Car Builders' associations are younger than the *Railroad Gazette*. The technical editor to a very great extent was compelled to extract the results of experience and the opinions drawn therefrom by personal intercourse with the practical men; to obtain by pressure, as it were, the data which now comes in floods in the form of papers for technical societies and journals.

Mr. Forney will doubtless never get full credit for what he did to change this condition of things His influence on the two societies named was very great, and otherwise he did much to favor the method of collecting data of experience, complete so far as possible, as a basis for conclusions and a guide for practice.

To us who knew Mr Forney intimately, however, the character of the man overshadows all accomplishments and performances. He not only did justly, but he was willing to spend and be spent that justice might be done He loved mercy, and he labored that the weak and helpless should be mercifully dealt with. In the later years of his life he gave a great deal of work and was at considerable expense to secure better treatment of horses—creatures with which personally he had little more to do than with elephants. Believing that material political progress is to be hoped for from minority representation, he published at his own expense a book on the subject, containing, with much else, the substance of other works then out of print. In many similar ways he demonstrated his public spirit, his humanity and his unselfishness No one could more truly say

"Write me as one who loves his fellow-men " S. W D.

Forney was a dreamer and saw visions, but his dreams and visions were not unreal except as to time. For practical purposes he was apt to look too far in the future. His highly successful invention of a tank locomotive was probably fully ten years in advance of the need for it, although he did not think so. Its chief value proved to be for suburban services, not then highly developed. He was among the early observers of the evil results of the foolish practice of high-checking horses and did much earnest work as a reformer, with the usual early disappointments. He sustained the same relation and like early disappointments in his advocacy of cumulative voting and minority representation. It was long years before he could get attention to his powerful and valid arguments, which resulted in the standardization of screw threads in this country, a reform whose beneficial results are incalculable. He was among the early engineers who recognized not only the value, but the absolute necessity of standardization in locomotive and car work. This was his central idea in joining in the reorganization of the Master Car Builders' Association on a basis which secured for it official recognition and caused the adopted standards to be generally accepted by the railroads in this country. His professional work is outlined in his own biographical notes, but little reference is made to his other activities, which were many. For example, his too long foresight is illustrated by his study, many years ago, of the real estate possibilities in a portion of the city of New York. To some extent he profited by this study in an important real estate investment. His undertaking to produce a commercially successful balanced engine occupied intervals of time through many years, but latterly his drawings and studies for a solution of the problem seemed to be a form of recreation. Nevertheless, he was always hopeful.

No one of Forney's friends will ever recall his personality without a quick thought of his peculiar sense of humor and his use of it. He was never a funny man and he abhorred such men. He had what might be defined a useful sense of humor and in the use of ridicule as an argument he was highly successful without being disagreeable. Whenever he spoke—and he spoke often at conventions of railroad associations and railroad clubs—he was always expected to be amusing as well as instructive, and he seemed never to disappoint either of these expectations, although it was plain that he was in thorough control of his power to amuse and he was using it for a specific purpose. In the use of ridicule for the purpose of argument in the discussion of mechanical problems he was masterful. For example, two locomotives designed by Eugene Fontaine were built at Paterson, N. J., and put at work. Before building these locomotives Mr. Fontaine naturally consulted Forney, then the highest authority, who gave him an adverse report on his design for superimposing the two forward driving wheels over the two rear driving wheels, so as to have a friction drive and be capable of adjustment for a high rate of speed with a slow piston motion and dispense with side rods. The machines were unsuccessful, but before this was discovered in practice Forney ended the discussion which the invention involved by an absurd drawing of a man driving a bicycle under somewhat like circumstances.

During the period 1870 to 1885 it was often said of Forney that he had a wider acquaintance and more friendships among railroad officers than anyone else, and this was perhaps true if we assume that friendship means respect. He was a man of many fads, none of them objectionable. He was well known for his condemnation of smoking. He maintained over his office desk a modestly printed card reading as follows: "Is smoking offensive? Yes, always," and yet frequently in his own office he would insist on a friend smoking when he noticed that the temporary abstinence was producing unrest.

Forney remained a bachelor until he was 72 years old and then married a friend of his youth, a lovable and helpful companion, and it is unquestionably true that his last year in this world was his happiest year. W. H. B.

THE RECESSION OF A GOVERNOR.

Some six months ago, near the close of its long session, the Massachusetts legislature passed a bill, necessarily general in terms, but aimed actually at the New Haven-Boston & Maine merger. It was a veritable curio in railroad law-making, all the more grotesque as emanating from a commonwealth in which mind is inferred by tradition and habitude to dominate matter. It prohibited any railroad corporation of that state from acquiring or attempting to acquire, any shares of a Massachusetts railroad corporation; gave enlarged powers to the State Railroad Commission; and, until July of 1908, set the veto of the state on the voting power of stock held by a railroad company in another railroad company. The measure even went further and into the limbo of corporate psychology by prohibiting "any control, direction, supervision or influence whatsoever," directly or indirectly, by one railroad corporation over the other in which it had an interest. Apparently President Mellen was denied even telepathic communication with President Tuttle, and all train currents from the New Haven directorate flowing toward Boston & Maine territory were dammed up at the Massachusetts border. And this state embargo on influences concrete and mental was enforced by mighty penalties rising to $10,000 and a year's imprisonment for each offense.

All this was "before election" in Massachusetts. Politics were hot, personal ambitions vaulting high, candidates timid on the subject of popular sentiment, and Governor Guild, who signed the drastic measure afore-cited, himself seeking another term since obtained. It is "after election" now. There has been financial panic, contraction, industrial retreat. President Mellen has reduced train and trolley service, the looms of Massachusetts are humming much less than they did, and the verities of an industrial "drag," longer or shorter, rest upon the Bay state as upon other commonwealths of the land. In this sharp light of the luminous after event it is interesting to read the text of Governor Guild's message just sent in to the Massachusetts law-makers.

The Governor, last spring assertive, now becomes suggestive and interrogative. The public service corporations must still be made aware that the dignity and inviolability of Massachusetts statutes will be maintained. But "legislation that is merely destructive should be avoided. No policy which has not been thoroughly and carefully followed to its conclusion should be adopted. The burden of proof in any proposed change of management emphatically is on those seeking the change. He who asserts must prove. * * * Detailed and exact knowledge of actual existing conditions should precede any action in any case in question." Right here, by the way, one might criticize the Governor's own "exact knowledge" when later in his message he refers to one of the three steam railroad systems of Massachusetts as "dominated by an express company with headquarters in New York." Were not the American Express Company's holdings, direct and indirect, of about one-tenth of the outstanding Boston & Maine shares transferred some seven months ago to the New Haven by exchange of stock? The former one-tenth interest in the Boston & Maine has become an interest of about one-thirty-third in New Haven control now, and without a single New Haven director to represent it. Does it still "dominate" the Boston & Maine.

Mildly and in an interrogative form the Governor treats matters which a few months ago were expressed by the foes of the merger in Massachusetts as radical dogmatisms. He criticizes steam railroad service in the state and still favors the severance of railroads from the trolleys and from express corporations. But he holds it wise and beneficent that the railroad corporations should control steamship lines, this idea obviously carrying with it the wisdom of control of the Sound boat lines—a subject which has been "under investigation" at Washington and raised against the New Haven by some of its foes in Massachusetts. But it is upon the more relevant and imperative question, "Should one steam railroad be allowed to control another?" that the Governor's recession becomes most evident. He believes that "on certain terms permission for some union of interests not in violation of any national statute should be granted." This under larger powers of the railroad commission, with community of interest between the combined systems, under Massachusetts charters, with headquarters at Boston and the controlling system owning no Atlantic terminal for eastbound freight outside of New England. These conditions hit the New York Central. They obviously do not hit hard the New Haven-Boston & Maine merger proposition which has been the focal point of the recent acrimonious controversy.

After the bitter asperities of the Massachusetts anti-merger conflict, the recession of the Governor is suggestive even though one allows for the elimination of pre-election politics. In that state, as elsewhere, the pocket nerve of communities has begun to quiver and not without pain. Depressed industry and trade have struck home and, as usual in manufacturing regions, struck home quickly. The large ratio of the railroad in the sum total of commercial welfare and touching that welfare not merely as a carrier and as an employer of labor, but through the fiscal weal of thousands of shareholders, becomes more luminous in the gloom of industrial depression. Corporation backing recedes when the public finds that it is baited too. Governor Guild is but one of many advance agents to proclaim these economic truisms, nor does judgment go far astray when it infers that the Massachusetts legislature will be but one of a good many lawmaking bodies to follow his example.

Atlantic Coast Line.

The Atlantic Coast Line-Louisville & Nashville system is the largest, richest and most important of the three large railroad systems in the South. The Atlantic Coast Line itself without the Louisville & Nashville is stronger than either the Seaboard Air Line or the Southern Railway. As its name implies, its territory is the strip of country south of Chesapeake bay nearest the Atlantic coast. This coast strip, as the map shows, it occupies very completely. Generally speaking, the Seaboard Air Line occupies the north and south strip next inland, and the Southern Railway the territory further inland still.

The Richmond & Petersburg, a 25-mile road chartered by act of the legislature of Virginia in 1836 and opened for traffic between Richmond and Petersburg on September 17, 1838, was the beginning and nucleus of the Atlantic Coast Line. Various other railroads reaching southward along the coast as far as Charleston, S. C., and inland from the coast, were bought by the owners of the Richmond & Petersburg and were operated together as "The Atlantic Coast Line of Railways to the South." Control of these allied roads was transferred in 1889 to the Atlantic Coast Line Company which was organized in that year under the laws of Connecticut. In 1900, by amendment of the original Virginia legislative act, the name of the Richmond & Petersburg was changed to the Atlantic Coast Line Railroad. With this were merged a few months later the other railroads controlled by the Atlantic Coast Line Company. The fact that the Atlantic Coast Line Railroad is the successor of the Richmond & Petersburg explains the fact that its report for the year ended June 30, 1907, is the "seventy-third annual report."

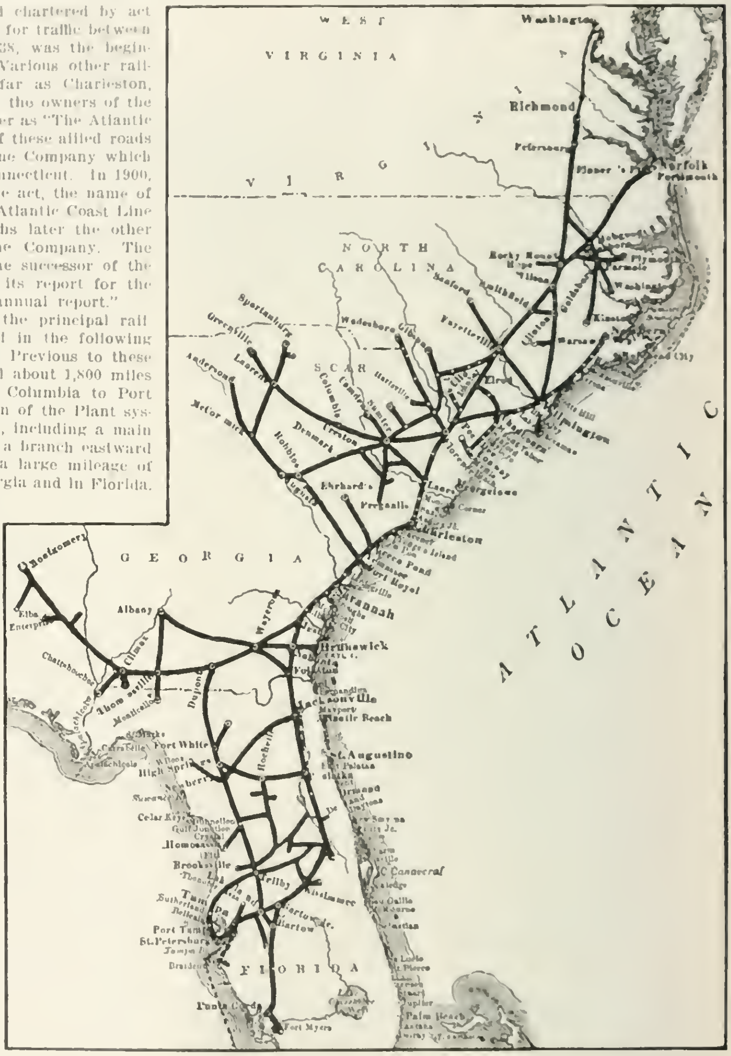
In 1901 the Savannah, Florida & Western, the principal railroad of the Plant system, was taken over, and in the following year the rest of the Plant system of railroads. Previous to these acquisitions the Atlantic Coast Line had operated about 1,800 miles of line, all, with the exception of a line from Columbia to Port Royal, north of Charleston, S. C. The acquisition of the Plant system added about 2,200 miles south of Charleston, including a main line through Savannah, Ga., to Jacksonville, Fla., a branch eastward from this main line to Montgomery, Ala., and a large mileage of branches and connecting lines in southeastern Georgia and in Florida. These additions brought up the Atlantic Coast Line mileage to over 4,000 miles.

In October, 1902, as a result of the sale by the Louisville & Nashville of new stock previous to its issue and listing on the New York Stock Exchange and the Gates corner which followed, it was arranged that the Atlantic Coast Line should buy a majority of the stock of the Louisville & Nashville. Control of this road has since been held, but the two companies are operated separately. Ownership of the Louisville & Nashville, which lies to the westward of both the Seaboard Air Line and the Southern, has been valuable among other reasons because the Atlantic Coast Line has received from it, either directly or through controlled roads, considerable high grade and other traffic.

With the taking over of the Plant system and the Louisville & Nashville purchase, the power and importance of the Atlantic Coast Line Company were greatly increased, so that now, according to the annual report of the Interstate Commerce Commission issued last week, this holding company, with a capitalization which probably represents not more than $5,000,000 of actual investment, is in virtual control of a railroad system more than 11,000 miles long.

For many years the Atlantic Coast Line was the aristocrat of the southern railroads. It had money to spend and it bought the best. As recently as 1906 its stock sold as high as 167. But it could not escape the consequences of the various adverse factors which have developed in the South during the last two years. Along with its poorer neighbors, it suffered severely. Net earnings for the last fiscal year were the smallest earned in any year since the Plant system was taken over. The net earnings in 1903 were $7,800,000, while last year's net amounted to only $7,200,000; all this while gross earnings were increasing, so that from $19,700,000 in 1903 they rose to $26,800,000 last year. In four years, therefore, there was an increase of 36 per cent. in gross earnings and a decrease of 8 per cent. in net earnings. Even with its better equipment, larger yards and terminals and greater *esprit de corps*, the Atlantic Coast Line was not able to handle the sudden rush of traffic in the South. In a speech on March 7, 1907, at the annual banquet of the Wilmington Chamber of Commerce, President Emerson showed that for the 19 months from June, 1905, to February, 1907, "prosperity" brought in nearly $4,000,000 additional revenue but the same "prosperity" took away in the way of increased wages, increased cost of material, etc., nearly $5,000,000, so that for this period the Atlantic Coast Line's share in the prosperity of the South was represented by about $900,000 less than nothing.

Meanwhile the public was demanding increased facilities, more and better equipment, improved stations and more of them, and faster freight movement. Mr. Emerson showed that in order to meet these demands the Atlantic Coast Line during the 5½ years



Atlantic Coast Line.

preceding March 1, 1907, had bought new equipment costing $15,800,000, and had spent for yards, terminals, new stations, heavier rail, signal towers and interlocking plants, double tracking, etc., $6,200,000, which latter amount did not include $2,000,000 more authorized but not then spent owing to scarcity of material and efficient labor. On July 1, 1902, the road owned 13,157 freight cars. On January 1, 1908, if delivery of new cars ordered was made promptly, it owned about 26,000 freight cars, or nearly 100 per cent. increase in 5½ years. These large expenditures, too, were made at a time when prices were high. For instance, box cars which in 1904 would have cost from $500 to $550, in 1907 cost $900 to $1,000.

Early in the year these expenditures for new improvements came to a sudden stop. In February the Atlantic Coast Line sold $5,000,000 5 per cent. 3-year gold notes at 95½ net, but since then it has been able to get no new funds. Its working capital, in fact, fell so low that the semi-annual dividend of 3 per cent., declared in December, was made payable in 4 per cent. certificates of indebtedness instead of in cash. On Wednesday the closing market price for Atlantic Coast Line stock was 72.

President Emerson speaks as follows in regard to the rate reductions of the year. His brief comment should be pondered by every citizen who favors reductions of railroad rates by act of legislature without investigation:

"Since our last report the following named states, either through their legislatures or corporation commissions, have taken such action as will greatly reduce your passenger rates:

Virginia.

By corporation commission: Reducing passenger rates from 3 cents a mile to 2 cents a mile, effective Oct. 1, 1907.

North Carolina.

By act of legislature: Reducing passenger rates from 3¼ cents a mile for first-class, and 2¾ cents a mile for second class, to 2¼ cents a mile for both classes; effective Aug. 8, 1907.

Georgia.

By railroad commission: Reducing passenger rates from 3 cents a mile to 2½ cents a mile, effective Sept. 1, 1907.

Alabama.

By act of legislature: Reducing passenger rates from 3 cents a mile to 2½ cents a mile, and also a material reduction in freight rates, effective Oct. 1, 1907.

"We are now operating these reduced rates, although we believe them to be confiscatory, and their legality is being tested in the courts; in the meantime the company is suffering irreparable loss pending final decision."

Gross earnings for the year increased $1,900,000, or 8 per cent. over 1906. Freight earnings increased 6 per cent. and passenger earnings 12 per cent. Operating expenses were larger by $3,500,000, or 22 per cent. As a result there was a decrease of $1,600,000, or 18 per cent. in net earnings. Net income was $3,100,000, against $4,800,000 in 1906, a decrease of 40 per cent. The operating ratio was 73.2 per cent., against 64.7 per cent. in 1906. After payment of the regular dividends, there was a surplus for the year of $126,000, against $2,100,000 in 1906, a decrease of 94 per cent.

The income results of particular interest are in the operating expenses. Maintenance of way and structures (not including $249,000 charged in this account for additions and betterments) increased 18 per cent. and cost $842 per mile of line, against $719 in 1906. Large improvements were made to the roadbed. There were 352 miles of new 85-lb. rails and over 2,000,000 new cross ties laid in track. Nearly 14,000,000 board feet of lumber, not including piling, were used in new work and repairs. Work was begun in February on 22 miles of new second track in North Carolina. With completion of this, the road will have 86 miles of second track on its 4,347 miles operated. There were many general improvements, including new bridges, changes of line, new freight yards at South Rocky Mount, and Wilmington, N. C., and at Southover Junction, near Savannah, Ga.; new freight and shop yards and new shops at Waycross, Ga., and coal storage plants of 40,000 tons capacity, at South Rocky Mount and at Waycross. All these were to have been finished by the beginning of 1908.

Maintenance of equipment (not including $9,000 charged for additions and betterments) increased 28 per cent. Repairs and renewals of locomotives cost $2,108, against $1,948 in 1906. The 1907 figure included $94,000 charged to replace missing numbers. Repairs and renewals of passenger cars cost $838 per passenger car, against $754 in 1906. The 1907 figure included $41,000 charged to replace missing numbers. Repairs and renewals of freight cars cost $78 per car, against $73 in 1906. This item for 1907 included $258,000 charged to replace missing numbers. New equipment costing over $5,000,000 was contracted for on equipment trusts for delivery between March and November, 1907. The apportioning between capital and operating accounts of the expenditures for new equipment, are given clearly and fully, an example which ought to be followed by all railroads.

Conducting transportation, the cost of getting and moving the traffic, increased from $9,000,000 to $11,000,000, a rise of 23 per cent. Part of this was due to the greater traffic, for there was an increase of 11 per cent. in revenue ton-miles and of 12 per cent. in revenue passenger-miles. Engine miles (coal burning)—perhaps the most accurate test of the amount of work done—increased 16 per cent. Mr. Emerson analyzes certain increases in expenses aggregating $2,700,000, or 78 per cent. of the total rise in operating expenses. Most, though not all, of these fall under the head of conducting transportation. The analysis of these increases follows:

	Increase.
Changes in method of accounting	$44,089
Replacement charges, equipment and structures	124,871
Materials and supplies	615,561
Overtime	84,189
Paid foreign roads for car repairs	69,957
Fuel, increased consumption	248,985
Car mileage balance	266,899
Loss and damage	221,371
Roadway pay roll	245,461
Shop force pay roll	272,389
Other additional forces	76,702
Pay roll of train crews	163,877
Other pay rolls	296,888
Total	$2,731,239

With this may be compared another table published in the annual report for 1906 analyzing certain increases in expenses for the last six months of that fiscal year, which amounted to $1,845,876, or 70 per cent. of the increases in operating expenses for the whole fiscal year ended June 30, 1906. This table follows:

	Increase.
Additions and betterments	$227,975
Real estate purchased	6,553
Changes in method of accounting	26,375
Additions to force	454,435
Wages	41,700
Various small items	42,276
Replacement charges, equipment and structures	225,918
Material and supplies	158,029
Overtime	65,503
Paid foreign roads for car repairs	44,044
Fuel, increased cost per ton	85,602
Fuel, increased consumption	160,976
Car mileage balance	144,287
Loss and damage	139,814
Rentals	2,589
Totals	$1,845,876

These statements suggest the difficulties with which the management has had to contend in the last two years.

No classification of tonnage by commodities is given in the report. The Atlantic Coast Line's traffic is quite different from that of any other road. Probably the two most important items are fruit and vegetables, and lumber—two widely different classes of traffic. The perishable fast freight traffic of the road is large and varied. From its southern lines it carries Florida oranges, lemons and grapefruit to the northern markets; Georgia sends peaches; South Carolina and North Carolina, small fruits and vegetables. The Atlantic Coast Line has been known to haul in one day off its main line between Florence, S. C., and Weldon, N. C., 210 miles, as many as 700 cars of strawberries. Last year there was a shortage of the strawberry and vegetable crops which resulted in a decrease of $239,000 in gross earnings from these sources, but other traffic more than made up for this loss. The extent of the refrigerator traffic is reflected in the trainload, which is 179 tons. The next two most important items of traffic are probably naval stores and phosphate. The road has an agricultural and immigration department through whose efforts 578 heads of families, in addition to a large number of settlers placed by other agencies, last year located on the lines to engage in agriculture. There were 127 new industries started.

Since November the traffic of the road has shown a great falling off. The lumber industry was one of the first to be hard hit by the panic owing to the general suspension of building and construction operations. There has also been a large decrease in general traffic. These are the most unfavorable features of the present situation. On the other hand, public opinion is changing. The people of the South are beginning to realize that railroad officers were sincere when they prophesied that the legislative attacks on the railroads would hurt the people of the South. The receivership of the Seaboard Air Line has had some effect in bringing about this change, but even before that happened, the effects of the industrial depression were being sharply felt in the South and it was obvious that the attacks on the railroads had been one of its principal causes. The future of the Atlantic Coast Line rests largely with the people of its territory. The officers of the road are doing their best, as they have been, to be fair in their treatment of the public. They ask in return justice; no special favors, but an understanding by the public of the facts and difficulties of railroad operation, and the passage of laws based in fairness on these facts. The most encouraging sign of the present railroad situation in the South, amid all its discouraging features, is the tendency toward a fair and reasonable co-operation between the railroads and the public.

The following table, rearranged according to our usual method, shows the income results of the Atlantic Coast Line Railroad for the past two years ended June 30:

	1907.	1906.
Mileage worked	4,347	4,327
Passenger earnings	$6,083,991	$5,4[illegible]6,174
Freight earnings	18,113,695	17,374,526
Gross earnings	26,771,529	24,868,448
Maint. way and structures	3,660,312	3,112,368
Maint. of equipment	3,936,686	3,071,036
Conducting transportation	11,088,157	8,904,691
Operating expenses	19,328,625	15,746,097
Net earnings	7,442,904	9,122,351
Net income	3,370,708	5,153,175
Dividends	2,992,086	2,718,830
Improvement appropriations	258,753	[illegible]36,233
Year's surplus	125,869	2,098,312

NEW PUBLICATIONS.

How to Burn Illinois Coal Without Smoke.—Bulletin No. 15 of the Engineering Experiment Station of the University of Illinois, on the above subject, by L. P. Breckenridge, Director of the Station, has been issued. A few pages are devoted to the principles of combustion and the losses due to smoking chimneys, but the larger part of the bulletin relates to the constructive features of those boiler settings and furnaces that have been found practically smokeless in operation at the power plant and in the experiment station at the University of Illinois. The leading dimensions of the settings and furnaces are given, and sectioned cuts show the general character of the settings. With each cut is given a statement as to the range of capacity of each setting for smokeless operation. Especial emphasis is given to the importance of knowing the rate at which the coal is to be burned on each square foot of grate surface, together with the percentage of volatile combustible which the coal contains, and for which a suitable combustion space or chamber must be provided. Some interesting illustrations show clearly the significance of the numbers used in describing smoke densities, and there is also a chart devised for making graphic records of smoke observations. Five tables of tests are given showing the conditions of operation of a smokeless furnace under changes of boiler capacity varying from 50 to 150 per cent. There are no illustrations showing approved settings for the horizontal fire-tube boiler, but suggestions are given as to methods of hand firing which will tend to reduce smoke production.

While this bulletin discusses the smokeless burning of Illinois coals, the principles and methods explained apply equally well to the burning of all kinds of soft coal. Copies of this bulletin may be had free by writing to the Director, Engineering Experiment Station, Urbana, Ill.

Tests of Reinforced Concrete Beams.—Bulletin No. 14, Tests of Reinforced Concrete Beams, Series of 1906, has been issued by the University of Illinois Engineering Experiment Station. The tests described are a continuation of the tests discussed in Bulletin No. 4. The topics investigated include the effect of quality of concrete upon the strength of beams, the effect of repetitive loading upon the action of beams, and the resistance of beams to diagonal tension failures. The results of the investigation of diagonal tension failures throw light upon the amount of the vertical shearing stress which may be allowed in reinforced concrete beams not having metallic web reinforcement. The resistance of beams to diagonal tension may be the controlling feature of relatively short beams, and as such failures occur suddenly and without much warning, a knowledge of the resistance of the concrete is essential. Some beams gave surprisingly low values and it seems evident that the values allowed by many city building ordinances are higher than should be recommended. The tests of plain and reinforced concrete columns and of reinforced concrete T-beams for 1906 have already been published.

Manual of Recommended Practice of Railway Engineering and Maintenance of Way. 1907 edition. Published by the American Railway Engineering and Maintenance of Way Association, Chicago. Cloth, 291 pages; 6 in. x 9 in. Price, $3.

The first edition of the Manual was published in 1905 and covered the work of the first six conventions of the Association. Last year a supplement was published containing the amendments and addenda to the Manual adopted by the Association at its 1906 convention. This bore the title, "Supplement of 1906, Addenda to Edition of 1905," and was contained in Bulletin 79 of the Association. The present edition contains all matter in its final and duly authorized form as adopted by all conventions to 1907 inclusive. The volume has almost twice the number of pages of the first edition. The style of printing and the arrangement is similar to that of the annual Proceedings, the marginal topic headings being a great help to quick finding of any point sought. The Manual of this Association has been in demand by railroads in all parts of the world, and its value and usefulness increase each year.

CONTRIBUTIONS

The Service of the Railroads.

Albany, N. Y., Jan. 9, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the *North American Review* of November, 1907, Logan G. McPherson brings out some interesting comparisons under the heading, "The Farmer, the Manufacturer and the Railroad." Mr. McPherson's figures are taken from the reports of the Interstate Commerce Commission, the United States census and the Year Book of the Department of Agriculture, and show

	1905.	1900.
Gross returns per $1,000 of capital:		
Manufacturers	$1,216	$1,321
Railroads	150	128
Agriculture	191	187
Net returns per each $1,000 of capital		
Manufacturers	151	191
Railroads	44	41
Agriculture	98	92
Average salary—wage per worker:		
Manufacturers	539	477
Railroads	607	567
Total salary—wage per each $1,000 of expenditure		
Manufacturers	245	245
Railroads	572	568
Total salary—wage per each $1,000 net returns		
Manufacturers	1,730	1,430
Railroads	1,362	1,223

These figures bring out clearly the following points:

1. That the gross returns or receipts per dollar of investment in the railroads of the United States are less than the receipts either from manufacturing or from money invested in agriculture.

2. That the interest, reward or profit on each dollar invested in the railroads is 4.4 per cent., while that of the money invested in agriculture is 9.8 per cent., and in manufacturing 15.1 per cent.

3. That the average salary paid by the railroads of the country is 12.6 per cent. greater than the average paid by the manufactures and, if the figures were known, is wonderfully greater than the average pay of those engaged in agriculture.

Mr. McPherson also states: "The outcry has been taken up by politicians—who do not ship freight or pay freight bills—and their utterances have impressed the great body of the people who likewise do not to any appreciable extent ship freight or directly pay freight bills. These people have been ignorant of the fact that the freight charges have been in constantly decreasing ratio to the cost of production and the cost of marketing the great commodities of daily need. The freight charge is so low that it is seldom a factor in the retail prices of these commodities. That is, the retail prices of the commodities of daily use, with but few exceptions, are determined without reference to the rate of freight; they would be neither higher nor lower if the commodities were transported by the railroads gratis."

That the American railroad has done this much and even more for the United States is in a measure brought out by the following statements.

The developing of the manufacturer and of the agriculture of the country can be said almost to depend upon its transportation—its railroad building, which has pushed forward to such a point that in 1905 there was one mile of railroad for each 381 people.

Year.	Population U. S. census.	Miles of railroad.	Population to each mile of railroad
1820	9,633,822	.	9,633,822
1830	12,866,822	23	559,392
1840	17,069,453	2,818	6,057
1850	23,191,876	9,021	2,571
1860	31,443,321	30,626	1,026
1870	38,558,371	52,922	728
1880	50,155,783	93,262	537
1890	62,622,250	166,703	375
1900	76,303,387	194,262	392
1905	83,143,000	218,101	381

Thoroughly to appreciate what this enormous growth of railroad mileage means, it should be compared with the railroad mileage in some of the principal countries of the world.

Country	Miles of railroad.	People to each mile of railroad	Square miles to one mile of railroad
France	24,500	1,590	8.46
Brazil	12,370	1,558	260.16
Austria Hungary	26,901	1,789	9.76
Belgium	4,337	1,631	2.62
China	3,500	119,714	1,443.00
German Empire	33,423	1,813	6.25
Italy	9,943	3,286	11.12
Japan	4,496	9,844	36.17
Russian Empire	38,045	3,548	220.24
Spain	8,206	2,267	23.90
United Kingdom	22,847	1,821	5.29
United States	218,101	381	13.61

Regardless of the fact that these statements show that there is almost five times as much railroad mileage per capita, or, in other words, only one-fifth the number of people to support each mile of railroad—the charges for transportation of freight in this country are lower than in any country probably in the world.

That the charge for passenger transportation is wonderfully low, considering the fact that there is only one-fifth the population per mile, is shown by the following figures obtained from the Department of Commerce and Labor, Bureau of Statistics, and from the British Statistical Abstract of Foreign Countries, published by the Board of Trade, London; from the Interstate Commerce Commission and the London *Statist*:

FREIGHT

Country	Year	Rate per ton per mile in Cents
United States	1905	0.766
Germany	1904	1.552
France	1904	1.428
Austria	1904	1.503
Russia, European	1903	1.018
Russia, Asiatic	1903	1.157
England (United Kingdom)	1903	2.160

PASSENGER

Country	Year	Rate per passenger per mile in cents
United States	1905	1.962
Germany	1904	0.992
France	1904	1.133
Russia, European	1903	0.722
Russia, Asiatic	1903	0.458

But it is said that the American railroad is overcapitalized, regardless of the fact that the income earned on a dollar invested in American railroads is less than that of a dollar invested in almost any other line; that the average wage paid by the railroad is greater than that paid in almost any other form of business; that their charge for freight transportation is less than in any other nation in the world; and that their passenger charge, when considering the character of the equipment, the speed of the trains, the excellence of the service and the limited number of people to be transported compared with those of other countries, is wonderfully low. The ground is not well taken, as clearly shown by the following figures which are copied from a report on the transportation routes and systems of the world, issued by the Bureau of Statistics of the Department of Commerce and Labor.

Country.	Year.	Capital or cost per mile of railroad.
United States	1904	$55,261
Canada	1904	60,504
Uruguay	1899	52,758
Venezuela	1904	70,972
Germany	1903	98,443
Austria	1903	128,334
Hungary	1903	74,056
Belgium (State railroads only)	1903	160,893
France	1902	137,691
Switzerland	1903	104,969
United Kingdom	1904	272,737
Russia	1902	78,553
Finland	1902	32,189
Norway	1904	38,371
Sweden (State railroads)	1904	14,669
Sweden (private railroads)	1902	22,006
Italy	1902	108,212

As a matter of fact, the capitalization of the American railroad is vastly less than the actual value of the properties to-day. It is very much to be doubted whether one railroad in 20 could be replaced for its existing capitalization. The roads have forged ahead so rapidly that seldom, if ever, could their bonds be sold for par; in some cases they were sold at a discount as great as 40 per cent., and in many cases, in addition to a discount on the bonds, stock bonuses had to be given. This was necessary in order that the country could have this vast railroad growth and that the country could be built up to its present greatness.

Each year vast sums out of earnings are put into bettering the properties, in the form of heavier bridges and rail, better stations and grade and line changes; and these sums have not been capitalized and are of such magnitude that they would equal dividends of from 2 to 3 per cent. yearly on the entire stock capitalization. Again, the land and property increment in value is not capitalized and it is increasing at a rate of 4 or 5 per cent. a year, and in the case of railroad terminal property has reached vast proportions. An illustration: one of the important trunk lines paid a few hundred dollars for its terminal when entering the city of Chicago. Recently, under oath, a number of railroad presidents testified that the value of this property was from 12 to 15 million dollars.

As pointed out by Mr. McPherson, the people of the United States do not realize what has been done for the country by its railroads, or the present hostile conditions would not exist. Apparently every one of the 46 states in the United States is passing hostile railroad legislation. Some of it is confiscatory in its results. Much of it is unnecessary, ill-advised and harmful, and a little of it is proper and will have a healthful effect. All of it, however, has had the effect of undermining the credit of the railroads, and already one great line has gone into the hands of a receiver; and the monthly returns of the railroads unfortunate enough to be located in the states where legislation has been most drastic show that they are being sadly hampered; that their earnings are being depleted; that for lack of money, necessary railroad work is being stopped or slowed up all over the country; that they have had to borrow money on short-time notes at high rates of interest; and that the additional moneys which unreasonable legislation has deprived their making would have been put to very much better advantage were it used in the building of additional second-track, of block signaling and bettering the physical conditions of the properties.

Over 90 per cent. of the American railroad system is still single track, while in the United Kingdom there is only a little over 40 per cent. of single track. The further growth of the American manufacturer and of the agricultural interests of the country depends absolutely upon the prosperity of the American railroad.

That, in some few cases, there has been rebating and undue favoritism, is admitted, but the enforcement of the Elkins law absolutely stopped these practices. It is most unfortunate that through lack of exact information the American public should have any other than the kindest feeling toward its transportation properties; and as the people of this country have righted every wrong just as quickly as it is demonstrated, so will they correct the present situation when its vast importance and the injustice done is clearly brought to their attention. C. S. SIMS.

Second Vice-Pres. and Gen. Mgr. Delaware & Hudson Co.

Analogy of Conditions in 1884 and in 1907.

New York, Jan. 13, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your editorial entitled Five Panics (Dec. 27, 1907) says that the 1907 panic was more akin to that of 1884, in many important respects, than it was to any other of our serious commercial setbacks in this country, and because of this you conclude that the after-drag is going to be short and the recovery comparatively rapid. The Annual Review of the Foreign Commerce of the United States, recently published by the Department of Commerce and Labor, puts in evidence a rather striking confirmation of one phase of the resemblance between 1884 and 1907—the trade balance The following table (specie not included) illustrates this point:

	Excess			Excess	
	Of imports.	Of exports.		Of imports.	Of exports.
1837	$19,029,676	......	1884	......	$72,815,916
1857	54,604,582	......	1895	$18,735,728	......
1873	119,656,288	......	1907	.....	446,429,653

I realize that this showing was affected by local conditions in each of the above years, and that it is to a certain extent superficial. Nevertheless it certainly indicates an interesting tendency which bears out your analysis—and we should all like to believe that your prophecy of a short drag is correct. HISTORIAN.

The London Underground Troubles.

The Lot's Road, Chelsea, power house which is furnishing electrical energy to the district, several tube lines, and to a portion of the system of the London United Tramways, is supplying an average output of about 100,000,000 units per annum, which are sold at a price which while reasonable from the point of view of the different interests mentioned, is also yielding a satisfactory profit on the power house expenditure. In mentioning this fact in the annual report recently issued, the directors of the Underground Electric Railways Company of London show how far their different tube lines have been advanced structurally during the year, and they add some notes concerning the progress that each has been making from the traffic standpoint. The following references are made to the appointment of Mr. Stanley and to the troubles of financial and competitive kinds that the concern has been and is still passing through:

In April of this year the directors secured the services of Mr. Albert H. Stanley, who was up to that time general manager of the New Jersey Public Service Corporation. He is now the general manager of the Underground Electric Railways Company, as well as of the District and the three tube companies above mentioned, by which means co-ordination and uniformity of operation are secured. The very unsettled state of the money markets of the world has seriously hampered the development and operations of the company, and this unrest still continues. Stocks all over the world have depreciated in price, and those dependent on London traffic have, owing to severe competition and excessive reduction in fares, fallen lower than many securities of intrinsically less value. The competitors for London passenger traffic include the London County Council, on whose growing network of tramways passengers are carried at fares which it is believed are in many cases unremunerative, and the motor omnibus companies, who have come into the field since the incorporation of the company, but who can probably not operate profitably on the basis of their existing fares. It seems at last, however, to have been universally recognized that for a large number of companies to carry passengers at a loss is not sound business. The responsible heads of the principal London passenger traffic companies have, therefore, recently constituted a Traffic Conference under the chairmanship of the company's managing director, Sir George Gibb, for the purpose of discussing the best means by which injurious competition can be, as far as possible, avoided. The Board has been for some time considering (in conjunction with Messrs. Speyer) a plan for dealing with the £7,000,000 notes which will become due on June 1, 1908. It is hoped that within a short time, probably early in 1908, the plan will be published and submitted to the shareholders and noteholders for their approval. In the meantime, Messrs. Speyer offered to purchase at their face value the coupons on the notes due December 1, 1907.

Immigration in 1907.

The total number of cabin and steerage passengers landed at the port of New York during 1907 by all the transatlantic steamship lines was 1,287,617. In 1906, the number was 1,159,551; in 1905, 992,065. The largest number of passengers was carried on the ships of the North German Lloyd Line from Bremen and from Mediterranean ports. In 151 trips, 222,121 passengers were landed by the steamers of this line, and of these 17,051 were first cabin voyagers. The Hamburg-American Line, with 131 steamers arriving, brought 200,909 passengers, of which number 16,991 were first cabin. The White Star Line, from Liverpool, Southampton and the Mediterranean, landed 16,748 first cabin passengers, and the total number brought by this line was 115,859. The trips numbered 98

The Cunard steamers, from Liverpool and the Mediterranean, brought 147,766 passengers of all classes, and of these 12,086 were first cabin. Sailings to the number of 100 were made. The Red Star Line, from Antwerp, brought 81,642; the French Line from Havre, 83,882, and the Holland-American Line, from Rotterdam, brought 62,056 passengers of all classes. Composed of four lines and six services the International Mercantile Marine Company's ships made 196 trips from foreign ports, and brought a grand total of 237,906 passengers of all classes.

Autobiographical Notes by Matthias Nace Forney.

News of the death of Mr. Forney after a first attack of paralysis Jan. 14, came as an entire surprise to almost all his friends. We are glad to have the opportunity to print the following notes, which he gathered together in 1903.

If tradition and the record of the family Bible can be relied on, I was born in the old house on Chestnut street, in Hanover, York County, Pennsylvania, on March 28, 1835. My father, after whom I was named, died on March 25, 1837, leaving our good mother, Amanda Forney, to take care of three sons and three daughters.

The school education which was administered to us in Hanover in those early days was of a somewhat irregular kind, and depended upon the ministrations of teachers of a more or less itinerate habit. They were good, bad and indifferent—chiefly the latter—so that our book knowledge had to be assimilated from much indigestible food.

Very early in life mechanism and science interested me very much. It gave me great pleasure to decorate the top of our old woodshed with miniature windmills, to construct water-wheels which were driven by the stream from a spring near the house, and to make toy cannons out of anything which would hold a charge of powder. My great ambition was to build a small steam-engine, but for that my mechanical resources were not adequate, although I made a number of attempts in that direction. Tools and machinery were my delight then, and have been ever since. I then always had a workshop which was very poorly equipped with carpenters tools, but it was a source of endless pleasure to me. My first ambition was to be a ship-builder, then steam-engines took hold of my imagination and finally locomotives got possession of me and have absorbed much of my time and thoughts ever since.

Matthias Nace Forney.

When fourteen years of age I was sent to a school in Baltimore, with my brother George, who had already been there two years before me, where he had attended the "Collegiate Department of the University of Maryland," under which high sounding title Mr. Horace Morison—an uncle of the engineer, the late George S. Morison—conducted a school of from thirty to forty boys. Three winters were spent there, which ended my school education.

In April, 1852, I entered the shop of Ross Winans as an apprentice. He was then engaged in building locomotives in Baltimore, chiefly for the Baltimore & Ohio Railroad. Three years were spent in the shop, and after that one was spent in the drawing office. I then secured a position as draftsman in the shops of the Baltimore & Ohio Railroad, in Baltimore, then under the charge of Mr. Henry Tyson, who was Master of Machinery of the road, and continued in that position altogether about three years. As the prospect of advancement there seemed very poor, in 1857 or 1858 I was led to go into mercantile business in Baltimore, and continued in such occupation for about three years more. This brought me to 1861, the period of the outbreak of the War of Secession.

My business ventures up to this time had not been successful. All business in Baltimore was much disturbed, and after trying a number of different occupations I accepted a position as draftsman in the Machinery Department of the Illinois Central Railroad in Chicago, then under the charge of Mr. Samuel J. Hayes, who was Superintendent of Machinery of that road.

While employed there I designed an "improved tank locomotive," which afterwards became known as the "Forney engine." A patent was applied for, but there was considerable difficulty and delay in the Patent Office before the patent was allowed, so that it was not issued until 1866. Although every effort was made to introduce it into use, my efforts had little success until it was adopted for the New York Elevated Railroads nearly ten years after the patent was allowed. No other kind of locomotive was ever used on those roads thereafter, and it was also exclusively adopted in the Brooklyn and Chicago Elevated lines, and many were also built for other roads. Now, 1903, these engines have been superseded in the elevated roads by electric power, but it is still a popular form of locomotive for suburban and some other kinds of traffic. After the patent expired it was very generally adopted. It was a source of some profit to me during the latter part of the existence of the patent, but never paid as much as it would if the merits of the invention had been recognized earlier.

My engagement on the Illinois Central Railroad also continued for about three years. After this a brief engagement as draftsman with the Detroit Bridge & Iron Works followed, which was succeeded in the spring of 1865 by an appointment by the President of the Illinois Central Railroad Company, to superintend the building of some locomotives for that line, for the construction of which a contract had been made with the Hinckley & Williams Works in Boston. This was in the spring of 1865, and occupied me for about six months. When the engines were completed Mr. Williams made an arrangement with me to remain in their employ. My duties were partly those of a draftsman and partly of a traveling agent. My services there also lasted about three years.

During the last year of that term, my office and headquarters were in New York, and when my engagement with that company was ended, and after a year or more spent in futile attempts to make a living by office and other work, in the fall of 1870 I accepted the position of Associate Editor of the *Railroad Gazette*, which was offered to me by Mr. A. N. Kellogg, who then published that paper in Chicago. In 1871 the great fire occurred there and the publication office of the paper was temporarily—as it was then thought—removed to New York. Soon thereafter Mr. S. W. Dunning, who was Editor-in-Chief, and myself, each bought an interest in the paper, and a year or two thereafter bought the whole of it, each of us owning a half. In editing the paper, my department was that of engineering and mechanical matters, while Mr. Dunning had charge of the transportation and traffic department and general railroad news.

In 1873 we obtained a copy of Georg Kosak's excellent little book on the locomotive, written in German. Mr. Dunning, who reads that language, agreed to translate the book and proposed that I should revise and adapt it to American practice, and that the translation should then be published serially in the *Railroad Gazette* and in book form thereafter. The translation was made and submitted to me for revision and adaptation according to the original intention. Before that I had planned and had commenced writing an elementary treatise on the locomotive. In revising the first chapter of the translation of Mr. Kosak's book, it was found that it occupied only, to a very limited extent, the ground which in my incomplete plan I hoped to cover. Therefore the original intention of "adapting" Mr. Kosak's work was abandoned, and the whole book was rewritten and published in book form thereafter. In writing it, the aim was to explain the principles, construction and operation of locomotives in the simplest and clearest language possible so as to be easily comprehended by engineers, mechanics, firemen and apprentices who have had few educational advantages. The only mathematics employed, excepting simple arithmetic, was one algebraic formula, and that might have been omitted.

The book seemed to supply a need, and at once had a large sale, which has continued ever since. It was rewritten and enlarged in 1889, and the demand for the revised edition still continues.

In 1872 I became an associate member of the American Railway Master Mechanics' Association, and in 1873 of the Master Car Builders' Association. About the same time—or perhaps earlier—I was elected a member of the American Society of Civil Engineers, but resigned a few years ago. I was one of the organizers, and am still (1903) a member of the American Society of Mechanical Engineers.

The work of these associations, especially the two devoted exclusively to railroad engineering, was of great interest to me, and for years I took an active part in their proceedings, as is shown in their early annual reports.

By way of explanation, it may be said that away back in the seventies before any system of transit, more rapid than horse cars, existed in New York, that its population and daily papers, every winter, were thrown into paroxysms by each severe snowstorm which obstructed traffic in the streets and made it very difficult for people to be transported up and down town mornings and evenings. During such periods all kinds of wild projects were proposed for systems of rapid transit above, below, and in the streets of the city. In September, 1874, during such a period of exacerbation, at my suggestion, Mr. Octave Chanute, then Chief Engineer of the Erie Railroad, introduced a resolution at one of the meetings of the American Society of Civil Engineers, "that a committee of five members of the society be appointed by the president to investigate the necessary conditions of success, and to recommend plans for:

"First—The best means of rapid transit for passengers, and

"Second—The best and cheapest methods of delivering, storing and distributing goods and freight in and about the city of New York . . . and to report thereon."

The resolution was adopted, and a committee consisting of Mr. Chanute, Ashbel Welch, Gen. Charles K. Graham, Francis Collingwood and myself were appointed.

Although there were three other members of the committee, Mr. Chanute and myself did most of the work of preparing the report. We each of us devoted a great deal of time to collecting and tabulating data relating to the subjects submitted to the committee for investigation, concerning which there had then been very litle reliable information published. The old Greenwich street elevated railroad had been built from the Battery up to Thirtieth street, on Ninth avenue, and had then abandoned the use of a cable, which was first used by Mr. C. T. Harvey for transmitting the motive power to the cars, and a small four-wheeled locomotive had been substituted for the cable. This was then the only thing approximating to "rapid transit" in the city of New York. The only data obtainable concerning the probable traffic and expenses of a real "rapid transit" road was from this line, and those operated on the surface of the streets; the motive power of all of the latter was then horses.

In the report made it was said: "The committee deemed it necessary, as a preliminary basis, to ascertain what would be the probable earnings and expenses of rapid transit roads, and in what amount of capital the net revenue thus estimated would pay a fair rate of interest. The usual methods of assuming the operating expenses to be a certain percentage of the earnings seemed to us quite worthless when applied to roads possessing so many features of novelty. During the progress of this inquiry, therefore, two of the members of the committee made careful estimates, from the best data they could obtain, of the possible revenues, and of the cost of running trains furnishing the required accommodations. These computations were entirely independent of each other. . . . The result was gratifying. Although carried by somewhat different processes, the final computations agreed so closely as to give the committee confidence in the approximate correctness of their estimates."

The conclusion which was reached was: "That the traffic on rapid transit roads would in a few years be equal to 35,000,000 passengers per annum, on each side of the island, and that it would warrant an expenditure of about $935,000 per mile of road."

The last (1902) annual report of the Manhattan Elevated and the Interborough lines shows that 246,587,022 passengers were carried in the year covered by the report. When our committee in 1875 ventured to estimate that "the traffic on rapid transit roads would, in a few years, be equal to 35,000,000 passengers per annum, on each side of the island," or a total of 70,000,000, this "estimate" of the committee was regarded as wild and visionary.

The report was completed and read at a meeting of the Society held on February 3, 1875. It was received with a perfect storm of opposition and denunciation by members, some of whom had for years been recommending and lending their names and influence to different schemes for rapid transit railroads. The report was, however, printed by the Society. Legislation was then pending in Albany, which led to the appointment of what was known as the "Tilden committee," whose investigations and report was followed by the enactment of a Rapid Transit Act under which the existing Elevated roads were built. The report was placed in the hands of that committee and had much influence in shaping legislation and guiding those who directed it. The value of the work which the committee did, however, was never recognized, although it served to shape legislation and guide those who afterward built the elevated roads, and resulted in great advantage to their projectors and the public generally.

The appendix which I wrote for the report contained the recommendation, "that no authority should be granted to any company to build a rapid transit railroad without the express stipulation *that not more than half-fare should be collected unless the passenger is provided with a seat on demand.*" My recollection is that such a just and salutary provision was inserted in the original bill, but was eliminated before it finally passed the legislature.

After being a member of the Master Car Builders' Association for a number of years and taking an active part in its work, it became apparent to me that there was a great deal of work which such an association ought to do, but which could not be done unless some direct relations existed between it and the railroad companies whose interest it should represent. At the same time, it was evident that any important change in the existing conditions of membership would be defeated if proposed to the Association. In this dilemma, to quote from a report made in 1889, "the idea was conceived of leaving the conditions of membership the same as theretofore, but of creating a new class of members to be appointed by the Presidents, General Managers or General Superintendents, to represent the railroad companies in the Association, such members to have a vote proportionate to the number of cars owned by the companies they represented. This measure was proposed to some of the older members, including Leander Garey, F. D. Adams, and others, and approved by them.

After much negotiating, many reports and a great deal of discussion, such a measure was finally carried and ultimately resulted in all the principal railroad companies in this country and Canada appointing what were called representative members.

It was carried, however, in the face of very strong opposition, but its salutary effect upon the Association and its effectiveness at once became apparent, and the beneficial results have increased every year since.

A full account of the reorganization of the Association was given in my final report to the Association as Secretary in 1889. In that it was said: "The influence of the Association has been very much widened and strengthened by the reorganization, which has given to railroad companies a representation in its deliberations."

After the reorganization in 1882, I was appointed Secretary of the Association and held that position until 1889. The work interested me very much, and perhaps by aiding in the adoption of standard forms and methods of construction of cars, and the introduction of safety appliances, some good may have been accomplished. At any rate, the work which was commenced then has been followed up by other people and other agencies—notably the Interstate Commerce Commission—so that there is the satisfaction of having helped in a movement which has greatly lessened the loss of life and limb in railroads.

Early in the history of the Master Car Builders' Association the confusion of names used to designate the different parts of cars attracted attention, and in 1871 a committee was appointed to prepare a "Dictionary of Terms used in Car Building."

In the preface of the "Dictionary" which was subsequently published, it is said:

"This committee originally consisted of eight or ten members, who held a number of meetings without accomplishing much, and it soon became apparent that it was too unwieldy to do the work which had been undertaken." It was finally narrowed down to Leander Garey, Calvin Smith and myself. I did the writing and the other members acted as consulting members of the committee. We held many meetings, and the preparation of the first edition of that book was a long and tedious work. The book was, however, finally completed, and published by the *Railroad Gazette*. Several new editions have been issued since.

Mr. Dunning and myself continued to publish the *Railroad Gazette* until the end of 1883. I then sold my interest to W. H. Boardman, who had been business manager of the paper for a number of years. In a valedictory editorial, with the title "Some Last Words," published in the *Railroad Gazette* of Dec. 28, 1883, it was said:

"The work of editing a journal like the *Railroad Gazette* is not only severe, but unremitting. Every week brings its tasks, and there is no opportunity for recuperating exhausted energies, however serious the need may be. * * * When it became apparent that the editorial steam gage could no longer be kept up to working pressure, the question had to be decided whether it would be wisest under the circumstances to diminish the loads and continue at work until the mechanism was fit only for the scrap heap, or whether it would be best to uncouple from the train entirely and lay up for thorough repairs. The latter plan is the wisest course to pursue with locomotives, and is the one which the master mechanic who superintends the repairs to the writer insisted must be adopted in his case, or the machine would soon be too dilapidated for any further service.

"And thus a career commenced with much hope, pursued with more than a little toil, is ended with some disappointed anticipations, but with many pleasant and some tender recollections."

For three years thereafter, my life seems to have been divided into cycles of three years. I was not engaged in any regular business. Doing nothing soon grew wearisome, and in the latter part of 1886, for the sake of having regular occupation I bought the *American Railroad Journal* and Van Nostrand's *Engineering Magazine*, and on the first of January consolidated the two publications under the name of *The Railroad and Engineering Journal*. That paper I published and edited until the end of 1895, but changed its name at the beginning of the year 1893 to the *American Engineer and Railroad Journal*. The enterprise however, never was financially successful, and on Jan. 1, 1896, my interest in it was sold to R. M. Van Arsdale, the proprietor of *The National Car and Locomotive Builder*, who then consolidated the two publications. Part of the agreement in making the sale was that I should edit the new paper for one year.

Since that time I have not been in any regular business, although much occupied in different ways and on a variety of matters.

Invention has always had a great fascination to me as it has many others. It is akin to the passion which the fortuity of gambling has to a gamester, and once having developed the taste for invention its allurements have led me on, as will be shown by the following list of patents which have been granted to me, and which will indicate the subjects in which my efforts to improve things have been exercised:

List of Patents to M. N. Forney.

No.	Date.	Title.
52,406	Feb. 6, 1866	Locomotives
247,031	Sept 13, 1881.	Interlocking switch and signal apparatus
250,517	Dec. 6, 1881	Railroad signalling apparatus.
266,802	Oct. 31, 1882	Railway tell tale
266,685	Oct. 31, 1882	Locomotive engine
17,949	Oct. 24, 1883.	Improvement on locomotive engine (Canadian)
324,825	Aug. 25, 1885.	Car seat
354,631	Dec. 21, 1886.	Furnace doors.
360,148	Mar. 29, 1887.	Car seat.
408,004	July 30, 1889.	Locomotive engines.
414,035	Oct. 29, 1889	Railroad car bodies.
436,055	Sept. 9, 1890.	Safe depositories for railroad cars.
472,039	Apr. 5, 1892.	Fire grates.
482,417	Sept 13, 1892	Reversible backs for car or other seats
485,344	Nov 1, 1892.	Locomotive engine
488,992	Jan. 3, 1893.	Reversible backs for car or other seats.
489,648	Jan. 10, 1893.	Counterbalance and guides, reciprocating mechanism
510,636	Dec. 12, 1893.	Steam boilers.
518,399	Apr. 17, 1894	Steam boilers.
527,842	Oct. 23, 1894.	Car seats.
527,960	Oct 23, 1894.	Locomotive axle boxes.
528,294	Oct. 30, 1894	Means for counterbalancing momentum of reciprocating mechanism.
20,808	Oct. 30, 1894.	Improvement in steam engines (English)
557,794	Apr. 7, 1896.	Valve gear.
566,675	Aug. 25, 1896.	Car seats.
632,708	Sept. 12, 1899.	Feed water heaters for steam boilers
661,690	Nov. 13, 1900.	Multiple address envelope.
688,402	Dec. 10, 1901	Feed water and steam heaters for steam boilers.
701,477	June 3, 1902.	Means for counterbalancing the momentum of reciprocating elements.
735,739	Aug. 11, 1903.	Fluid pressure engine.
735,740	Aug 11, 1903.	" " "
735,741	Aug. 11, 1903.	" " "
735,742	Aug. 11, 1903.	" " "

Of the patents on tank locomotives, mention has already been made. Thus far the only other of these patents which have been profitable to me are some of those on car-seats. These for a time yielded me considerable income. Some of the rest, I feel sure, would have done so if sufficient effort had been made to introduce them, or, in other words, if they had been properly "pushed" commercially. Of the ultimate success of those, which still have any considerable term of existence, it is, of course, impossible to predict. It may, however, be well to make a confession here of a consciousness of a deficiency of the kind of capacity needed in selling things, and a constitutional abhorrence of anything relating to what is called the "solicitation of business." Probably if as much effort had been exerted, to the introduction of some of my inventions as was exercised in devising and perfecting their mechanical features, they would have been more or less successful and perhaps profitable. The mechanical development of my various schemes has been intensely interesting to me, whereas the effort required to introduce them has always been more or less obnoxious.

Besides a disposition to improve mechanism of various kinds, I have also had an inclination to improve social and political affairs, and to that end, have been a member of the American Free Trade League and American Peace Society in Boston, the Citizens' Union and Anti-Imperialist League of New York, and have been a member of the Executive Committee of the latter. I am also a member of the Union League, the Century, the Engineers' and the New York Railroad Clubs. In 1898, the American Railway Master Mechanics' Association did me the honor to elect me an "honorary member." My associate membership dated back to 1872, and that in the Master Car Builders' Association to 1873. The latter elected me a life member in 1890.

Besides the two mechanical books already referred to, in 1894 when the Constitutional Convention of the State of New York was in session, I wrote a book with the title "Political Reform by the Representation of Minorities," with the purpose of influencing that convention to make some form of Proportional Representation possible in this state. It failed to accomplish that purpose, and apparently has had little or no other influence. Later I wrote and published two pamphlets, one with the title "Proportional Representation; A Means for the Improvement of Municipal Government," and the other, "Minority Representation in Municipal Government." If any of these ever produced any effect it has not yet been made apparent to me. Writing them however gave me some diversion, and it of course may be that it is a case of "bread cast upon the waters." I have had and still have a strong conviction that the most effective means of improving national, state and municipal government would be some form of proportional or minority representation, which would place it in the power of portions of people less than a majority to represent their views and interests. The justice of such a measure does not seem to be suited to the apprehension of popular intelligence or perhaps it should be said popular ignorance.

During the most active part of my life I often made the mistake of undertaking too much, and now the consciousness is distinctly felt of having had too much work and not enough play during many of the past years.

Perhaps some men and all women who see these notes, will be curious to know why no woman was ever asked to share my joys and sorrows. It would not be difficult to give an answer, which would be somewhat like this: during the impressionable period of my life I could not afford to assume such a partnership; when things went better with me my time was too much occupied to give the matter the required attention, and later, by reason of age, attractive women would not smile on me. It would do no good to admit now that it was a mistake to live alone, but it is also true that celibacy has its compensations.

This brings the summary of life up to the present time, August, 1903. Someone else must add the date when it will be ended.

Electric Locomotive for Passenger and Freight Service; Metropolitan Railway, of London.

Of the ten electric locomotives for passenger and freight service which are being supplied by the British Thomson-Houston Co., Ltd., of Rugby, to the Metropolitan Railway Company, of London, three have been delivered.

These locomotives are of the double bogie type with box wagon

Front View of Electric Locomotive; Metropolitan Railway.

shaped cab, and weigh, in running order, 47 tons. The motors with which they are equipped are of the GE 69 type with one-turn armatures, the gear ratio being $\frac{}{}$ = 3.36. One motor is mounted on each of the four axles. They are of 200 h.p. each, and weigh, complete with gearing and gear case, approximately, 6,100 lbs. They are of the box frame type with nose suspension. The internal construction is of B. T. H. standard practice.

The control is the Sprague-Thomson-Houston multiple unit system, and is similar to that used on the passenger trains equipped for the Metropolitan Railway by the B. T. H. Co.

The collector gear consists of twelve shoes arranged as follows: Two positive shoes in parallel on each side of each truck which are supported by oak beams bolted to the axle boxes. There are four

Side View of Electric Locomotive; Metropolitan Railway.

negative shoes, one being attached by a suitable insulated bracket to each motor.

The following are the leading dimensions:

Gage	4 ft. 8½ in.
Length over cab and headstocks	30 " 0 "
Length over buffers	33 " 6 "
Centers of bogies	17 " 0 "
Wheel base of each bogie	7 " 6 "
Width over cab	8 " 0¼ "
Width over side sills	8 " 0 "
Width over all	8 " 7 "
Height from rails to top of cab	12 " 3⅞ "
Height from rails to top of floor	4 " 7½ "
Diameter of wheels	3 " 2 "
Diameter of axles:	
At center and in motor suspension bearings	6½ "
At gear wheel seat	7½ "
At wheel seats	7 1/16 "
At truck journals	5½ "
Length of journals	9 "

Trucks.—These are of the pressed steel type strengthened with reinforcing plates, steel angles and gussets; they are fitted with a swinging bolster, built up with steel sections and steel castings. The bolster is supported on two nests of coil springs of circular section, each nest consisting of three springs. The bolster is also provided with cast steel wearing plates, center and side bearing plates. The side frames are supported on the axle boxes by laminated springs of heavy design. The axle boxes are of steel castings, machined to work in the horn plates, which are also of steel castings and machined, being riveted to the side frames which are cut out to receive them. The side frames are further strengthened at this point by a doubling plate. The axle boxes are provided with removable fronts, each front of which is fitted with an inspection door. The bearings are of anti-friction metal. The axle boxes are provided with lugs at the bottom to which the collector shoe beams are attached. Ample provision is made for lubrication and the exclusion of dust. The brake gear is of the inside type, one block per wheel being provided, the whole being of specially heavy design so as to stand operation by both power brakes simultaneously. The wheels have centers of wrought iron with nine open spokes forged into them, and are fitted with rolled steel tires 5 in. wide by 3¼ in. deep, held in place by retaining rings, and also by four set screws. The motors are carried on the transoms by means of cast steel brackets riveted thereto, in which the nose on the motor rests, being held there by a forged strap. Collector shoe beams are of oak and bolted to the axle boxes on each side of each truck, the collector shoes being hung inside the wheel base.

Underframe.—This is constructed of steel members of sufficiently heavy section to bring up the locomotives to the weight desired. Each side sill is formed by a channel 12 in. x 3 in. x ½ in. section connected together at the ends by head stock channels of the same section. The underframe bolster is formed by two channels 10 in. x 3½ in. x ½ in. section, and between the two bolsters there are two crossbars of channel section 10 in. x 3 in. x ⅜ in. Between headstocks, bolsters and crossbars there are two longitudinal channels parallel to one another of 10 in. x 3 in. x ⅜ in. section. To further strengthen the ends of the frame against buffing strains there are two struts, diagonally placed, of channels of 10 in. x 3 in. x ⅜ in. section. The whole frame is firmly riveted together with steel angles and gussets. The top of this main underframe is covered with steel plate ¼ in. thick. Above this is a sub-floor 6 in. deep, formed by channels, in which is laid the whole of the piping containing the wiring, besides the piping for the brakes. On the top of this sub-floor is a floor of steel plates ¼ in. thick made in removable sections. At each end of the driving positions and down the center of the locomotive this floor is covered with wooden walking grids ⅞ in. thick. At each end of the underframe are

Control Apparatus in Cab of Electric Locomotive.

Interior Arrangement of Electrical Apparatus.

placed buffers and draw hooks with screw coupling, of standard English pattern, besides a central automatic coupler, so that the locomotives can be used for hauling either standard coaches or electric stock.

Cab.—The cab, of the box wagon shape with curved roof, is constructed of steel plates ⅛ in. thick riveted to supporting vertical and longitudinal angles, which are in turn riveted to the underframe. The upper portion of the cabs on each side between the doorways are fitted with louvres of pressed steel for ventilation. All lines of rivets are covered with neat metal mouldings so as to improve the appearance of the outside of the cab. At each end of the cab there are four movable windows, three being dropping lights, and one hinging inwards. There is also one dropping light at each side, in the corners.

Hinged doors are fitted at each side of the locomotive at the ends, there being two single doors and two double doors, the double doors for use whenever it is necessary to remove the exhausters, compressors, etc., from inside the cab. All windows are glazed with $^5/_{16}$ in. glass, the doors being fitted at the bottom with steel frames.

The locomotive is fitted at each end with complete driving equipment consisting of master controller, provided with "deadman's" handle, air and vacuum brake, driver's valves, starting switches for exhauster motors, valves for air operated whistle and sanding gear, air and vacuum gages and ammeter, also at each end of the cab to the right of the driving equipment is fitted a column to carry the hand brake gear.

The control and brake equipment is as far as possible divided into two sets and placed on either side of the locomotive, leaving a gangway down the center. The control itself is entirely divided into two sets, one set for each two motor equipments.

Taking each side of the locomotive, the arrangement is as follows:

On one side, switchboard containing the necessary main, control and cut-out switches, compressor motor switch and main lighting switch, control gear consisting of contactors, resistances and circuit breaker, all mounted on a strong steel frame rigidly connected to the cab sides and underframe. Underneath this is fixed the reverser. The air compressor, main air and vacuum reservoirs are placed in line with the supporting frame.

On the opposite side of the locomotive, looking from the same end, are arranged two motor-driven vacuum exhausters, and control gear on framework, arranged as above, together with switchboard containing the necessary control switches, etc., with the addition of the main switches for the vacuum exhausters. The auxiliary reservoir for the air brake is fixed in the cab over the exhausters.

The air brake is of the quick-acting pattern, air being supplied by a B. T. H. electrically-driven compressor of the C. P. 23 type. diameter. Immediately under the above are two transverse rocking shafts to which the pistons of the cylinders are connected, viz.: one air and one vacuum to each shaft, each set in turn being connected to the rigging for one truck. It should be noted, however, that the hand brake wheel at either end of the cab operates the brake rigging on both trucks.

Trip cocks, one for air and one for vacuum, are fitted on each truck.

Power sanding gear is provided, a sand hopper being fitted at each end of the locomotive in the cab, under which is fixed a combined air and sand valve, the sand and air being carried by a flexible pipe to the fixed delivery pipes on the leading end of each bogie.

Lighting.—Four lighting circuits are provided: one of five lamps placed in the roof down each side of the locomotive and one of five lamps at each end of the locomotive, the distribution of the light in the latter being four lights in the destination indicator and one in the headlight. All the lamps are of 16 c. p. and are arranged for working five in series on a 600 volt circuit. Provision is also made at each end of the locomotive for the reception of the necessary oil signal lamps to suit the traffic requirements.

Wiring.—All cables are asbestos covered, and are run in drawn steel tubing fitted in the sub-floor wherever possible. The connection between contactors and rheostats are of copper rod. The necessary connection boxes are fitted in the sub-floor and underframe for connecting to the motors and collector shoes.

Capacity.—Each locomotive when operating on a 600 volt circuit is capable of hauling a 120-ton passenger train on the level at a speed of 35 miles per hour, and of starting with the same load on a grade of 1 in 44, also of hauling a 250-ton goods train up a grade of 1 in 41 and starting with the same load on a grade of 1 in 90.

New Freight Car Repair Shops of the Santa Fe.

The great growth of freight traffic on the Atchison, Topeka & Santa Fe has made it necessary to provide facilities for repairing a greater number of freight cars with a shorter average detention than heretofore. For the past 10 years repairs to freight cars at Topeka, the largest shops on the system, have been made in a large shed run in conjunction with the passenger car repair shops. One planing mill and one wheel shop served both. But the need for larger and more modern facilities was so great that a new group of buildings has been provided for repairing freight cars only, and this work now is separated entirely from the passenger car work. Each of the departments is in charge of a general foreman who reports directly to the superintendent of shops.

The new buildings are, freight car repair shop, 208.5 ft. x

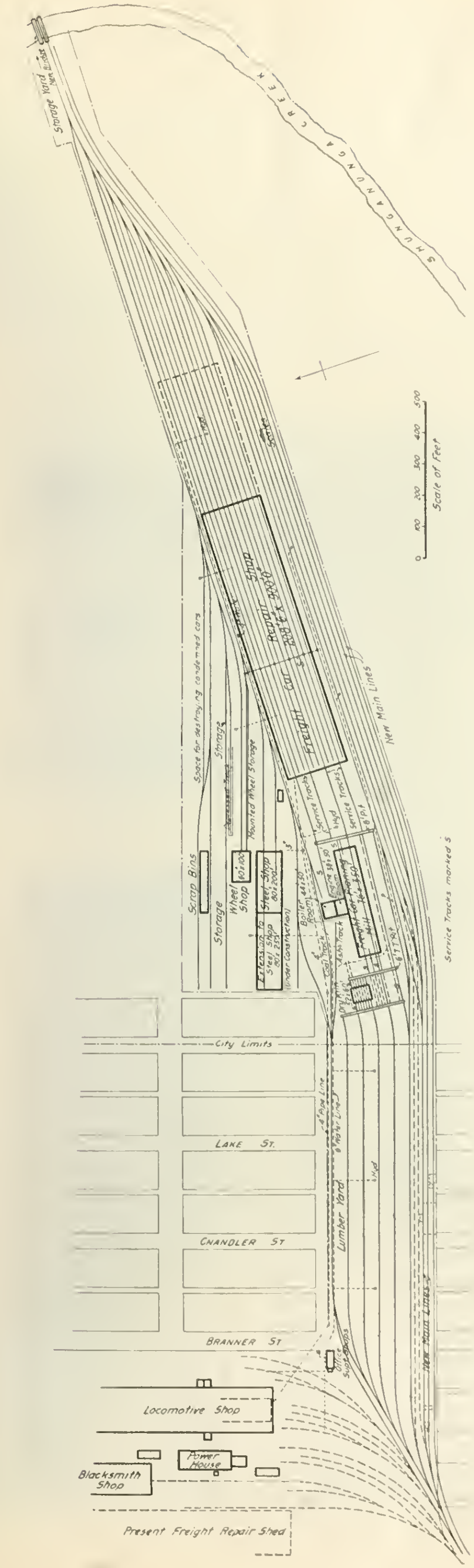
Planing Mill, Structural Street Shop and Power House on Left; Freight Car Shop Beyond on Right.

This set will operate against a pressure of 90 lbs. per sq. in., and has a cylinder displacement of 50 cu. ft. per minute.

In connection with the vacuum brake, there are provided two exhausters each electrically driven by a B. T. H. type D A motor. One of these exhausters is used for creating the vacuum when starting the train, the other (continuously in operation at half speed) for maintaining the vacuum whilst running.

In the underframe there are fixed two air brake cylinders of the vertical type, 13 in. diameter, and two vacuum cylinders, 22 in.

900 ft.; planing mill, 76 ft. x 350 ft.; power house, 50 ft. x 80 ft.; steel car repair shop, 80 ft. x 450 ft.; wheel shop, 60 ft. x 100 ft.; lavatory, 16 ft. x 36 ft.; dry kiln, 52 ft. x 60 ft. These buildings are located along the north side of the main line tracks just east of the older plant. Considerable land had to be bought to provide room for them, some of it improved residence property. Not all of this has yet been vacated, as the accompanying plan of the new group shows. The main line of the road also had to be moved southward. It formerly ran through the site of the freight car



Atchison Topeka & Santa Fe: Freight Car Repair Shops and Yards at Topeka, Kansas.

repair shop. The new buildings are brick with wooden roof framing and tar and gravel roofing.

The freight car repair shop, with roof of the familiar train-shed type, is plentifully supplied with windows, there being 40,000 sq. ft. of glass in the roof and walls, giving ample light. The roof is supported by wooden posts. The brackets for the scaffolding are attached directly to these posts and are so made that the lower or supporting member can be unfastened and the bracket swung down at the side of the posts out of the way. This leaves more room for handling heavy material to and from the cars.

There are 12 tracks running lengthwise through the building. Eight are repair tracks and four are material tracks, one of the latter supplying two repair tracks. There is a total of nearly two miles of tracks in the shop, with room for 140 cars, allowing 50 ft. of repair track to a car. On each side of the material tracks are bins and racks for bolts, nuts and other small material, so placed that the workman will always be within easy reach of whatever small supplies he needs. The material tracks are planked for convenience in handling small hand trucks, but the rest of the floor is surfaced with finely crushed stone. This is wet down about once a week, which keeps it hard and smooth and in good condition.

Outside of the shop, along the south side of the building, are well-arranged racks and bins for such large forgings and castings as cannot be accommodated inside. Material which is liable to damage by the weather is stored at the west end of the shop, between it and the planing mill. The distance between these buildings is 250 ft. and a large part of this is to be roofed over for the protection of this material. Repaired cars are painted outside of the shop on the first two tracks south, compressed air being used where possible.

Practically all of the car repairers work by the piece. The only exceptions to this are the "students," who are paid by the hour until they have become proficient enough in the use of their tools to warrant their being changed to piecework. The car repairers are worked in gangs of four, a leader being in charge of each gang. The work which each gang reports completed is checked by a timekeeper, who also figures the earnings of each gang. The earnings are divided equally among the members of the gang. Each leader has the privilege of choosing his own co-workers. This method has proven very satisfactory as it combines the good men into gangs by themselves and puts the poorer ones into less efficient and lower-paid groups.

It is the intention to make only heavy repairs in this building. The working force is to be increased in the near future to 400 men, including laborers, and the output will be between 50 and 60 extra heavy repairs a day.

Just west of and in direct line with the freight car shop is the planing mill. This is a modern building equipped with new machinery throughout and has capacity to prepare daily, without over-crowding, between 40,000 and 50,000 ft. of finished lumber for repairing freight cars. The shavings exhaust system is worked by 60-in. single exhaust fans, feeding to the fireboxes of three 150-h.p. return tubular boilers. No other fuel is necessary. Power for driving the mill is supplied by a simple Corliss engine built at the shops from designs furnished by the Allis-Chalmers Company.

North of the planing mill is the structural steel car shop. It has a capacity of eight cars and is supplied with all the necessary forges, etc., for handling the work. A traveling crane of 2,000 lbs. capacity supports a portable pneumatic riveter. There is also space in this building for making heavy repairs to car trucks for the freight car shop.

The wheel shop is north of the structural steel shop. It does all of the freight wheel and axle work for the Topeka plant and also for many outside points. There are two wheel presses, one each for pressing wheels on and off the axles, and three axles lathes. The capacity of the shop is between 130 and 140 pairs of wheels a day. The depressed track for unloading wheels and axles and loading scrap and mounted wheels accommodates four cars. Mounted wheels are stored on a spur leading from the wheel shop along the north side of the main shop; trucks from the structural steel shop are handled in the same way, and both are run into the main shop on a crossover track.

The structural steel and wheel shops are run by a small Corliss engine in the former, steam being obtained from the planing mill power house near by. The main shaft extends through the wall to the wheel shop. A rope drive is used.

The drying kiln is west of the planing mill and at the head of the lumber yard. It is large enough to accommodate sills and all other lumber that must be seasoned under cover. The steam coils are supplied by heavily lagged overhead pipes from the power house. The doors are canvas. The lumber yard has five tracks, each about 1,000 ft. long, with spaces 50 ft. wide between them, giving room for the storage of a considerable supply of green lumber. At the extreme east end of the shop grounds are tracks for the storage of bad order cars, with room for 1,000 cars.

The shops were planned for the economical handling of material. The lumber yard, drying kiln, planing mill and freight car shop lie practically in a line, and there is no reverse movement of material. The repaired cars are drawn from the east end of the shop. For such lumber as does not go through the dry kiln or planing mill, tracks pass outside of these buildings directly from the lumber yard into the freight car shop. All of the tracks from the lumber yard to the freight car shop, both outside and inside of the intermediate buildings, are connected transversely by three push car transfer tables, one placed respectively between the lumber yard and the dry kiln, the dry kiln and the planing mill, and planing mill and freight car shop.

The building of this freight car repair plant at Topeka is in line with the policy of the Santa Fe to centralize, as much as possible, repairs to cars and locomotives. The addition of these shops gives the Santa Fe the largest railroad shop plant west of Chicago.

List of Tools in Planing Mill

1 12 in. x 30 in. double surfacer (Berlin)
1 10 in. x 26 in. double surfacer (Preble)
1 16 in. x 24 in. (No. 8) planer and matcher (S. A. Woods & Co.)
1 12 in. x 20 in. sill planer (J. A. Fay & Egan Co.).
1 12 in. x 26 in. surfacer (J. A. Fay & Egan Co.).
1 18 in. x 20 in. four-spindle boring machine (Greenlee).
1 10 in. x 20 in. single spindle boring machine (J. A. Fay & Egan Co.)
1 14 in. x 16 in. three-spindle boring machine (J. A. Fay & Egan Co.)
1 36 in. automatic knife grinder (Berlin)
1 36 in. automatic cut-off saw (J. A. Fay & Egan Co.)
1 36 in. railway cut-off saw (J. A. Fay & Egan Co.)
1 30 in. rip saw (Greenlee)
2 24 in. rip saws (Atch., Top. & S. Fe)
1 Band saw for 18 in. stock (Bentel & Margedant)
1 36 in. resawing machine (J. A. Fay & Egan Co.)
2 No. 3 automatic cut-off saws, 24 in. (J. A. Fay & Egan Co.)
1 9 in. x 9 in. universal woodworker, jointer and sticker (J. A. Fay & Egan Co.)
2 14 in. x 16 in. reciprocal mortisers with boring attachment (J. A. Fay & Egan Co.)
1 14 in. x 16 in. hollow mortiser (Greenlee)
1 16 in. x 18 in. rotary mortiser with boring attachment (J. A. Fay & Egan Co.)
1 6 in. x 15 in. large matcher (J. A. Fay & Egan Co.)
1 6 in. x 15 in. small matcher (J. A. Fay & Egan Co.)
1 6 in. x 15 in. matcher (Berlin)
1 10 in. x 16 in. large tenoning machine (J. A. Fay & Egan Co.)
1 10 in. x 16 in. combination tenoning and gaining machine (J. A. Fay & Egan Co.)
1 14 in. x 14 in. sill tenoning machine (J. A. Fay & Egan Co.)
1 18 in. x 20 in. automatic gaining machine (J. A. Fay & Egan Co.)
1 Shaper, handles stock 3 in. thick (Atch., Top. & S. Fe)
1 Band saw filing machine for saws up to 2 in. wide (Hetrick & Harvey)
1 10 in. double emery wheel

New Freight Car Repair Shop at Topeka; Atchison, Topeka & Santa Fe.

Interior of Freight Car Repair Shop at Topeka; Atchison, Topeka & Santa Fe.

Coleman Sellers.

Dr. Coleman Sellers, one of the most distinguished mechanical engineers of the nineteenth century, both a scientist and an inventor, died at his home in Philadelphia, Pennsylvania, December 28, 1907, at the age of 81.

Dr. Sellers was born in Philadelphia, and in boyhood worked on a farm. His parents intended to have him live a farmer's life, but his mechanical bent was irresistible and during the two years that he worked on a farm he gave his time largely to improving farm implements. At the age of 19 he left the farm and went to work for his elder brothers in the Globe Rolling Mill at Cincinnati as draftsman, and from this time on the story of his achievements is a continuous record of important inventions rapidly succeeding one another. The story of his life, printed below, from the pen of the late president of Stevens Institute of Technology, gives the impressions of an associate and friend. Supplementing President Morton's narrative it should be noted that Stevens Institute conferred on Mr. Sellers the degree of Doctor of Engineering; and that the University of Pennsylvania made him Doctor of Science.

BY THE LATE DR. HENRY MORTON.

Coleman Sellers.

Coleman Sellers was born January 28, 1827. His father's family were among the earliest Quaker settlers of Pennsylvania, and his immediate ancestors were men of mechanical pursuits and respected and influential citizens. His mother was a daughter of Charles Wilson Peale, best known for his portraits of Washington and other officers of the Revolution, but also remarkable for the versatility of his talents, his mechanical skill, and his ingenuity. Dr. Sellers began his education in private schools in Philadelphia, and in 1838 entered the academy of Anthony Bolmar at West Chester, Pa., where he remained until his seventeenth year, distinguishing himself for his scholarship, especially in mathematics and the natural sciences, which had for him a marked attraction. * * * In his nineteenth year an opportunity was offered him in the Globe Rolling Mill in Cincinnati, then operated by his elder brothers, Charles and Escol. It was arranged that he should be the draftsman for the rolling mill, and his first work was in that line. He found his new business congenial, and he applied himself with ardor to mastering its details and with such success that we find him, before his twenty-first birthday, acting as superintendent of the plant, with entire control of its operation. The mills made wire bars, merchant bar and flat rails such as were then in use, and also drew iron telegraph wire. His brothers sold out their interests in the business, and in 1850 he was persuaded to join his brother Escol in building his patent hill-climbing locomotives and his "orograph," a mechanical surveying-machine for plotting contours; it was also a part of the scheme that they should instruct the young men in the mechanic arts. Three locomotives were built for the Panama Railroad and did good service there, although the third-rail grip—the hill-climbing feature—was not used. A few other locomotives were constructed, but the enterprise failed, and Coleman Sellers accepted a position in the Niles Locomotive Works in Cincinnati and soon became foreman. He reorganized the shop, subdivided the work, introduced an effective piece-work system, and radically changed the methods of manufacture, purchased and installed new machinery, and recorded in his diary that he was prepared to complete two engines a week.

These strenuous years of his young manhood were formative in a great degree in determining the bent of his mind and in giving him a fund of experience and a diversified practice which was of great value to him in his subsequent career. They were years of hard mental and manual work, often with primitive and inefficient appliances; but they developed his ingenuity and resourcefulness.

He read with interest the published accounts of electrical discoveries as they were from time to time announced by Faraday and others, and made for his own use the apparatus necessary to repeat many of the experiments for the benefit of his friends. Much of this apparatus is still in existence, and its marked excellence speaks well for his neatness and skill. He botanized, collected fossils and fresh-water shells, and in the latter pursuit his zeal and success were recognized by the distinguished conchologist, Mr. Isaac Lea, who named a new species from his cabinet *Melania Sellersiana* in his honor.

In 1850 he married the daughter of Horace Wells, of Cincinnati, a man of advanced mechanical ideas, who was first attracted to his future son-in-law by a lecture he delivered on "Scientific Fallacies," in which he demonstrated the conservation of energy and assailed, among others, a perpetual-motion scheme then very alluring to many otherwise sane persons.

In 1856 he removed to Philadelphia and entered the establishment of his kinsmen, William Sellers & Company, as chief draftsman and engineer. He applied himself with zeal to the duties of his new position, which afforded him ample scope for his marked inventive ability. His thoroughness, his originality and sound mechanical ideas, as illustrated in the productions of his firm and demonstrated in his published writings and his lectures, soon earned for him a distinguished position in the engineering world. As in Cincinnati he had identified himself with the Ohio Mechanics' Institute, so in Philadelphia he soon applied himself to the work of the Franklin Institute, and in a great measure helped, by his papers, lectures and committee work, to instil a new measure of vitality into that venerable society.

Dr. Sellers early took up photography, first as an adjunct to his business—to advertise machines—then as a pastime, and found in it a new outlet for his vigorous mental activity. He attained considerable proficiency and contributed many useful papers to the photographic press. He was for several years the American correspondent of the "British Journal of Photography," then the leading exponent of the art.

Dr. Sellers was admitted to partnership in the firm of William Sellers & Company about 1870, and upon its incorporation in 1885 was elected to the office of engineer. He remained with the house for over 30 years, retiring in 1887 to take up an independent practice as a consulting engineer. He has been granted more than 30 patents of utility and value, and the science of engineering is largely indebted to him for the great progress it has made during the last half century in the direction of increase of efficiency of machinery and mechanical appliances.

The versatility of Dr. Sellers has already been referred to. As additional evidence of this, and also the practicality which marked his original work in whatever line, may be mentioned the use of absorbent cotton for surgical operations, which was first thought of and recommended by him in his contributions to scientific journals as early as 1861. He also proposed the employment of glycerine for the purpose of keeping photographic plates moist, and it is interesting to note, in connection with the experiments in the early days of photography, that in the year 1861 Dr. Sellers invented and patented an apparatus in which figures in stereoscopic photographs could be seen as if in motion. Dr. Sellers' uncle, the late Franklin Peale, suggested the name "kinomatoscope" for this apparatus, which therefore, both in name and purpose, may be truly accepted as the parent of the "kinetoscope" of to-day, which has been made possible by instantaneous photography and subsequent improvements in electrical appliances. He had many avocations. Needing a microscope to study boiler scale he mastered microscopy and invented many improvements in that field. He used the telegraph to connect the different departments of the factory at Philadelphia and himself became a capable operator. He was also expert at shorthand. At the Centennial Exposition in 1876 he was one of the special judges for final settlement of disputed awards.

When Dr. Sellers retired from his position as chief engineer with William Sellers & Company in 1887, he became a non-resident member of the Faculty of the Stevens Institute as Professor of Engineering practice, giving such time as he could spare from his practice as consulting engineer to deliver lectures on the actual practice of engineering.

In 1889 Dr. Sellers was called upon by capitalists to consider the practicability of the development and utilization of the hydraulic power of Niagara Falls. He was subsequently appointed to represent America in the International Niagara Commission of five members, with Lord Kelvin as chairman, which in 1890 was established in London to consider various methods of utilizing the power of the falls, and he became the active engineering head of the work, both as consulting engineer of the Cataract Construction Company, and president and chief engineer of the Niagara Falls Power Company. The important mechanical design of the large dynamos for the plant was the invention of Dr. Sellers, and they were built under his patents by the Westinghouse Electric & Manufacturing Company. Under his advice and directions important improvements have been made in the hydraulic machinery, and to his mechanical ability, sound judgment, and experience is largely due the success of the entire equipment and its freedom from costly methods so often met with in undertakings of this magnitude. In 1881 Dr. Sellers was appointed to the honorary Chair of Professor of Mechanics in the Franklin Institute of the state of Pennsylvania.

He is a member of the American Society of Naval Architects and Marine Engineers; member and past president of the Franklin Institute of the state of Pennsylvania; member and past president of the American Society of Mechanical Engineers; member of the American Society of Civil Engineers and of the American Philosophical Society; also of the Institution of Civil Engineers and the Institution of Mechanical Engineers, both of Great Britain; and corresponding member of the Society of Arts of Geneva, Switzerland.

In 1887 the Royal Norwegian Order of St. Olaf was conferred upon him by the King of Sweden in recognition of his valued services in his profession. He was one of the founders and for a time president of the Photographic Society of Philadelphia, and also of the Pennsylvania Museum and School of Industrial Art of Philadelphia. He was a member of the Seybert Commission of the University of Pennsylvania for the investigation of the claims of spiritualism, being chosen in consequence of his active and clear perception of the laws governing cause and effect, and his knowledge of sleight-of-hand in which art, as a pastime, he had been an expert since boyhood.

Railway Signal Association.

The regular meeting of this association was held at the United Engineering Societies Building, New York City, on Tuesday last, President A. H. Rudd in the chair. About 150 members were present, which is the largest attendance ever reported at other than an annual meeting.

The executive committee announced that under the revised constitution 22 railroads had appointed representative members of the association, the representative member in nearly every case being the signal engineer of the road. These roads are the Atchison, Topeka & Santa Fe; Baltimore & Ohio; Baltimore & Ohio Southwestern; Boston & Maine; Chicago, Rock Island & Pacific; Chicago, Indiana & Southern; Chicago & North-Western; Chicago, Milwaukee & St. Paul; Cincinnati, Hamilton & Dayton; Canadian Pacific; Delaware & Hudson; Delaware, Lackawanna & Western; Lehigh Valley; Maine Central; New York Central & Hudson River; Norfolk & Western; Pennsylvania; Pennsylvania Lines West of Pittsburgh; Philadelphia & Reading; Pittsburgh & Lake Erie; Seaboard Air Line, and the Staten Island Rapid Transit.

The first discussion was that on specifications for the installation of automatic block signals, taking up the report which was presented at the Milwaukee meeting last October, but which was not then discussed. Mr. Denny, Chairman of the committee, read the specifications paragraph by paragraph, and the meeting, resolving itself into a committee of the whole, discussed and criticised every word. As in former discussions of this kind, the differences of opinion which developed were legion, and the subject occupied the attention of the meeting until luncheon time. Votes were taken on a number of questions, but the conclusions reached have the effect only of suggestions to the committee—to guide it in making revisions for the next annual meeting.

In the afternoon the association listened to a paper by T. R. Cook, an electrical expert of the Pennsylvania Lines West of Pittsburgh, on Economy in the Use of Storage Batteries in Operating Signals and on the Details of Caring for Such Batteries. Mr. Cook is not a member of the association, but the paper was prepared at the request of a member. Statistics of service and of experiment were presented, showing the cost of operating signal motors by power derived from a power house conveyed by a line wire, and by primary batteries situated at the signals; and the principal conclusion was that for the average double-track road the cost by the power line will be 30 per cent. less than with the use of gravity batteries.

In the discussion Mr. W. H. Elliott thought that Mr. Cook had figured the cost of using gravity cells too high, and that the saving by using the power line would be greater than he had shown. Besides this there is a marked advantage in using a power line with storage batteries, because of the greater freedom from failures. On a four-track line the saving in cost in using the power line is still greater. Mr. Cozzens told of the satisfactory service of a power line on the New York Central, where power is bought from the Niagara Falls plant. Mr. Gilmor told of the successful use of power lines on the Pennsylvania. Asked as to the greatest difficulty encountered in the use of storage batteries, he said that it was the need of better informed repair men. These men should be able to discover trouble in storage batteries by ocular inspection. They can see the batteries every day, whereas the battery expert cannot make inspections so often. Mr. Rudd said that in one case the charging line on the Pennsylvania had been out of service for a week, yet the storage batteries kept the automatic signals working satisfactorily. This, however, was with electro-pneumatic signals, requiring but little current. The Pennsylvania now uses cells of the 5E type, fixed at each signal bridge—a cell working a track circuit and a signal circuit. A four-track bridge requires eight cells, one for each track and four in reserve. Formerly "9-E" cells were used, each cell feeding two-track circuits; but this was not entirely satisfactory. On a busy four-track line cells are charged every night, and on lighter divisions three times a week.

On the Lake Shore & Michigan Southern, as reported by Mr. Denny, power plants, consisting of a 15-h.p. gasolene engine and a 10-kw. generator, are situated at intervals of about 15 miles, and each is used to charge two loops, one east and one west. This is a convenient length of line for a maintainer. Mr. Denny could give no complete statistics, but said that for the first 11 months the cost was about 20 per cent. less than it would have been with primary batteries.

The meeting passed a vote of thanks to Mr. Cook, the author of the paper, and referred it to the committee on storage batteries. The specifications for automatic block signals were then again taken up for discussion. The only radical difference of opinion developed was on the question whether an automatic semaphore should be so designed as to lock when in the stop position. One member had had a distant signal (standing in a horizontal position) pulled down by a painter and tied there for convenience in painting and then forgotten and left so as to send a train over a misplaced switch. The majority of the speakers, however, believed the lock undesirable.

In discussing the question of what metals should be used for bearings attention was called to the fact that new non-corrosive metals were now appearing on the market, so that a specification requiring the use of bronze for one of the two metals for bearings may be behind the times.

An informal discussion followed concerning the difficulty in arranging mechanical connections between cabins and signals, so that all switches can be bolt-locked by the signal connection. In large plants it is often necessary to run a circuitous line of pipe to comply with this requirement of the specification. Many members agreed that electric locking was the only practicable remedy.

Foreign Railroad Notes.

The Swiss union of railroad employees asks the state to raise the pay of the lowest grade of employee to $291 per year.

The Hungarian State Railroads purpose to buy three coal mines in different parts of the country to secure a better supply of fuel.

Trial trips have been made on a new railroad up the Wetterhorn, which is so steep it is called an "elevator," rising 450 meters in a length of 600, which is a "grade" of 3,960 ft. per mile, or 75 per cent.

Hungary is rejoicing over its first self-unloading car. It is for coal, built in Budapest, and apparently substantially after an American design, with trucks, but carrying only 44,000 lbs. It is for a 38-in. gage road, however.

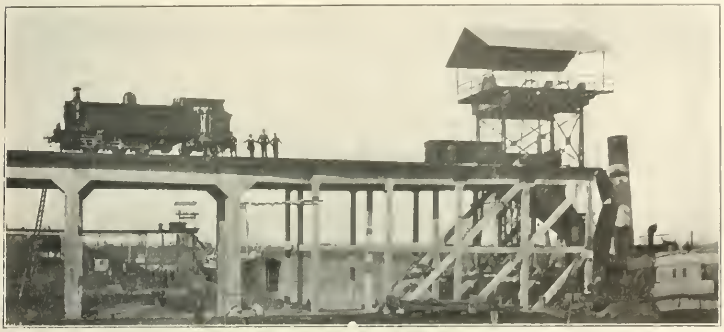
The project for pooling the rolling stock of the state railroads of the several German states, which was seriously discussed a year or two ago, has come up again, and is said to be likely to succeed, but limited to the freight car equipment.

The train-robber turns up in Germany adapted to the environment. He put on a conductor's cap, sidled along the foot-board until he came to a compartment where there was but one man, opened the door and asked to see the passenger's ticket; when the passenger pulled out his pocket-book with the ticket he knocked him senseless with a revolver and seized the pocket-book (which contained $8.33), and when next the train slowed down lighted out, and at last accounts had not been traced.

Reinforced Concrete Railroad Viaducts at Seville, Spain.

BY E. OMMELANOE.

The Spanish Cala Iron Company recently built a private railroad about 60 miles long from its mines in the interior to the port of Seville, where it ships ore by vessel. Its original plan for terminal docks in Seville included two timber loading wharves along the river, approached by timber trestles and earth embankments over the low ground between the river bank and the high ground further inland. Work had already been begun on this plan and some of the approach embankment made when the company decided to build the loading wharves of reinforced concrete instead of timber and instead of timber trestle and embankment approaches to use reinforced concrete viaducts. The change in plan was decided on because of the height of the approach viaducts necessary to carry the line from the high ground back from the river to the docks, the treacherous nature of the intermediate low ground and the necessity of making as small obstruction as possible to the flow of water across the flats during floods.



Reinforced Concrete Wharf With Car Dumper at Seville, Spain.
Second wharf and viaduct in left background.

The two wharves are about 600 ft. apart. The completed part of the embankment was made use of in building the approach viaduct to one of the docks. Nine spans of concrete viaduct were built between the end of the embankment and the wharf. The other viaduct approaching the second wharf is built entirely of reinforced concrete girder spans.

In general the concrete spans of both viaducts are similar. Each is double-tracked and is built in two levels. The upper level gives a slight down grade to the dock from the high ground back of the river. The track on the lower level slopes back from the dock and is used for returning empty cars by gravity to a storage yard at the inner end of the viaduct. The reinforced concrete girders are 4 ft. deep by 9 in. wide with a span of 29 ft. 2 in. between centers of supporting columns. There are two such girders under each track supporting a concrete slab floor 11 ft. 8 in. wide, on which a track of 3 ft. 4 in. gage is laid with 65-lb. rails on longitudinal stringers secured by bolts passing through the concrete floor. The girders and the supporting columns were built in the form of a monolithic structure.

The columns are rectangular, 23½ in. x 9 in. They are braced laterally at two levels, one 26 ft. 3 in., and the other 35 ft. above high water. Additional lateral bracing is provided for the high columns at about 42 ft. 7 in. above high water. Each lateral row of four columns supporting the two tracks rests on a reinforced concrete slab 22 ft. 2 in. x 5 ft. 9 in. x 8 in. deep, stiffened with ribs. This slab is in turn carried on a foundation block of ordinary concrete, 22 ft. 11 in. x 6 ft. 6 in. x 12 in. deep, giving a uniform bearing pressure on the ground of 1,000 lbs. per sq. in. under normal load and which may be increased to 2,200 lbs. per sq. in. if both tracks are supporting the weight of two loaded trains complete with their locomotives. The first six spans of one of the viaducts inland from the wharf are built in the form of a curve of 622 ft radius which was made necessary in order to join the line to the other line back on the high ground.

The two wharves or docks were the most difficult part of the work. They consist of reinforced concrete columns, the highest of which are 89 ft. high, braced together by longitudinal and lateral girders and by diagonals in the three outer panels. One of the illustrations shows one of the docks in the foreground and the other dock in the background. The docks have two levels, one 17 ft 6 in. above low water and the other 49 ft. 6 in above low water. The upper platform is about 25 ft. wide and 75 ft. long. The floor is 8 in thick and is designed to have a carrying capacity of 736 lbs. per sq. ft., or to support at any point a movable 10-ton crane. The lower platform is 5 in thick and is designed to carry a load of only 184 lbs. per sq. ft. It is used for loading ore from light dump cars. The upper platform supports the large cars used in through transportation of ore and if necessary the locomotives, as shown in the illustration. The vertical posts and all of the diagonal and horizontal braces are 12½ in. sq. On the upper level of the dock is mounted a car dumping apparatus for unloading the cars direct into a spout leading to the hold of the vessel loading alongside.

The columns in the docks are supported on reinforced concrete piles 12½ in. sq. These piles were moulded and allowed to set two months before being driven. In building the first dock a pile driver with a tup weighing 2,500 lbs. was used and the piles sunk with the aid of a water jet. In driving the piles for the second wharf however, no water jet was used, but the weight of the tup of the pile driver was increased to 6,000 lbs.

In the construction of the first viaduct and wharf the concrete moulds were made of timber and the scaffolding was erected and taken down as each panel was finished. It was found, however, that the tamping of the concrete into the moulds together with the caustic action of the cement and the changes from wet to dry and vice versa made the boards warp. Therefore, and because the spans were similar so that the same moulds could be used for the same parts on each, the moulds used on the second viaduct were made of sheet iron ⅛ in thick stiffened with ribs of angle iron placed 1 ft. 8 in. apart. In this way the erection and dismounting of the moulds was hastened, the concrete ran better and the finish was smoother and finer. In a few instances this method could not be used and at such times specially stout timbers were selected. The moulds for the girders and the cantilever extensions were made in the same way.

Section of Two Reinforced Concrete Viaducts Leading to Wharf of the Spanish Cala Iron Company at Seville.

Before use, the whole structure was carefully tested. One of the spans of the first viaduct was loaded with rails placed so as to correspond to the weight of a 18-ton locomotive. The deflection under this load was only [illegible] in. after 72 hours. Another span was loaded with 72 tons, which is more than half again as much as the weight of the locomotive which is used on the viaduct. The greatest deflection under this load was [illegible] in. In another test a moving train of 20 cars weighing 20 tons each hauled by a locomotive weighing 18 tons was suddenly stopped by emergency application of the brakes. This was done repeatedly, the wheels being skidded on some of the stops. The greatest deflections recorded were $^{1}/_{10}$ in. under the locomotive and [illegible] in. under the cars. No oscillation was observed even in the curved part of the viaduct where the columns are highest.

The one of the two viaducts which was built first took about eight months. It cost about $34,500. Its loading pier, not including the tipping apparatus, cost about $12,000, making a total of $46,500.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

II.

*The Epoch of the Merchant Carrier on the Sea.**

The common carrier performs the most conspicuous transportation service upon the ocean, but the private sea carrier continues to perform a surprisingly large amount of work. The wagon, the typical private land conveyance, is relegated to a purely local work, but on sea the independent vessel is yet a good ship still maintaining a position of independence, equality and rivalry in certain phases of the work.

The development of the common carrier upon the ocean giving regular service is more recent than it is upon the land. Its beginning in American foreign commerce dates practically from the close of the war of 1812. Before that date, with certain small exceptions, the unit was the single private vessel belonging to and used by a merchant or a roving captain. Since that date the independent ship has been of steadily declining importance in comparison to the line of vessels running at regular intervals and carrying for all shippers. The causes of the late continuance of the merchant epoch and the slow emergence of the common carrier may be considered under three heads: (1) The lack of facilities for carrying on commerce, (2) the character of the commerce, including the great lack of travel and exchange of mail, and (3) the disturbed, warlike and semi-piratical conditions of the times.

(1) At the beginning of the last century and during all the preceding colonial epoch, a long period was required to deliver produce in a foreign country and get the returns from its sale. There was not, as now, prompt departure and quick voyages, not to mention selling by telegraph, and if need be, paying by telegraph. It is now easy to follow prices and, if need be, to send produce to a European commission merchant and get quick returns. By the actual commercial practice of to-day the world has ceased to have dimensions, so far as they affect international sales and payments. For practical purposes the telephones bring the merchants of a great city as near to each other as though they were in one building, and the ocean cable, with its codes of pregnant words, brings the man of all cities side by side. Their knowledge of prices, their quotations and their bargains are almost as prompt as the telephone. The financial partners of the wire-flashed knowledge are the bill of exchange, and the international banking system which can transmit credits and payments to the seller as quickly as quotations can be passed to prospective purchasers. From bargaining and from payment the time element has been eliminated, and the improvement of shipping shows that in a century about three-fourths of the time element has been cut out of the actual moving of commodities.

A comparison of the modern speedy methods with the possibilities that faced the 18th century merchant shows why there was so little organization in those days. A single exchange of letters in any bargaining operation took an amount of time. If a man made a quotation by mail greater than the long round voyage. It might be three months before his transatlantic correspondent could accept or decline. Plainly, business by correspondence was well-nigh impossible—a paralyzing example of the drawbacks that came from slow communication. It is true that the bankers had long used bills of exchange in place of bullion and cash, but the bills had to be presented. In the year 1837 there were some heavy failures of American merchants in London, due to the non-arrival of large remittances which they expected to come by the New York packets. They were hourly expected, but were so greatly delayed "during the prevalence of extraordinary east winds which blew for two months" that the merchants with wealth locked in the Atlantic winds failed wretchedly in London for the want of it. This, too, occurred in the days of the famous American packet ships. The present cable would have shortened the anxiety [illegible] The sailing vessels of these [illegible] so slow that months elapsed before American goods [illegible] European [illegible] could be heard from.

It was therefore difficult to organize regular ocean carriers in the face of such difficulty of communication, and the natural response to the conditions of the time was that each vessel usually became a commercial unit—a trading [illegible], her commercial operations being managed in some one small world in nearly the same way that a cart peddler or a trader among the Indians seeks his market. The management of the ship [illegible] and the goods concerned had to be in the same place. The possibility of detached control of moving merchandise had not arisen. Under such conditions regularity of exchange of goods is difficult to arrange, and it is upon regularity that lines of vessels depend. Satisfactory development of lines demands such organization of commercial operations that the supercargo or the bargaining captain can be done away with so that the merchants may stay at home and send their goods by the dependable carrier. This was almost impossible in the slow-going and disturbed century preceding the peace of 1815.

The continuance of the period of private ocean carrying enterprise was made easier by the small tonnage of the ordinary vessel of that day. It was by its size fitted for a private conveyance. Three or four modern freight cars would hold as much as a good-sized vessel and more than most of them. The Maryland or Virginia planter living upon the tidewater estuaries connecting with the Chesapeake often had his own sailing vessel by which he could send his tobacco or grain to Europe. If he had room he might carry some of his neighbors'. The merchants of our seaports who handled the export commodities of the small producers placed this freight in their own ships, sent it across the sea to market to be sold upon their own account by their own representatives and loaded the ships with goods to be distributed from their own warehouses on this side. Almost the whole of ocean transportation of this period was upon the basis of the individual ship carrying the private cargo of her merchant owner.

(2) The character of the commerce was such that no steady flow of goods took place between Europe and America or any other two continents of the world. America was in the homespun stage and every household was nearly independent of every other one and of the rest of the world. Foreign trade depended largely upon luxuries and exotics. The import of manufactures from abroad was small and the family supply for many months could easily be laid in at one time. The export of our raw colonial produce was not a trade requiring shipments at all seasons of the year. It was shipped then, as are such goods now, shortly after harvest. Hence there was no great need for lines of vessels to carry freight either to or from this country at all seasons. The commerce of that day was sufficiently served by the irregular voyages of independent ships, of which there were many.

Nor were lines necessary to accommodate the travel of that period. The number of travelers was so small that it would not have paid ship owners to establish passenger lines. People did not go to sea for pleasure in those days. They went when they were compelled to, and their departure was a matter of tears, prayers and the making of wills. Those few persons who were thus compelled to make sea journeys hunted up any vessel that happened to be going their way and made their bargains with the captain.[1] The passenger was a corollary, a by-product gladly taken and even advertised for[2] when opportunity offered and the vessel came to a promising port; but the passenger traffic was never sufficient for a regular business. It is surprising to note the small provision for passengers and the consequent small passenger traffic at the time of the introduction of steam navigation on the North Atlantic. The famous packet ships of 1840 usually had provision for ten first cabin passengers and twenty second cabin passengers. In the steerage they could carry hundreds of emigrants to a new home across the Atlantic, but the emigrant business was small in the half century between the Stamp Act and the exile of Napoleon. The satisfactory unit for all kinds of ocean carrying was, therefore, primarily and naturally the freight vessel sent across the sea upon the private enterprise of her owner.

After the Revolution various changes in national life, commercial conditions and the technique of ship building were paving the way for a rapid rise of common carriers when the world settled down to order after the commercial chaos of the epoch of dynastic, colonial and imperial wars that ended in 1815.

It is not the intention of the writer to give the impression that the period prior to 1815 was one of meager commercial connections. It was, on the contrary, a period of very wide shipping connections. American ships were everywhere; our fishermen, our traders and our merchants carried the flag upon their small sailing craft to places where it has since been unseen for decades at a time, but

*The author wishes to state that in the collection of data for part of this chapter he received valuable assistance from Mr. A. R. [illegible], of Philadelphia.

[1] *Quarterly Review*, Vol. 62, p. 207.

[1] In "Views Afoot," p. [illegible], Bayard Taylor gives a graphic account of his journey across the Atlantic with a captain whom he had sought out. This was near the middle of the nineteenth century, in the day of the regular packets, but the packets were costly, and Taylor, to spare expense, went in the style of 1800 and hunted up a captain who was quite as willing to fill his space with human beings as with cotton if they paid as well.

[2] [illegible] Gazette, September, 17[illegible].

they were bound on individual enterprises, not as common carriers, and they went once where they might never go again.

Referring to the eastern trade of Boston and Salem, Lindsay says: "In the late 18th and the early part of the 19th century the merchants of Massachusetts supplied not merely their own people with the bulk of the teas, spices, silks, sugar and coffee from the East, as well as with nankeens and other cotton clothes, but re-shipped them from Boston to Hamburg and the northern ports of Europe in their own vessels." Owing to the monopoly of the British East India Company they were enabled to derive large profits from trade with British colonies from which British subjects were excluded.

In the same period Philadelphia boasted that her ships went to Calcutta, Madras and Canton and Sumatra; to Leghorn Messina, Hamburg; the ports of Spain, Portugal and France, and, as of old, greatly to the West Indies.‡

This is almost as good a list of connections as that same port can boast to-day, when it is the metropolis of a state twice as populous as the nation of 1790. Many a little port like Salem, Nantucket, Richmond, Bridgeton, N. J., which sent ships the world over a century ago, is now but the harbor of fishing boats and paddle-wheelers.

The method of carrying foreign mail during the colonial period is indicative of our transportation methods until after the war of 1812. We are told in the early history of New York that the keeper of a tavern hung up a coffee bag in his place for the receipt of letters. Before setting sail the masters of vessels called for any accumulated mail and delivered the letters through some tavern at the port of destination for a penny a piece. This method the British conquerors of New York found in vogue in 1665, and continued throughout most of the colonial period. It was only in 1816 that the mail was taken permanently by regular lines of packets.

As late as 1851 an American publicist in setting forth the reasons why the United States should have a steamship line to the Mediterranean advanced as one of his arguments the fact that it was a shame for the American people and the American nation to be any longer dependent upon the chance sailing ship for the transport of mails to that part of the world. "At the present time it (the Government at Washington) is compelled to rely even for the carrying of its despatches to naval commanders on that station and the coast of Africa upon transient vessels or the ordinary routes over the continent of Europe. We have known of a case of a vessel in the Mediterranean and others on the coast of Africa required in our home service and ordered home immediately when the despatch did not reach the commander for fourteen weeks after it was sent*— time enough for the battleship "Oregon" to sail around two continents and have a month to spare.

The same writer who in 1850 was arguing for a steam line to Italy from New York estimated that since travel to Italy had so greatly increased, there must then have been 700 Americans going to Italy each year. As mail and travel go hand in hand, it is plain to be seen why there was no regular connection or regular mail to the Mediterranean from this country even in 1850, for these conditions were like those prevailing between America and the other countries of Europe at earlier dates.

(3) The effect of unsettled conditions. The period from the Revolution to the war of 1812 was one of great commercial activity, but one ill-suited to the establishment of regular connections. The European trade reprisals which accompanied the wars, beginning with the French Revolution and extending through the Napoleonic upheaval, rendered the American ship often the prey of the naval vessels of both England and France. She suffered from the navies and the privateers of both these countries from Mediterranean pirates, and it is even asserted[2] that under the cover of the general disturbances American privateers took American vessels. Under such risks the maintenance of regular service was impossible. But the profits of the commerce of this period were so large as greatly to tempt individual enterprise, and this indeed seems to have been the period of its greatest development in ocean transportation. Lindsay in his "History of Merchant Shipping" says (Vol. 2, p. 363) of this time that American "merchants and shipowners increased in numbers to an extent out of all proportion to the general state of the population. Many persons who had realized moderate capitals from mercantile and other pursuits now became daring adventurers as carriers by sea." Plain commerce was "daring adventure."

The establishment of lines which might have come then was unquestionably delayed by the uncertainties and disturbances of the time. Periods of peace, then as during the preceding century were of short duration—too short for the growth of well-established lines, which at best are the result of years of development.

The great shipping lines of the present have nearly all had small beginnings, with slow growth at first and have attained their great size in from 30 to 60 years. Their ripening into greatness is usually the result of some one man's business genius, and his career normally reaches over several decades—sometimes half a century. Many of the great ocean lines show, by an examination of their history, that they have been started and built up by the life-work of some one man. This slow growth, too, has occurred when the merchant and the carrier have had at their command all the speedy tools of to-day—of steamships, railways, telegraphs and the security of large populations and nearly continuous naval peace. During the 18th century England, France, Spain or Holland were engaged in naval wars nearly half of the time. Two decades of continuous peace were almost if not quite unknown, and the intervals were usually much shorter than this. And pirates almost as bad as war were ever on the sea and were never out of the merchant captain's mind.

The New York and Philadelphia journals of the first part of the 18th century contain a wonderful collection of reports of the encounters and experiences with the pirates who sailed the shores of the North Atlantic. This is the reason for the 18th century resemblance in build that existed between a merchantman and a war vessel. To make matters still worse, war in that day meant privateers who multiplied many fold the number and commercial destructiveness of navies. It is hard to draw any economic distinction between privateers and protected pirates. Both forbid line traffic. No vessel was so surely theirs as the vessel of known and regular movements.

There was thus a premium on disorganization and a premium on increased trade in the first quarter of a century of our national existence. The merchant trader loaded his vessel with a cargo and sailed away. If he escaped capture he could sell his cargo in the West Indies or Europe at rates which were extremely profitable. But he took in his own hands not only his property, but his life. Here, therefore, was the most commanding motives for the building of fast ships. If you could outsail your rivals and the pirates you got rich quickly; if they outsailed you there was a fight, and perchance your ship went off under some other captain flying a foreign flag, and you might return a man before the mast or you might end your days a slave in Barbary. The result was that the American vessel became the fastest in the world.

The trade method of the period is well established by the case of one Abraham Pesch, a prominent shipping merchant of Philadelphia. He decided to risk the danger of trading with the blacks of San Domingo, who were then in insurrection and bitter with hatred toward the whole white race. Pesch's schooner was forthwith "invitingly" laden and cruised about at a safe distance, but near enough to tempt the natives. Thomas Thuit, the single white man whom the natives had saved, that he might serve their commercial interests, communicated with the schooner, assured her of safety if she moored, unloaded and sold her cargo. "Impromptu coffee at 5 cents a pound was poured like sand into the hold of the craft until water washed her gunwales." The cargo was sold at a great profit on the vessel's return. Such vessels might be owned by a merchant who would send his vessel after cargo, or they might be owned by a roving trading captain, who would get a cargo in the manner indicated above and sell it to some merchant upon his arrival in port.

The career of Stephen Girard is typical of the commercial methods of the period. He was a merchant and shipowner who sent his ships for foreign goods, and he also bought cargoes that were brought to the port by such rovers as Pesch. Girard's greatest prosperity came during the period 1793-1812. He seems to have been one of the pioneers in a quickly copied policy of sending a vessel out to make repeated exchanges of cargo before returning with the accumulated profits. His vessel went to the West Indies, where cargo was exchanged for coffee and sugar, then proceeding to Hamburg or Amsterdam, the coffee would be sold for Spanish dollars or exchanged for cargo which would secure him at the Spice Islands, Calcutta or Canton the products of those climes. We probably owe the possession of Oregon to voyages of this character by which Astor and others of New York traded for furs on the Pacific coast that they might exchange them for tea in China.

Men did not usually embark on these enterprises, more dangerous than present service in the navy or standing army for mere pay. Then, too, the owner wanted the greatest possible interest of the crew in the success of the voyage. Derby, the great merchant of Salem, gave each of his common sailors the privilege of taking 800 lbs. of freight for private trafficking and personal profit. The officers had a proportionately larger share. In 1819 an English publicist bewailed the fact that his nation must soon disappear from the China trade because there was nothing to send out but bullion and coin, while the prosperous traders of the United States had the coveted ginseng and possessed a monopoly of trading on the north Pacific coast of America, where for a few trinkets and old clothes the Indians would surrender the choicest furs to be exchanged for China cargoes on so profitable a basis that even the common seaman's share of the gain was sometimes several thousand dollars.

During the merchant carrier period of the beginning of the 19th century the captain of the ship naturally filled a much more important place than he now does. At present he is chief navigator,

‡ "History of Merchant Shipping," Vol. 3, p. 6.
† Young's "Memorial History of Philadelphia," Vol. I, p. 409.
* De Bow's Magazine, 11:232.
[2] Lindsay's "History of Merchant Shipping," Vol. 11, p. 379.

Abraham R[illegible]'s "Philad[illegible] and Her Merchants," p. 21.
Henry W[illegible]'s "Girard College and Its Founder," p. 16.

subject to steamship agents, who load and unload his vessel and to pilots who keep him in leading strings until he is safely down to sea. A hundred years ago he was usually his own pilot, and he was often, in addition, the owner or the business representative of the owner, if perchance the owner was not also on board. The captain sold and bought cargo like a merchant. If he lacked the qualities for such service the ship carried a business manager called the supercargo, a man who has now long been unnecessary because of the commission merchant, the ship broker, the freight broker, the ocean cable and the wide mercantile organization that has resulted from instantaneous communication, changes which have reduced the captain to the position of conductor on a freight train and made the supercargo, like the pirate, an ornament of history.

The close of the war of 1812 has been mentioned as the most important date marking the transition from the merchant carrier to the common carrier. It is almost needless to point out that the merchant continued a carrier after this date, and that, on the other hand, there had been many previous signs of the coming change. Some of the preliminary steps in this change are worthy of notice here. First among these signs of change is the increase in the practice of chartering ships—*i. e.*, hiring out; second, is the growth of the practice of having an agent transact the port business of the ship; third, the increase of joint ownership of shipping enterprises; fourth, attempts at founding lines.

1. The practice of chartering vessels is almost as old as history. It was practiced on the Nile in Roman times, with a good bill of lading. The Venetians carried it to a fine point to the heyday of their prosperity, but the practice did not begin to affect relations in the western world until about the close of the 18th century.

It was the most natural thing conceivable for a merchant knowing the lines of trade to find that he could use more ships than he had and hire one. That it had not come into prominence much sooner must be due to the fact that wars, disturbances and governmental restrictions in America and the greater chartered companies in Europe kept mercantile firms at a small size in colonial times. But in the prosperity that came from supplying Napoleon's armies during the last decade of the 18th century ships were chartered.[1]

Closely akin to chartering was the offer of merchants of Havre to the rover Cleveland, when he was in that port empty-handed and with full pocket from profitable sale of both ship and cargo. Several firms offered to fit up a ship for him, load it with a rich cargo and let him start out to make traffic with it.[2]

In Boston[3] two vessels were advertised in 1789 as about to sail for the isles of France and India, and "any person wishing to adventure to that part of the world may have an opportunity of sending goods on freight." The use of the word "adventure" there is also extremely suggestive of the attitude of the day toward maritime operations—you sailed over unchartered and piratic seas to unknown lands, strange peoples and markets of which you had only last year's reports. This practice of carrying for others evidently advanced rather more rapidly in Great Britain than in America, as witnessed by the following passage from the introduction to the volume published in 1807 by the Society of Shipowners of Great Britain:[4]

> The Society of Shipowners think it important to state that the numerous body of men whose capitals are embarked at this time in British shipping are not engaged in other mercantile pursuits, but depend wholly on the returns they expect to receive from their property so employed. This observation is considered the more necessary from recent inquiries which have been made to ascertain who the Shipowners were, they never having been before considered distinct from the Merchants, and that the property in shipping generally belonged to that very respectable and intelligent class of his Majesty's subjects.

2. *The Rise of the Agent.*—Toward the end of the 18th century there appear evidences of a change in the function of the captain. His old position is well shown by this advertisement from the New York *Gazette* of 1736:

> "For Philadelphia, the Schooner Judith and Rebecah, John Clark, Master. Well accommodated for Passengers, will sail in about ten days. For Freight or Passage agree with said master at his house near the Custom House."

This announcement, full of the atmosphere of a village on the river's bank, was replaced in 1783 by another announcing that in addition to the captain (who might not always be available to landsmen) persons desiring freight or passage could confer either with the captain or some merchant who was an important user of the vessel[5] and was taking orders for her and for the time at least acting as the merchant captain's assistant. We have here the germ of the present institution of ship agents—a world-scattered fraternity—who now arrange such a large share of the world's ocean transportation.

An advertisement of the year 1800 (Philadelphia *General Advertiser*, April) shows that the ship's agent was fast developing:

> "SAMUEL EMERY, Ship Broker.—Buys and sells vessels, procures freight or charters, transacts all kinds of business at the custom house for entering and clearing [illegible] of goods [illegible] bottomry, etc. Secures [illegible]"

3. *Joint Enterprise.*—The close of the Revolutionary war made it possible for Americans to engage in the China tea trade—a trade requiring such a long voyage and so much capital that the individual owner was often unable to finance the venture. The first American ship that went out from New York to China was the joint enterprise of merchants in Philadelphia, New York and Boston. Joint stock companies were formed to build and despatch these ships. It also became common for partnerships[7] to be formed, in which each holder had a share corresponding to the present method of divided ownership in American coasting vessels, various persons owning halves, fourths, sixteenths, thirty-seconds or sixty-fourths. The captains of these vessels usually had a small share, each sailor also often had a share, in that he was allowed a certain amount of space or a certain weight of cargo to use for any merchandise he might take for private trading on the voyage. The partnership vessel was operated as a unit—a private unit—the partnership having merely split the ownership without changing management or service. The time for lines had not yet come.

4. *Early Attempts at Lines.*—There were some early attempts at the establishments of lines, but a diligent search of the literature of the period reveals but little concerning them. There were vessels to charter, and there were roving sea captains engaged in all grades of occupations, from the "honest" buccaneer to the legitimate merchant. But none of these approach line traffic, and the very existence of most of these navigators and the accounts of their activity add weight to the belief that the scanty annals of the 18th century line traffic are scant because of the paucity of such activity. What we know of the history of the period and of the requirements of line traffic show that it was plainly impossible for any such service to have been long-lived. The following incidents appear to be natural and descriptive of the period:

Before the Revolutionary war there were five packet boats plying between New York and the port of Falmouth, England, known as the Falmouth Line.[8] They sailed occasionally during the Revolutionary war, and some of them resumed service after 1783, but the accounts of their operations are extremely meager, and a dozen chroniclers aver that the first line from America was in 1816.

The signing of the Treaty of Peace of 1783 was the signal for a pretentious French venture at opening up connections with the new republic. In November, 1783, before the evacuation of New York, the "Courier de l'Europe" arrived in port from l'Orient, France, and heralded herself as the first of a line of first-class packet ships which advertised to make monthly sailings between New York and France and to carry passengers, mail and freight.[9] But the depressed condition of American commerce seems to have been very discouraging for this new venture which did not long survive. Then came the French wars, and regular service was impossible.

Mention is made in Colonial Office Records (London), Board of Trade papers, Vol. XVI, Trade Papers, of the establishment of regular sailings of packet boats between New York and England, 1703. There are also post-office record references to the New York packet service.

An examination of the documents of Colonial History of New York shows plainly (Vol. V, p. 811) that packet service could refer to a single ship, 1726, and further accounts of the traffic show that if lines existed they must have been very nearly imaginary lines. For three years, 1715-18 (Vol. V, p. 618) the average number of ships sloops and the like from New York to Great Britain was 21, of 1,461 tons and 226 men. This entire flotilla is only one-tenth the size of some steamers now plying on that route. The correspondence of the colonial governors with the Board of Trade shows frequently that there was no regular service, and that many weeks, and even months, elapsed between opportunities to send a letter.

This rather brief statement of the conditions under which early ocean carrying existed has, it is hoped, made clear the reason for calling this long period of the American colonial epoch and the establishment of the republic the epoch of the merchant carrier. There was, practically speaking, no other carrier than the merchant carrying his own goods—other service was incidental—a by-product. The common carrier, the specialist, had to have the better conditions of the 19th century, and of all of these beneficial conditions the most important were peace and security from the ravaging hand of man. The resulting traffic transformation has been remarkable.

In the merchant carrier days of the late 18th century a small city like Salem sent ships to a wide list of countries, such as we now only find trading with a few of our ports, each of which is ten to twenty times as large as was the now decadent Salem in her prime. Her merchants sailed from place to place and traded with the merchants in the ports where they stopped. To-day the merchant ships his consignments by some line of steamers from New York, Boston, San Francisco, Philadelphia, and if need be he

[1] Lindsay's "History of Merchant Shipping," Vol. 2, p. 397.
[2] "Voyages of a Merchant Navigator," p. 17. Cleveland.
[3] "Memorial History of Boston."
[4] The volume is entitled "Collection of Interesting and Important Reports and papers on the Navigation and Trade of Great Britain, Ireland and the British Colonies in the West Indies and America, with Tables of Tonnage and of Exports and Imports."
[5] See New York *Royal Gazette*, 1783.

[6] Scharff and Westcott's "History of Philadelphia," Vol. 3, pp. 2210-12.
[7] "Memorial History of Boston," Vol. IV, p. 201.
[8] J. G. Wilson's "Memorial History of New York," Vol. 3, p. 534.
[9] Ibid, p. 544.

will have them transshipped at Liverpool, London, Hamburg, Antwerp or Genoa, but it goes by the lines.

We still have a long list of countries on the custom house books for ship entry and clearance, but instead of being roving merchant ships, with valuable cargoes, they are tramps carrying a full load of some bulky produce—logs for cabinet, dye or tanning stuffs, ores or copper, nickel silver, iron or manganese, flint or clay for the potter, pebbles for cement grinding, guano bones or fossils for fertilizer, coal, petroleum, lumber, sugar or wheat. Most of this is new commerce—commerce of the steam engine and steamship era, and it has arisen beside the old which yet flourished, but in a different way. The tea, silk, spices and trinkets of the 18th century now ride in state and haste in some snug, secure and peaceful steamer fully insured and following a prosaic schedule along a firm, fixed, well-lighted, safe and unromantic route. Together the merchant carrier and his counterpart in independence of the pirate, ceased to be the conspicuous figures of the sea.

(*To be continued.*)

Immigrant Laborers in the United States.

Italy, Austria-Hungary and the Slavic countries of eastern Europe are at present the principal sources of the unskilled labor supply of the United States. They contribute more than two-thirds of all the immigrants now entering the country, about one-fourth of the total coming from Italy. The Slavic group includes the Jews from eastern Europe, who, while not Slavs, economically and industrially represent practically the same classes. The distribution, employment and manner of living of these immigrants, with special reference to their assimilation into American industrial life, is the subject of a study by Frank J. Sheridan in Bulletin 72 of the Bureau of Labor.

Although about half of them had previously been at work as farmers or farm laborers, they do not seek a similar employment here, mainly because of the higher rates of wages in transportation, manufacturing, mining and in building, where the demand for common labor has been very great. The Italian immigrant shows a marked preference for railroad construction, tunnel building, grading, ditching, building excavation, and work in factory industries, while the Slav and the Hungarian turn to those industries where the pay is somewhat higher and the work somewhat heavier—as in blast furnaces, iron and steel works, iron-ore handling, and coal mining.

Large numbers of the immigrants seek and find work through employment agencies, but the great mass, through acting on the advice of relatives and friends, go directly to the states where wages are highest and their services are in greatest demand. In 1906, 78.82 per cent. of all immigrants and 86.55 per cent. of the Italian, Slavic and Hungarian immigrants went to seven states—New York, Pennsylvania, Illinois, New Jersey, Massachusetts, Ohio and Connecticut—the states where the demands of industry were expressed in terms of the highest wages. Objection to paying long-distance railroad fares, the great demand for labor in the north, and a seeming disinclination to work in the south, except in some cases where northern contractors are building railroads in the south, kept the majority of the Italian laborers in the north. To these reasons may be added the desire of the Italian padrone agency to keep the men where it can again distribute them to its own advantage and furnish the commissary after the temporary employments cease.

Of the 36,176 unskilled laborers distributed by New York City agencies, the average rate of wages per day for the Italians was $1.46, for the Slavs and Hungarians $1.46, and for the other nationalities $1.41. Of the Italians, one-third received less than $1.50 a day, 60 per cent. $1.50 a day, and 7 per cent. over $1.50. Of the Slavs and Hungarians, 38 per cent. received less than $1.50 a day, 41 per cent. $1.50, and 21 per cent. over $1.50. These rates are for 1905 and the first seven months of 1906. The records of a large contracting company engaged on railroad construction and employing many laborers of various nationalities as well as Italians shows that the actual cost to the company of groceries, provisions and payment for cooks, waiters, fuel, light, etc., at its boarding camps for a given period was 19 cents a meal, or $3.99 a week for each man. The men were charged $18 a month for board and lodging. The records of three railroads in New York, Pennsylvania and New Jersey for 1905 and 1905 give accurately the earnings and the total cost of living of large numbers of Italian laborers employed on these railroads and living under the usual commissary system. The average earnings per man for a representative month in 1906 for 89 gangs, numbering 1,530 men, were $37.07. The cost of all food was $5.30, and of rent of shanty and sundries $1.49, or a total of $6.79, leaving a surplus of $30.28.

The Italian laborers are said to save more money at the same wage rate than any other class of European laborers in the United States. The amount is indicated to some extent by the money orders sent from this country to Italy. The total amount of money orders sent in 1906 to all countries was $62,435,343, and of this $36,798,562, or 58.9 per cent., went to Italy and the Slavic countries. The total amount of these money orders sent to Italy was $16,239,134, while the amount sent to Austria-Hungary and Russia was $20,559,428, the number of natives of those countries in the United States being about double those from Italy. These sums, great as they are, represent but a part of the total savings of these laborers sent abroad. Large amounts, of which there are no records, are sent over through Italian bankers. Immense sums in the aggregate are carried over in person by immigrants who return to Italy late in the fall of each year. At least 100,000 Italians return to Italy each year for the winter months because they find it cheaper, healthier, and more satisfactory to return to Italy and spend the winter months with their families.

Alternating Current Automatic Block Signals on the Highland Division of the New York, New Haven & Hartford.

Signal engineers who have been perplexed to decide the question whether semaphore arms should be inclined upward or downward, and whether they should project from the right or from the left of the post, may find all their difficulties settled in an actual installation which has lately been finished on the Highland division of the New York, New Haven & Hartford, near Hartford. Here the arms point both ways at once and all theories ought to be satisfied. These block signals have been installed on this section, which is eight miles long, East Hartford to Vernon, because of the introduction of electric propulsion and of a consequent large increase in the number of daily trains. The two main tracks of the steam railroad have been equipped for the use of the cars of the Connecticut Company, running between Hartford and Rockville. The signal installation is A. C. stepping down from a 10,000-volt power transmission line to a 2,200-volt transmission line for signal purposes. The signals are operated (and also lighted) directly by a 110-volt 60-cycle alternating current, so that no batterymen or lamp men are required.

Signal arms similar to those here used, pivoted near the center, have been in use for several months on the electrified section of the New Haven road, west of Stamford, where all the signals are suspended from the under side of the bridges which support the power lines for conveying current to the motors. Those here used (Fig. 1) are of the same design, except as to minor details of the casting. In the horizontal position these arms extend equal distances to the right and to the left of the bearing, but when in the proceed position much more than half of the arm is at the left of the post.

This section of the line is now used both by the New Haven road for passenger and freight service, using steam locomotives, and by the Connecticut Company, for passenger service, using electrically propelled cars. The Signal Engineer was required not only to install a signal system to work with the present direct-current 550-volt equipment of the street railway company, but also to provide for working equally well, and without any change, with an alternating single-phase propulsion current of 25-cycle frequency, in case that should be adopted.

At each of the junctions, East Hartford and Vernon, there has been installed a manual interlocking station for the operation of the switches and signals, and the automatic semaphore signals between the stations named are set at intervals of from 3,700 to 5,200 feet. The entire electrical equipment is operated by alternating current.

Source of Energy.—Through the entire length of the signaled section there is a 10,000-volt, three-phase, 60-cycle commercial line giving a reliable 24-hour service. From this supply current is procured for the signal system, the connection being made through step-down transformers. The transformers are connected to one phase of the high potential line, stepping the current down from 10,000-volt to 2,200-volt and connecting through oil switches to the signal transmission lines which extend the entire length of the signal system. From this 2,200-volt, 60-cycle line, current is obtained through transformers for the various signal requirements.

Interlocking Plants.—The interlocking towers are built on concrete foundations. In the front opening in the foundation for the lead-out the building is supported by cast-iron pillars set 24 in. apart between centers. In these cabins special attention was given to the design of the roof and the windows. The roof is carried out four feet from the side of the building to shade the windows, and it is slightly curved upward so that the lower edge does not reach below the top of the window and there is no limitation of the signalman's outlook. The lower window sash is much longer than the upper so that the frame at its upper end is above the range of the eye, and the building is so framed that the sash when raised passes up to the plate, bringing its lower edge up to the top sash.

The machine is a Saxby & Farmer and the frame rests on concrete foundations. All home and dwarf signals are pipe connected and stand upon concrete foundations. All cranks and compensators are mounted on iron piers imbedded in concrete. The distant signals are of the electric motor type the same as the automatic signals hereinafter described. These signals are controlled from the tower and also through circuit controllers attached to the arms of the home signal to which they govern the approach. All home signals are equipped with electric motors, which are controlled by an indicator in the tower, the indicators being controlled by the track circuit so that the operator has constantly before him an indicator which shows the presence of any train on any section of track to which his signals give admission. All levers which operate home signals controlling distant signals are equipped with an indication lock which prevents the latching of the home signal lever in the stop position until the distant signal is in the caution position. The electric motors, indicators and locks are supplied with current by a duplicate set of 21 ampere-hour storage batteries. The batteries are charged by a single-phase mercury arc rectifier, taking current from the 2,200-volt signal transmission line through a transformer stepping down to 110 volts.

Automatic Signals.—The automatic equipment consists of home and distant signals mounted upon the same post. The eastbound and the westbound signals are placed nearly opposite each other but are staggered sufficiently to avoid putting a signal where a trolley pole will hide it from the engineman. The blade grip castings are designed to permit the arm to extend to the left of the post for the reason that the trolley poles would obstruct the view of the signal if it extended only to the right.

The motor signals have double-case bases and rest on concrete

Fig. 1—Special Semaphore for East Hartford-Vernon Line.

foundations. The upper case contains the signal mechanism which is operated by a 110-volt single-phase induction motor. The motor has sufficient torque at starting to start under load from any point in the arc through which the signal travels. The time required to clear both the home and the distant arms is five seconds. The lower case contains the track relays, the line relays, the controlling switches, the fuses and the lightning arresters. All signals have the same apparatus in the same relative position and are wired alike, so that the maintainer finds a uniform arrangement in all the cases. Duplicate two-candle power incandescent electric lights are used in the lanterns. Oil founts are also provided.

At each signal there is a transformer transforming the current from the 2,200-volt line to 110 volts to supply current for the local signals and the control circuits for the next signals in the rear. All wire connections between transformers, signals, tracks and the signal control circuits are in wood boxing placed upon stakes four feet apart. The signal control line extends the entire length of the block section, taking energy at the outgoing end and looping through the track relays and switch instruments.

The track circuit equipment installed is designed to be used with a propulsion current either direct or alternating, either 550-volt direct or 11,000-volt 25-cycle single-phase alternating. The electric railway company required that the tracks be cross bonded at least every 3,000 ft., thus making necessary a "cut section" in each block. Energy is supplied to the tracks by a transformer situated in the middle of a track circuit section. The track circuit has a relay at each end. These are "frequency" relays, that is to say,

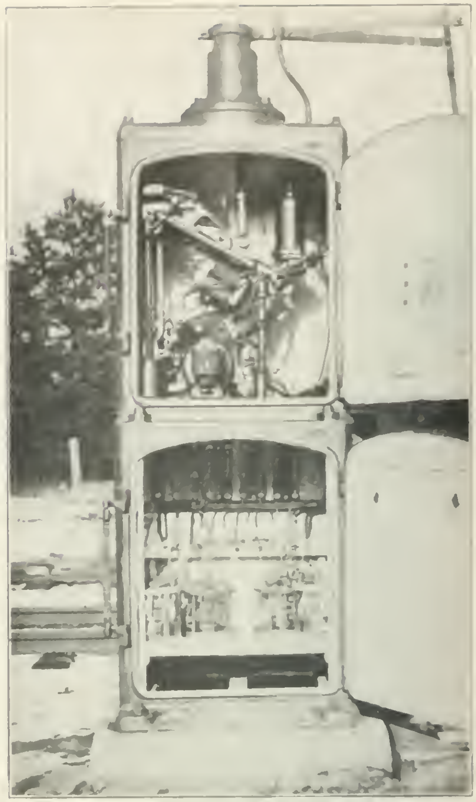


Fig. 2—Signal Motor and Relays.

relays which respond only to alternating currents of a given frequency. These control the signal circuits. At each end of the track circuit there is also an inductance bond the terminals of which are connected to the rails and the center of which is connected to the center of the bond of the next track circuit, thus forming a metallic connection around the insulated rail joints for the return propulsion current. This center connection may also be used for cross bond taps.

The inductance bonds were designed to carry the heavy current necessary with direct-current propulsion and also were perfectly balanced to offer the least possible impedance to an alternating propulsion current. In fact, if the external track return is perfectly balanced the only impedance of the bonds may be said to be ohmic. The frequency relays are absolutely immune

Fig. 3—Signal Cabin, Vernon, Conn.

to a direct current or to alternating current of 25 cycles, having been designed to operate at 60 cycles. The unbalancing of the track therefore, even if sufficient to throw a heavy current through the frequency relays, would not result in a false clear signal indication. This system will, of course, be not in the least affected by any foreign trolley current. In connecting the inductance bonds to the rails use is made of an old rail about 15 ft. long. To connect up an inductance bond to a track with broken or staggered joints, it is necessary either to cut one rail of the track so as to have the

In Fig. 1 the 2,200-volt signal wire may be seen on the pole which stands close to the signal. The 110-volt signal wires are on the lower arm of the Western Union poles, situated at the extreme right of the photograph. The three-phase, 10,000-volt, 60 cycle, and the three-phase, 11,000-volt, 25-cycle power lines are on the upper arms of the poles at the left of the track, while the short lower arm on these poles carries the 550-volt feeders for the trolley wires. Fig. 2 shows the motor signal case with the relays in the lower part. Fig. 3 shows one of the standard interlocking cabins.

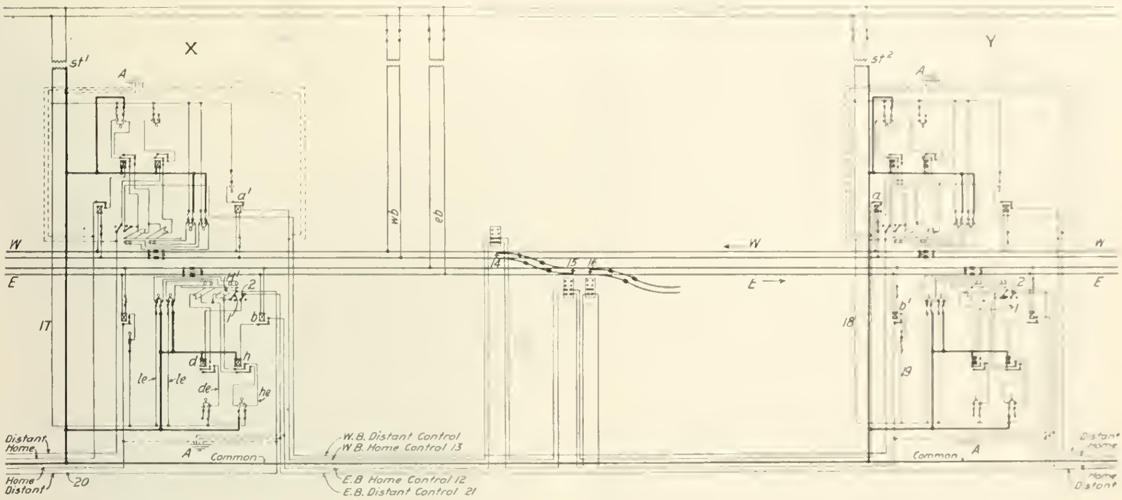


Fig. 4—Signal Circuits for Electrified Line; Highland Division, New York, New Haven & Hartford.

insulated joint near the bond, or to provide a conductor from the bond to connect with the track beyond the insulated joint, which may be some 15 ft. The piece of steel rail is better than copper because it costs less and is not liable to be stolen; and besides this if alternating current is used for propulsion, the iron serves to restore the balance of the inductance of the two lines of rails, which with one side 15 ft. shorter than the other, would be unbalanced.

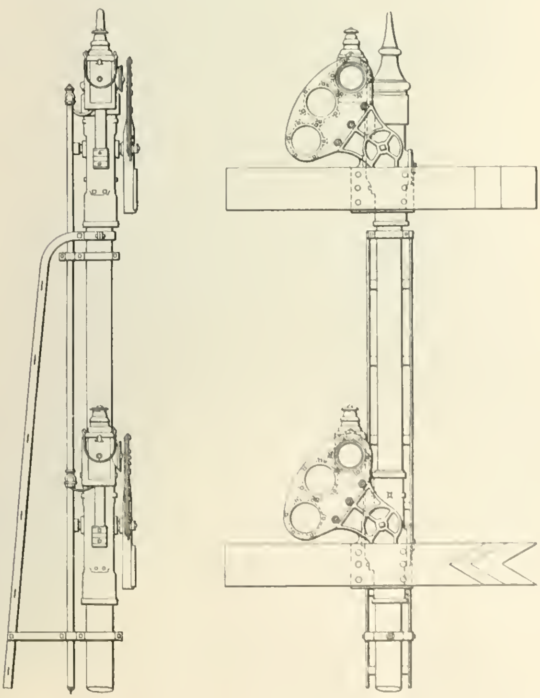


Fig. 5—Details of Signal, Showing Electric Light Connection.

The arrangement of the track and signal circuits is shown in Fig. 4, in which W is the westbound and E the eastbound track. Taking, for example, the eastbound track, the current is fed to the rails at *e b* near the middle of the section, and this circuit controls the signals through relays *b* and *b*'. These two track relays, when closed, close signal relay *h*, at station X, which receives energy through home control wire 12 from transformer *s t 2* at station Y, through wires 18 and 19. Signal relay *h* closes the motor circuit to home signal H', admitting trains to block section X Y. Power for this motor comes from transformer *s t 1* at station X through wires 17, *h*, *e*, etc.

Home signal H being cleared, is clears the corresponding distant signal in the rear by means of the circuit closer 1, and distant

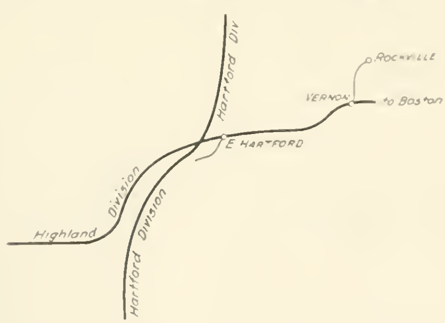


Fig. 6—Electrified Line—East Hartford to Vernon.

control wire 20. The distant signal at station X is controlled in the same way through relay *d*, which receives energy through circuit breaker 2 on signal H' and distant control wire 21, which may be traced to circuit breaker 2 at station Y. Signal H', when put to the stop position, causes the distant signal on the same post to also go to the horizontal position by opening circuit breaker 2.

The control wires not numbered are for the westbound track. The common wire is shown by a heavy line throughout the drawing.

The control wires are run through the switch instruments in the usual manner, and opening either switch 14 or switch 15 puts in the stop position the signals on both main tracks. The locations of the lightning arresters at each signal are shown by broken-line connections to the ground, A.

The arrangement of the electric lights on the signals is self-explanatory. These lights derive their power from the mains, as may be seen by following wires 17 *l e* at station X.

The apparatus for the entire installation was designed and installed by the Union Switch & Signal Company of Swissvale, Pa.

The Best Design of Car for Suburban Traffic at Melbourne.*

BY THOMAS TAIT,
Chairman of the Victorian Railways Commission

The type of car best suited for the passenger traffic on the Melbourne suburban lines is a subject which has been receiving the consideration of the Commissioners for some time past, and I lost no opportunity of acquiring information which would be of help in determining this important question, visiting Hamburg and Chicago mainly for that purpose.

The latest standard car in use on the Melbourne lines for suburban traffic is of the cross compartment type, with two side doors for each compartment, and no corridor. The body of this car is 50 ft. long, and 8 ft. 6 in. wide, and will seat about 80 passengers. The principal advantages of such a car are maximum seating capacity for its length and width, as no space is taken up for corridors, and the celerity with which passengers can enter and leave the car owing to there being side doors for each compartment.

One of the disadvantages of such a car is that there is no means of getting from one compartment to another, which results frequently in some overcrowding with passengers standing in some compartments, while, at the same time, there is seating accommodation to spare in other compartments on the same train. Passengers from a way station boarding a fairly well filled train (that is, a train in which a number of the compartments are already fully occupied), have not much time to select a compartment in which there is unoccupied seating accommodation, and are apt to enter compartments which are already fully occupied, in which event, owing to the absence of any means of access to other parts of the car or train, such passengers must either stand or overcrowd the seating capacity of such compartments, and this, although there may be seating accommodation to spare elsewhere on the train. The provision of corridors in the cars and of vestibule connections between the cars would overcome this and permit of a better distribution of passengers throughout the trains, and the use of the seating accommodation to the fullest extent. Investigation of some of the complaints received as to overcrowding on our suburban trains shows that while some of the compartments had more passengers in them than there were seats, there was seating accommodation on the train as a whole for all the passengers on it.

Another disadvantage of the existing type of car is the swinging side door.

Although the gage of the Victorian lines is 5 ft. 3 in. (with the exception of three short narrow-gage lines), we do not derive as great an advantage as we should from this wide gage in the direction of being able to run wide carriages, etc., as contrasted with a 4-ft. 8½-in. gage, owing to the fact that the tracks on double-track lines and elsewhere have been built so close together, viz., 11 ft. 8 in. center to center, whereas in America the 4-ft. 8½-in. double tracks are built from 12 ft. to 13 ft. center to center.

It has not been considered advisable to use so wide a side-door car that the side door, if open, would strike the head or arm of a person projecting from a car on a contiguous track, and this has limited the width of the body of the cars for use on our suburban lines to 8 ft. 6 in. The use of sliding, instead of swinging side-doors would, I think, permit of the width of these cars being increased to about 9 ft. 6 in., with a considerable increase in the floor area available for seating accommodation and corridors.

Another disadvantage of the swinging side-door is the fact that it requires, in the interest of the safety of the passengers in the compartment, as well as those on trains running on contiguous tracks and of persons standing on station platforms, to be closed and fastened, and that this requires the services of the guards and platform staff, as well as involves some delay at stations, and the closing of these doors is accompanied by objectionable noise, which cannot be entirely avoided. Moreover, a swinging side door closed but not fastened is an element of danger, especially in the case of children riding in the compartment, as it may swing open if leaned against.

The closing and fastening of side-doors will become a very important matter if electric traction is adopted, for with the increase in acceleration on electric trains (that is, the increase in speed when starting from stations) it will not be possible for the present staff to close and fasten such doors, and to restrict the acceleration on electric trains would be to abandon to some extent one of the chief advantages of electrification.

The adoption of a sliding side door on the cars employed, at least for the suburban traffic, would enable us to safely widen those cars sufficiently to provide a corridor without diminishing their seating capacity, thus with vestibule connections, between the cars enabling the passengers to distribute themselves throughout the train, and utilize the seating accommodation to its fullest extent.

Sliding side doors could not, however, be closed and fastened by the guards and platform staff, but I see no reason why such doors could not only be opened, as the swinging doors are at present, by the passengers themselves, but the closing and fastening of them be left, with safety, to the passengers, as in the case of the electric cars on the Southport line of the Lancashire & Yorkshire. Thus, not only would some time at stations and labor of staff be saved, but the noise accompanying the closing of swinging doors be got rid of. Less danger would be attached to failure to fasten a sliding door than in the case of a swinging door, for, in the event of a child or other person leaning against it, it would not swing outwards and would not slide. The liability to catch and seriously injure fingers would be less with the sliding than the swinging doors, as also the liability to injure persons standing on station platforms. I may add that sliding doors at the ends and the center of cars have been lately adopted on the underground railways in London, and opposite each pair of seats on the Illinois Central for its suburban traffic at Chicago.

As I have mentioned, the adoption of sliding doors would enable us to safely use wider suburban cars and provide a corridor without much, if any, reduction in the seating capacity. On the underground railways in London the cars with sliding doors have a central corridor, or, more properly speaking, a central aisle, while in the Illinois Central company's new type of suburban car there is an aisle on each side. This latter is, no doubt, the best arrangement to facilitate the movement and distribution of passengers throughout the car and the celerity of ingress and egress, but two aisles occupy too much space, and the advantages gained as contrasted with one aisle do not justify the sacrifice of so much seating accommodation. The extra space gained by the use of sliding instead of swinging doors for suburban cars will not be sufficient to provide more than one aisle without a serious diminution in seating capacity, which we cannot afford, but a corridor or an aisle along one side only would appear to have an advantage over a center aisle in that passengers entering the car on the aisle side could, in the event of there being no vacant seat in the compartment immediately opposite the door by which they entered, pass along the side aisle to a compartment with vacant seating accommodation without in any way disturbing the passengers in the compartment immediately opposite the door by which they entered the car as they would with a center aisle.

It would be possible, as a rule, to so run cars with one side aisle that the aisle would be next the station platforms on the trains bringing passengers into the city, especially during the busy hours of the morning, the seating capacity of which trains is fully taxed, and for which passengers have little time to select a compartment with vacant seating room. The aisle being on the side of the car away from the platform at the central terminal stations on departing trains would be no disadvantage, as passengers taking such trains at those stations have, as a rule, ample time to select a compartment which is not fully occupied. Nor would the aisle being on the side away from the platform be of any disadvantage in the case of passengers disembarking at any station, as it would not be necessary for them to use the aisle to reach the door of their compartment. The Prussian State Railways have adopted an aisle on one side for their suburban cars in Berlin and Hamburg.

The accommodation for passengers in a number of our suburban cars is somewhat too luxurious and too liberal as to space, and consequently too costly, having regard to the comparatively short time suburban passengers occupy such accommodation. The average length of all journeys on our suburban trains during the year ended June 30, 1907, was only 4.76 miles, and the average time occupied per journey about 17 minutes—the average fare being 4.82 cents,* which is equivalent to 1 cent* per passenger mile. Not only do partitions and high seat backs and luxuriously leather upholstered seats and backs with upholstered arm rests add appreciably to the cost of suburban cars, but they add materially to their weight, a very important factor in view of the numerous starts which the suburban trains make, and the heavy gradients on some of our lines. We can undoubtedly save considerable expenditure in the construction and maintenance of our suburban cars by the adoption of comfortable low-backed seats upholstered in leather or other suitable material without arm-rests, and the elimination of all partitions except between smoking and non-smoking compartments, in combination smoking and non-smoking cars. The abolition of partitions and high-backed seats will not only increase the air space and improve the ventilation and light, but allow passengers to see at a glance where there are vacant seats, and reach them by way of the proposed aisle.

The seating and other accommodations provided for suburban travelers at the various places visited by me fully confirm me in the views I have just expressed.

*This statement is from the report of Mr. Tait on electrification of steam railroads, most of which was published in the *Railroad Gazette* of Dec. 13, 1907, on page 709.

*Pence transferred to cents by multiplying by 2.

GENERAL NEWS SECTION

NOTES.

The New York, New Haven & Hartford has established a school of telegraphy at Boston.

The Swiss Federal Railroads have opened a handsome passenger office in New York City, at 241 Fifth avenue.

The amount of anthracite coal mined in the year 1907 was 67,109,393 tons, by far the largest production on record, and about 11½ millions more than in 1906.

The State Railroad Commission of Georgia is to issue an order revising passenger rates in the state in accordance with the proposition lately made by the Southern Railway.

The legal department of the state of Wisconsin is to sue the Chicago, Milwaukee & St. Paul for violation of the law limiting to eight hours the working time of certain employees.

President Finley announces that, in view of the falling off in business, the Southern Railway has determined to reduce by 10 per cent. the pay of the President, Vice-Presidents and the other general officers, and their office forces.

The Chicago subway now moves 2,000 cars daily, of which 1,200 carry United States mails. The lines now connect with 11 railroads and 14 large mercantile houses. Negotiations are under way for many other connections.

The Attorney-General of Texas has filed suit against the Missouri, Kansas & Texas, the Texas & New Orleans and the Galveston, Harrisburg & San Antonio for heavy penalties for alleged violations of orders of the Railroad Commission, requiring them to run their passenger trains on time.

Under a decision by a board of arbitration telegraph operators on the Grand Trunk are to receive an increase of salary of about 10 per cent. and aggregating $27,000 yearly. This refers to ordinary operators; about $10,000 will also be added to the pay of telegraphers in the higher grades.

Senator Crane of Massachusetts has introduced in Congress a resolution instructing the Interstate Commerce Commission to enlarge the field of its investigation of safety appliances by including facing point switches, the necessity for protecting them, and also the question of the automatic control of such switches.

The Department of Justice at Washington announces that the Chicago, Burlington & Quincy and the Chicago & Eastern Illinois are to be at once prosecuted on indictments for giving secret rates similar to those on which the Chicago & Alton was tried (but let off) and on which the Standard Oil Company was fined $29,400,000.

The Georgia State Railroad Commission has issued a rule requiring railroads to receive and check baggage for prospective passengers, in advance of the passenger's departure. The checks given may be made exchangeable for a regular check at the time of departure, and if baggage is brought more than 12 hours in advance a storage charge may be imposed.

The Long Island Railroad advises that there has been no thought of abolishing demurrage charges at Long Island City or other stations. The note in our issue of January 10 proves to have been based on a proposition to discontinue track storage charges, which, however, has not yet been carried out. It appears that on certain team tracks special "track charges" are made.

At Mineola, N. Y., January 8, a conductor on an electric railroad was sentenced to three months' imprisonment for manslaughter in the second degree. He was held responsible for leaving a meeting point before the opposite car had arrived, his action being in direct disobedience of an order. In the resulting collision the motorman of the other car was killed. The case has been appealed to a higher court.

A number of roads have reduced wages in freight houses and in forces of laborers, on track work and elsewhere; and reductions still more expensive appear to have been decided on in many cases, but not formally announced. Reductions of working hours in shops and on track work are numerous. On many roads payrolls have been much reduced within the past two weeks, without changes in rates, by the falling off in freight traffic, trainmen being paid by the trip.

The Farmers' Special, which was run by the Cincinnati, Hamilton & Dayton the first week in January, and heretofore referred to, stopped at 26 places and over 6,000 farmers were addressed by the speakers. Division Freight Agent Law says that the enterprise was a great success, outdoor meetings having to be held to accommodate the large numbers attending. State Grain Inspector Culver accompanied the party and gave useful statistics concerning the profits which have been made on different kinds of grain.

The Interstate Commerce Commission has issued a circular calling the attention of railroads to the necessity of changes in many features of many freight tariffs to make them conform to the law and to the rules which have been promulgated by the Commission, and stating that all tariffs hereafter issued must conform strictly to the regulations. Tariffs now in use, however, may be continued in force until July 15, 1908, notwithstanding their irregularities, provided the railroads show good faith in their endeavors to eliminate all features which are not approved by the Commission.

Prosecutions for Imperfect Car Couplers, Etc.

The Government is going to prosecute the Illinois Central in Kentucky for 22 violations of the Safety Appliance Act. A prior decision in that district on similar cases was unsatisfactory, but the circumstances were such that the United States could not take an appeal. The suits now about to be brought will be so framed as to cure this difficulty.

Attorney-General Bonaparte last week directed the various United States Attorneys to institute suits against 43 other roads, 312 violations in all. The roads are:

	No. of violations.
Ashland Coal & Iron Rwy. Co.	28
Atchison, Topeka & Santa Fe	11
Baltimore & Ohio	28
Baltimore & Ohio Southwestern	1
Boston & Albany	12
Boston & Maine	5
Butte, Anaconda & Pacific	1
Butte County	11
Central of New Jersey	15
Chesapeake & Ohio	25
Chicago, Burlington & Quincy	5
Cincinnati, New Orleans & Texas Pacific	8
Delaware & Hudson	9
Denver & Rio Grande	8
El Paso & Southwestern	7
Erie	4
Great Northern	2
Gulf, Colorado & Santa Fe	6
Idaho Northern	2
Kansas City Southern	1
Louisville & Nashville	3
Missouri, Kansas & Texas	1
New Orleans & Northeastern	1
New York Central & Hudson River	4
New York, New Haven & Hartford	10
New York, Philadelphia & Norfolk	2
Northern Pacific	36
Oregon R. R. & Navigation Co.	1
Oregon Short Line	9
Pennsylvania	6
Peoria & Eastern	2
Philadelphia & Reading	1
Pittsburgh & Lake Erie	6
St. Louis, Iron Mountain & Southern	3
St. Louis Southwestern	1
St. Louis Southwestern of Texas	5
St. Louis, Watkins & Gulf	11
Salt Lake & Ogden	1
Southern	8
Southern Pacific	10
Tombigbee Valley	5
Union Freight	3
Wheeling & Lake Erie	21

Helping to Restore Confidence.

The Sherwin-Williams Co., Cleveland, Ohio, is trying to help re-establish normal business conditions by increasing the enthusiasm of the members of its force. The following extract from a bulletin issued by General Manager W. H. Cothingham to representatives of the company is a good example of the encouraging literature it is distributing.

"America is a great and an extraordinary country. Whatever she does, she does in a big way. No other country has ever done as many big and extraordinary things as she has. When she goes in for a panic it's a good one; not a little flurry, not a little storm, but a good, stiff hurricane; one worthy of her vastness and her gigantic force. Big storms, while extremely severe at the time don't last long. They usually leave some wreckage behind, it's true, but the worst is soon over. The clouds quickly pass and the sun shines for all once more, and we feel better for it and appreciate more fully the daily blessings we enjoy. The great financial hurricane that has swept across the land is over. It will take a little time to clear away the debris, but not long, for the wreckage has not been great, and the warm sun of prosperity will soon repair what damage has been done. Let me repeat, America is a great country, and always does big and extraordinary things—this is the proof of her genius; and, just as the panic stunned us all with its fearful suddenness and frightful severity, I believe, now that it has passed, we will have an exhibition of the country's great stability and recuperative powers that will astonish the world as much as the panic did.

Overhead Carrier Between Warehouse and Dock.

All steamboat cargoes discharged or awaiting shipment at the Virginia street dock in Seattle, Wash., are stored in a warehouse on the opposite side of Railway avenue, about 250 ft. from the dock. A large volume of miscellaneous freight is handled daily between the dock and warehouse. To transfer this economically and at the necessary speed, without obstructing traffic in the street, there was recently installed an overhead carrier which does the work at low cost and which can handle the freight more rapidly than it is possible to load or dispose of it at the terminal points. The equipment is simple and can be modified to suit almost any industrial condition which involves moving packages or miscellaneous articles in large numbers between fixed points.

As shown by the accompanying illustrations, the dock and warehouse are connected by a light elevated structure which supports an endless-chain carrier, with terminals on the dock level at one end and on the second floor of the warehouse at the other. The carrier consists of a series of wooden flights, 9 in. wide by 1 in. thick and 30 in. long, made of Puget Sound fir. These are secured every 12 in. to two strands of No. 180 Jeffrey steel-thimble roller chain, forming an almost continuous apron on which the freight is carried. Wedge-shaped blocks attached to every third flight catch anything that might roll down the incline at the dock end. The conveyor is driven by a 10-h.p. electric motor at the upper, or warehouse, end.

Overhead Carrier Between Warehouse and Dock.

Dock End of Overhead Carrier.

Being reversible, it carries freight to equal advantage in either direction. It is designed to handle packages not more than 3 ft. wide and 4 ft. high. They are usually cases of salmon, sacks of salt and sugar, barrels of cement and miscellaneous articles weighing as much as 1,000 lbs. each. It travels at a speed of 70 f.p.m. and consumes about 6 h.p. when delivering 1,000 packages weighing 100 lbs. each per hour. As already mentioned, this rate of delivery represents the limit of speed with which packages can be loaded and cared for at the dock and the warehouse; it is much below the actual capacity of the machine.

The plant was designed and installed by the Pacific Engineering Co., Seattle, the conveying machinery being furnished by the Jeffrey Manufacturing Co., Columbus, Ohio. The latter company has installed several machines of this general character for handling freight to and from ships direct; for such work the outer end is adjusted to the rise and fall of the tide and the height of freeboard of vessels.

Storage Battery Motor Truck for Industrial Railways.

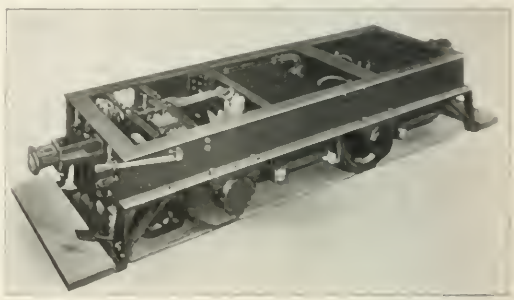
The Westinghouse Machine Co., Pittsburgh, Pa., is now making and selling storage battery motor-trucks of from 10 to 10 tons capacity for use on industrial railways. The company used to use at its own works small cast iron 3-ft. gage trucks, of small capacity and moved by hand. Heavy castings were carried on 50-ton trucks, which were usually moved by a rope passing under a snatch block and attached to a crane hook. When the storage battery trucks were installed there was a marked improvement in crane service, since they relieved the crane of the work of transporting many of the heavier castings from one end of the long shops to the other.

The accompanying photograph shows a 10-ton truck. A steel frame, thoroughly braced, is carried on four wheels, the journals of which run in roller bearings. The driving axle or axles, as the case may be, carry the motor, or motors, as in street railway practice. The motor is spring suspended from the frame at one end, and connected to driving axle by suitable reducing gearing. A spring suspended cradle of angle irons carries the battery trays. At the operating end of the truck are mounted the controller, brake, charging receptacle, cut-out switch and volt-ammeter. A convenient step and drawbar head are provided at each end. All the machinery is below the top of the frame and is covered by a heavy wooden deck for carrying the load. This deck, which is not shown in the illustration, is made in sections so that any part of the mechanism is readily accessible.

The motor is of the Westinghouse vehicle type, designed for heavy overloads and being dustproof and self-oiling. The controller is of the same type, and gives four speeds in either direction. It is provided with operating and reverse levers, which are interlocking to prevent premature reversal.

The battery is in two or more trays of cells and is built to operate at high rates of charge and discharge, so as to stand short periods of heavy duty usually requiring a battery of four or five times the capacity. Another reason for adopting a battery of smaller ampere hour capacity than is customary in similar work is that the time available for charging during the working hours is usually three times the period of time that the truck is actually running.

During a six months' test of the 10-ton truck the power required to charge the battery in regular and heavy shop service averaged 63 k.w. hours a month. The work done was recorded and averaged about 700 ton miles a month, the loads ranging from a few hundred pounds to 15 tons. These trucks used as locomotives on a level track and without any weight to secure adhesion can haul on suitable cars, from one-half to their full rated capacity as a truck, depending on the condition of the track and kind of bearings on the cars hauled. By placing sufficient weight over the drivers to secure adhesion, they can handle from one to two times their capacity as a truck for a continuous period of not more than five minutes.



Westinghouse 10-Ton Storage Battery Motor Truck.

Standard trucks are made for six different gages: 18, $21\frac{1}{2}$, 24, 30 and 36 in., and 4 ft. $8\frac{1}{2}$ in. For track systems provided with turn-tables they are made with rigid trucks. Where tracks are installed with curves, the trucks for all gages, up to 36 in., have swivelled front axles, allowing free operation on curves of 12 ft. radius.

Long-Time Burner Without a Chimney.

Peter Gray & Sons, 82 Union street, Boston, Mass., makers of switch and signal lamps and lanterns, use a chimney-less long-time burner for such lamps. They report the results of a long-time service test as giving a high candle power after burning 100 hours. The

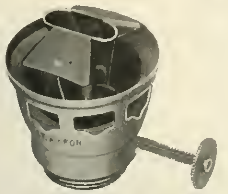


Fig. 1—Chimney-less Long-Time Burner.

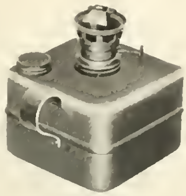


Fig. 3—Oil Fount.

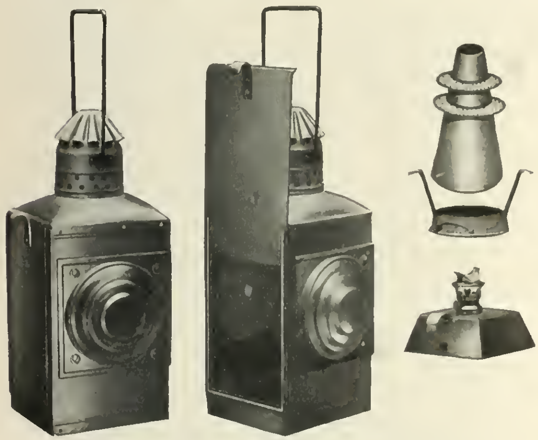


Fig. 2—Peter Gray & Sons' Semaphore Lamp.

shape and style of the burner are shown in the accompanying engravings. By doing without the chimney it is expected to save about one-half the cost of this part of the lamp, besides doing away with the risk of failures of lights from accumulations of smoke on chimneys and from breakages. Because of the peculiar design of the burner, the flame issues in a wide and uniform body. It is a robust and steady flame. Messrs. Gray & Sons have also designed a new fount, as shown in the engraving, Fig. 3. Both fount and burner are so designed that the position of the flame in relation to the lens is the same as in former styles.

Machinery Club of New York.

The Machinery Club of the City of New York is being organized to provide a convenient meeting place for persons interested in the machinery and metal trades. It is to be, primarily, a lunch club. The rooms are to be on the 21st, 20th and possibly the 19th floors of the Fulton Terminal building, which is under construction by the Hudson & Manhattan as the Manhattan terminal of its tunnels under the Hudson river. The club's quarters include a roof garden, lunch and grill rooms, assembly rooms, library and perhaps a few bedrooms for out-of-town members. It expects to occupy this space by May 1, 1908. The membership is limited as follows: Resident, 750; suburban, 500; non-resident, 1,000. The temporary address is 26 Cortlandt street. The officers are: President, F. H. Stillman, President of the Watson-Stillman Co., New York; Vice-President, R. C. McKinney, President of the Niles-Bement-Pond Co., New York; Treasurer, Walter L. Pierce, Secretary of the Lidgerwood Manufacturing Co., New York; Secretary, Theodore Waters.

Meeting of the Society for Promoting Industrial Education.

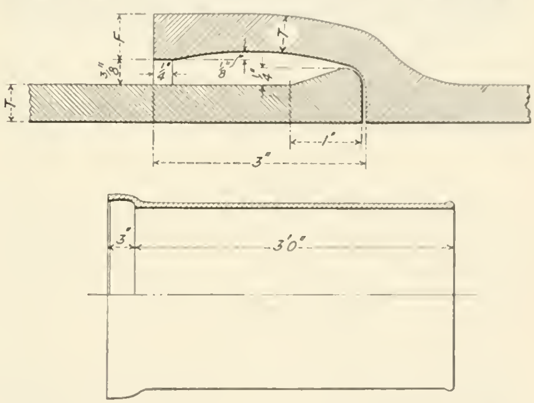
The annual meeting of the National Society for the Promotion of Industrial Education is to be held at Chicago on Thursday, Friday and Saturday, January 23, 24 and 25. It will begin with a public dinner at 6.30 p.m. on January 23 at the Auditorium Hotel, where the speakers will discuss the aims of the society and industrial education as an essential factor in national prosperity. The next day there will be public meetings at the Art Institute. The subjects of addresses and discussions include: The Apprenticeship Systems as a Means of Promoting Industrial Efficiency; The Place of a Trade School in Industrial Education and the Wage Earners' Benefit from Industrial Education. On Saturday morning the subject before the public meeting will be, A True Ideal of the Public School System that Aims to Benefit All. The afternoon will be taken up with business meetings of the society. C. R. Richards, Columbia University, New York, is Secretary, his address after January 20 will be the Auditorium Hotel, Chicago.

Cast Iron Culvert Pipe in 3-ft. Lengths.

The American Casting Co., Birmingham, Ala., is putting on the market a new design of cast-iron pipe for culverts. The cast iron pipes usually used for this purpose are the ordinary water main sections which are of unwieldy lengths and unnecessarily heavy for culverts, the internal pressure in a culvert being so much less than that in a water main. The pipe made by the above company is furnished in 3-ft. lengths, with dimensions and weights as follows:

	Thickness of pipe, T.	Face of hub, F.	Weight, per ft.
Diameter of pipe, 12-inch	[illegible]/16 in.	[illegible]/16 in.	60 lbs.
" " " 14-inch	[illegible]/16 in.	[illegible]/16 in.	70 "
" " " 16-inch	1/2 in.	5/8 in.	90 "
" " " 18-inch	1/2 in.	5/8 in.	105 "
" " " 20-inch	1/2 in.	5/8 in.	120 "
" " " 24-inch	[illegible]/16 in.	[illegible]/16 in.	160
" " " 30-inch	5/8 in.	3/4 in.	220
" " " 36-inch	11/16 in.	[illegible]/16 in.	300
" " " 42-inch	3/4 in.	7/8 in.	380
" " " 48-inch	[illegible]/16 in.	[illegible]/16 in.	[illegible]

The accompanying drawings show longitudinal sections of the whole pipe and of the joint. The bell is 3 in. deep and the inside diameter at the face of the hub is 1/4 in. larger than the outside diameter at the thickest part of the spigot. The short 3-ft. lengths of pipe, besides being easily handled, render the culvert quite flexible and by the enlargement of the inside diameter of the middle of the bell still further flexibility is secured. This design gives enough clearance for assembling, yet requires but a small amount of lead or cement



Cast-Iron Culvert Pipe, Showing Detail of Bell and Spigot.

for calking and frequently makes any calking unnecessary. In connection with culverts, the following table of estimated areas which certain sizes of pipe with given fall will drain of storm water is of interest:

Diameter of pipe.		Fall per 100 feet							
		1 in.	2 in.	3 in.	6 in.	9 in.	12 in.	24 in.	[illegible]
12 in.	Acres	1	2	3	4	5	6	8	10
14 "		2	3	4	6	8	10	13	16
16 "		3	4	5	7	9	12	16	[illegible]
18 "		4	5	6	8	10	13	20	[illegible]
20 "		6	8	10	12	16	20	[illegible]	[illegible]
24 "		10	12	15	20	25	30	[illegible]	[illegible]
30 "		20	25	30	45	60	75	100	[illegible]
36 "		40	50	60	75	100	130	200	[illegible]
42 "		60	80	100	125	150	200	300	[illegible]
48 "		80	100	120	150	200	260	400	[illegible]

Abolition of Grade Crossings on the Pennsylvania.

While invariably avoiding grade crossings on new work, the Pennsylvania has in the last five years been eliminating crossings at grade at many other places. On Jan. 1, 1902, there were 994 grade crossings on the lines of heaviest traffic between New York and Washington, and Philadelphia and Pittsburgh; but in the six years since then 568 of these—or more than half—have been abolished. The completion of the new Washington terminal marks the consummation of the plan of the late President Cassatt to eliminate all grade crossings in the important cities between New York and Washington. This has involved the elevation or depression of tracks in Jersey City, Newark, Elizabeth, New Brunswick, Trenton, Philadelphia, Chester, Wilmington, Baltimore and Washington. Out of 101 grade crossings between Altoona and Harrisburg on Jan. 1, 1902, only 51 remained on the first day of this year. These figures take no account of the extensive and costly revision of grades so conspicuous in Philadelphia—whereby tracks for trains in different directions have been either elevated or depressed, thereby eliminating the necessity for trains to cross tracks at grade. This has been an important factor of safety at places where traffic is dense.

A Forty-Yard Blue Print.

The accompanying photograph shows a blue print 51 in. wide and 120 ft. long recently made on an Everett-McAdam continuous

Blue Print 120 Feet Long.

electric blue printing machine manufactured by the Revolute Machine Company, New York. This print was made on a single sheet of paper.

In Reduced Circumstances.

The Nantucket Central, the smallest railroad in New England, has installed gasolene motor cars, and will send back to the Boston, Revere Beach & Lynn the little narrow gage locomotive that has been its motive power for many years. The line is 8.50 miles in length, and its yearly mileage has been 6,500 miles. Now there will be that boon that Nantucket Island people never enjoyed before—winter service between Nantucket and Siasconset.

The first of the new cars arrived the other day. It is a small affair, capable of carrying nine persons. Two larger cars will be constructed for summer use to carry 35 persons each. It is planned to construct a turnout at the four-mile marker so that trains may leave Nantucket and Siasconset simultaneously and pass each other. The trains will stop wherever signaled to allow passengers to board. Hereafter the force will probably consist of one baggage master, in charge of the baggage car, two or three motormen (as traffic requires), and a master mechanic. Hitherto there has been a coal bill of $500 annually. This will be materially reduced. Another plan is the extension of the track down Steamboat wharf as far as the freight house. This will bring close connection with the steamboat trade.—*Boston Herald.*

TRADE CATALOGUES.

A California Hydro-Electric Plant.—Bulletin No. 2,027 of the Allis-Chalmers Co., Milwaukee, Wis., entitled "The Hydro-Electric Plant at Trinity River, California," gives information on an interesting power transmission system. This plant has been built with an eye to future, rather than present, needs of the communities which it serves. It is in the central part of Trinity county, California, two miles below Junction City, where Canon creek, which supplies the water power, flows into Trinity river. The drainage area is 52 square miles. The dam, which is small, serves only to divert the water. In the system are 5,250 ft. of ditches and open flumes and a 1,821-ft. tunnel. An effective head of 600 ft., or a working pressure of 260 lbs. per sq. in., is obtained from two penstocks each 1,165 ft. long. The power house is equipped with Allis-Chalmers electrical machinery consisting of two three-phase, 25-cycle, 750-k.w., 500-r.p.m., 2,200-volt generators, seven step-up transformers, and auxiliary apparatus. The description of the plant is quite complete and will be of interest to engineers and students.

Band Saw Tools and Sharpeners.—The Rotary File & Machine Company, Brooklyn, N. Y., has issued a booklet describing band saw filing, setting, brazing and sharpening machines. The Ideal band saw sharpener is a new machine just being put on the market. It is similar to the New Reliable power machine, but is worked by hand and is designed for filing small band-saws up to 1½ in. wide with teeth spaced ½ in. apart. The saw is gripped by a vise firmly enough to hold it while each tooth is being filed, yet allowing it afterward to slip along into position for filing the next tooth. At each revolution of the file shaft the file is automatically withdrawn from the tooth, the saw is moved along and the file engages the next tooth. It is easily adjusted to take different sizes and the cutting depth is controlled by cams.

Speed Indicator.—Harry Vissering, Chicago, has published a pamphlet describing the Hausshalter speed, time and distance indicator and recorder for locomotives and cars. This apparatus has been used in Europe for the last eight years. It indicates and records speed at all times up to 100 miles an hour and also records the time of stops and time between stops, the total time that the train stands still between terminals, the time of delays and distance from the terminal where the delay occurred, the time of acceleration from stop to any speed and vice versa, distance between stations or stops and the total length of run. Line drawings show the construction of the device and its application to cars and locomotives.

Suction Gas Plants.—A pamphlet issued by R. D. Wood & Co., Philadelphia, Pa., is devoted to suction gas power plants. This system is designed particularly for prime movers from 40 to 300 h.p. The pamphlet gives tables comparing the relative net efficiency of steam engine and gas engine based on the original heating power per pound of coal. Other tables show the comparative consumption and fuel costs of different types of reciprocating and turbine steam engines, of gasolene, oil and gas engines and of the gas engine with suction producer. There are also some interesting results of tests. The illustrations consist of line drawings and half-tones of suction producer plants.

Small D. C. Generators.—Bulletin No. 93 of the Crocker-Wheeler Co., Ampere, N. J., is devoted to small engine type d.c. generators. These range in size from 25 k.w. to 150 k.w. The bulletin is illustrated with half-tones showing the motor and certain parts; rating and speeds of the different sizes are given in a table. Bulletins Nos. 91, 92 and 94 take up, respectively, induction motor panels; combined generator and feeder panels for direct current of from 125 to 250 volts, and switchboard panels.

Boilers.—A pamphlet of the Rust Boiler Co., Pittsburgh, Pa., is mostly taken up with full reports of two evaporation tests made by William Kent, Mem. A. S. M. E., of a 335-h.p. Rust boiler. The tests show between 10.8 and 12.2 lbs. equivalent evaporation per pound of combustible and from 69.2 to 75.9 per cent. efficiency of boiler based on combustible. The fuel used was Pittsburgh bituminous coal. The rest of the pamphlet illustrates and describes the Rust boiler.

Fans.—The Massachusetts Fan Co., Watertown, Mass., has just issued an additional section of its perpetual catalogue. This section is 16 pages and is entitled "Vertical and Horizontal Engines for Fan Driving." It is illustrated and gives descriptions, dimensions and horse-power tables. Previous sections of the catalogue relate to blowers and exhausters, heating, ventilating, drying and mechanical draft apparatus, etc.

Paint.—A recent issue of *Co-operation and Expansion*, published in the interests of the Heath & Milligan Co., Chicago, contains two interesting addresses on paint legislation, suggestions to sales agents, figures showing the growth in the number of establishments, capital invested and value of product of the paint manufacturers in the country, and news notes of interest to agents.

Reinforced Concrete.—The Atlas Portland Cement Co., New York, has published a 249-page pamphlet entitled "Reinforced Concrete in Factory Construction." It gives general data on factory construction and design, with one chapter on concrete aggregates, and then goes into more detail in descriptions of 10 individual buildings. It is profusely illustrated with photographs.

Portable Industrial Railways.—The Arthur Koppel Co., Pittsburgh, Pa., is distributing a pamphlet devoted to portable industrial railways. It gives dimensions, weights, etc., of types of dump and platform cars of various gages, and the weight of 15-ft. sections of track with different gages and rail sections. There are numerous photographs of installations.

Oil Storage.—Bulletin No. 4,002 of S. F. Bowser & Co., Fort Wayne, Ind., describes the Bowser system of oil storage as adapted to railroad storehouses and signal towers. It describes in detail the construction of the tanks, dumps and accessories, and is illustrated with half-tones showing parts and complete installations on several roads.

Catenary Line Material.—Bulletin No. 4,538 of the General Electric Co., Schenectady, N. Y., describes the catenary system of line conductors for high tension a.c. electric traction. The bulletin also describes designs of frogs, crossings, hangers, etc., and separate parts. It is illustrated with numerous half-tones of installations and auxiliary devices.

Thermit.—A folder issued by the Goldschmidt Thermit Co., New York, briefly describes the process of welding broken motor cases with thermit. A matrix of yellow wax is shaped about the fracture and the sand mold built about this as a pattern. The wax is then burnt out with a gasolene torch and the weld made as usual.

Storage Batteries.—Bulletin No. 8 of the Gould Storage Battery Co., New York, describes the two storage battery plants on the Dayton & Western, an interurban line. Bulletin No. 9 is devoted to storage batteries on alternating current systems and describes the plant on the Rutland Railway, Light & Power Co.

"Off for California."—One of the most attractive publications for the California season yet received is that of the Chicago, Milwaukee & St. Paul, with the above title. It is printed in colors, with artistic half-tone illustrations. There is a map of the system and a schedule of the "Overland Limited."

The Valve World.—The December issue of this organ of the Crane Company, Chicago, gives in full a paper on Education for Mechanics, read by President R. T. Crane at a recent meeting of the Western Railway Club. Correspondence between Mr. Crane and Andrew Carnegie on this subject is included.

United of Havana.—A recent folder entitled "Cuba: Its Battlements and Bowers," maintains the standard set by the passenger department in previous publications. Nearly all the photographs reproduced are new and well adapted to attract the attention of prospective tourists.

Belts and Ropes.—The Cling Surface Co., Buffalo, N. Y., has issued a pamphlet entitled "The Treatment of Belts and Ropes for Service and Profit." It goes at length into methods of using Cling surface on many different types of belts and ropes under various conditions.

Illinois Central.—A recent folder issued by the passenger department is designed to point out the interest and comfort of the trip to Cuba via New Orleans. It describes, with attractive illustrations, the sea voyage and Havana and other Cuban cities.

Rail Chairs.—T. H. Symington, Baltimore Md., is distributing a circular showing a drawing and perspective view of Gilchrist rail chairs of two types: one for light work on electric lines and the other for heavy work on both electric and steam lines.

Frogs, Switches and Crossings.—The Indianapolis Switch & Frog Co., Springfield, Ohio, is distributing a portfolio consisting of perspective views and drawings of many styles of switches, frogs and crossings, including parts and accessories.

Tie Plates.—The Spencer Otis Co., Chicago, has issued a pamphlet illustrating the Economy rolled steel flange tie plate. Several types of this and other plates are shown.

MANUFACTURING AND BUSINESS.

Fritz von Hiller has been appointed representative at Mexico City of the Pressed Steel Car Co., Pittsburgh, Pa., succeeding D. G. Farragut, resigned.

An organization in western Europe wants to get in touch with makers of pressed steel fire bars. For address, apply to the Bureau of Manufactures, Washington, D. C., mentioning file number 1,829.

A. E. Robbins has resigned from the Gold Car Heating & Lighting Co., New York, to go to the Ward Equipment Co., 141 Broadway, New York. His position in the latter company will be prominent; the title is as yet undecided, as the details of organization are not fully worked out.

The Erie has arranged to have some locomotives repaired by the American Locomotive Co., New York, but has not made any definite contract as to the number of engines. The Baldwin Locomotive Works, Philadelphia, Pa., has been for some time repairing about one locomotive a day for the Erie.

During 1907 the Baldwin Locomotive Works, Philadelphia, Pa., built 2,663 locomotives, of which 363 were for export. The total output includes 2,371 steam locomotives and 292 electric locomotives. Of the steam locomotives, 40 were Mallet compounds. The average weekly payroll amounted to 18,665 men.

F. K. Rhines has been made Assistant to the Treasurer and General Manager of the General Fireproofing Co., Youngstown, Ohio. Mr. Rhines was formerly Engineer with the East Iron & Machine Co., bridge builders, at Lima, Ohio, and more recently has been Chief Engineer and General Manager of the Dixon Engineering & Construction Co., Toledo, Ohio.

The new factory of the Glidden Varnish Co., Cleveland, Ohio, is completed and in full operation, and the old factory, the home of the company since 1874, is idle for the first time in its history. The new plant has been a year and a half in building and cost over $500,000. It covers 17 acres and the buildings are of brick, concrete and steel. It is said to be the largest and most perfectly appointed exclusive varnish factory in the world both in manufacturing and storage facilities. There also is a large grinding department.

Beginning Jan. 1, 1908, the sales departments of the Western Tube Co., Kewanee, Ill., and the Shelby Steel Tube Co., Pittsburgh, Pa., will be consolidated with the sales department of the National Tube Co., Pittsburgh, Pa. The new sales organization will be as follows. Edward Worcester, First Vice-President and General Manager of Sales; James W. Downer, John Duncan and H. S. White, Assistant General Managers of Sales, all with offices at Pittsburgh Instead of five local sales offices, there will be nine, as follows: New York, Battery Park building, Clifton Wharton, Jr., Manager of Sales, with sub-office in the Pennsylvania building, Philadelphia, Pa.; Pittsburgh, Pa., Frick building, A. M. Lally, Manager of Sales; Chicago, Commercial Bank building, H. S. Raymond, Manager of Sales; St. Louis, Mo., Chemical building, E. A. Downey, Manager of Sales; San Francisco, Cal., Crocker building, George S. Garritt, Manager of Sales, Thos. W. Brooks, Assistant Manager of Sales; Portland, Ore., R. R. Hoge, Manager of Sales, with sub-office at Seattle, Wash.; Denver, Colo., Majestic building, Edwin H. Fowle, Manager of Sales; New Orleans, La., Hugo Weidmann, Manager of Sales, and Atlanta, Ga., Candler building, Edward Worcester, Jr., Manager of Sales.

Iron and Steel.

The Chicago, Milwaukee & St. Paul has bought 2,200 tons of bridge steel.

The Pittsburgh & Lake Erie is reported to be in the market for 16,000 tons of bridge steel for a bridge at Beaver, Pa.

OBITUARY NOTICES.

Frank L. Palmer, formerly and for about 30 years connected with the passenger department of the Wabash, died suddenly at his home in Chicago, January 11, at the age of 65. Mr. Palmer resigned the office of Assistant General Passenger Agent about three years ago.

Henry F. Kenney, formerly and for many years Superintendent of the Philadelphia, Wilmington & Baltimore, died on January 10 at his home in Ridley Park, near Philadelphia, at the age of 73. Mr. Kenney continued in charge of the P., W. & B., and also of the Baltimore & Potomac after they came under control of the Pennsylvania, and he retired from active service only a few years ago. He remained President of the Delaware Railroad, a part of the system, up to the time of his death.

George F. Evans, Vice-President and General Manager of the Maine Central, died suddenly at Vanceboro, Me., January 10, while on a tour of inspection. Mr. Evans was about 60 years old. He was born at Concord, N. H. His first railroad service was on the Louisville, Evansville & St. Louis, where he began in 1881 as Secretary and Treasurer and rose to be General Manager. In 1892 he left that company to go to the Boston & Maine, where he was for three years Superintendent of the Southern division. Then for a year he was Assistant General Manager, and on December 1, 1896 was appointed to the position on the Maine Central (controlled by the Boston & Maine), which he held at his death. He was also Vice-President of the Washington County Railway.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

New York Railroad Club.

At the meeting of this club to be held in the building of the United Engineering Societies, No. 29 West 39th street, on Friday, January 17, a paper on "The Era of Steel and the Passing of Wood in Car Construction," by Arthur M. Waitt, will be read. W. R. McKeen (Union Pacific), and G. R. Henderson, of New York, will participate in the discussion.

Western Railway Club.

At the January meeting, to be held in the Auditorium Hotel, Chicago, on Tuesday, the 21st inst., at 8 o'clock p.m., the paper on "Ventilation and Heating of Coaches and Sleeping Cars," by S. G. Thompson, Assistant Engineer of Motive Power, Pennsylvania Railroad, postponed from the December meeting, will be presented; also a paper on "The Car Wheel and Its Relation to the Rail and Car," by S. P. Bush, Vice-President and General Manager of the Buckeye Steel Castings Co., Columbus, Ohio.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago River & Indiana.—The President of this company is H. T. Gilbert; Vice-President and Treasurer, Frank Donnelly, office of both at Chicago.

Pennsylvania State Railroad Commission.—Governor Stuart on January 13 announced the appointment of the three members of the new State Railroad Commission, authorized under the law which went into effect January 1. The Chairman is Nathaniel Ewing, now Judge of the United States District Court in Western Pennsylvania, and formerly counsel for the Pennsylvania Railroad and other corporations. He is appointed for a term of five years. He is 60 years old. The second member is Charles N. Mann, of Philadelphia, clerk in the office of the prothonotary of Philadelphia county, 70 years old, appointed for four years. The third member is John Y. Boyd, of Harrisburg, retired; 45 years old. Mr. Boyd was formerly connected with anthracite coal companies on the line of the Pennsylvania Railroad.

Seaboard Air Line.—The United States Circuit Court has appointed E. C. Duncan, of Raleigh, N. C., as a third Receiver of this road.

Operating Officers.

Ann Arbor.—Eugene Hertenstein has been appointed Superintendent at Owosso.

Chicago Great Western.—C. S. Weston has been appointed Superintendent of the Southwest division, with office at Des Moines, Iowa, in place of C. L. Nichols, resigned. C. T. Banks has been appointed Superintendent at Red Wing, Minn.

Chicago River & Indiana.—D. L. Phipps is General Superintendent and T. P. Convey, Car Accountant; offices at Chicago.

Cleveland, Cincinnati, Chicago & St. Louis.—A. A. Hyatt has been appointed Trainmaster on the Cairo division, in place of T. J. Hayes.

Coahuila & Zacatecas.—P. E. O. Carr has been appointed General Manager, with office at Saltillo, Mex.

Lake Shore & Michigan Southern.—J. M. Horgan, heretofore Trainmaster, has been appointed Assistant Superintendent of the Franklin division.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—J. H. McGoff, heretofore Master Mechanic at Fort Madison, Iowa, has been appointed Mechanical Superintendent of the Eastern Grand division, with office at Topeka, Kan.

International & Great Northern.—J. F. Enright has been appointed Superintendent of Motive Power, with office at Palestine, Tex. See Mobile & Ohio.

Mexican.—W. T. Ingram, heretofore Engineer of Maintenance of Way on the Interoceanic, has been appointed Superintendent of Permanent Way, in place of T. A. Corry, office at Mexico, Mex.

Missouri Pacific.—J. L. Butler has been appointed Master Mechanic at Atchison, Kan., in place of L. J. Mills.

Mobile & Ohio.—E. G. Brooks has been appointed Master Mechanic of the Mobile division at Whistler, Ala., in place of J. F. Enright, who has resigned. Mr. Brooks also holds the title of Master Mechanic of the Southern Railway in Mississippi.

Tonopah & Goldfield.—E. S. Van Housen has been appointed Chief Engineer of this road and of the Bullfrog-Goldfield Railroad.

LOCOMOTIVE BUILDING.

The Imperial Copper Co. of Oregon has ordered one locomotive from the Hicks Locomotive & Car Works.

The Smith & Powers Logging Co., of Oregon, has ordered one locomotive from the Hicks Locomotive & Car Works.

CAR BUILDING.

The Stanley, Merrill & Phillips Ry. has ordered 25 flat cars from the Hicks Locomotive & Car Works.

The Canadian Pacific has ordered 400 composite steel and wood freight and ballast cars from the Dominion Car & Foundry Co.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arkansas, Louisiana & Gulf.—This company's projected line is from Monroe, La., on the St. Louis, Iron Mountain & Southern and the Vicksburg, Shreveport & Pacific, north across the Louisiana-Arkansas state line to Pine Bluff, Ark., with a seven-mile branch to Crossett, Ark., on the Chicago, Rock Island & Pacific, in all 113 miles. It has made a mortgage, of which the Colorado Title & Trust Company, of Colorado Springs, is trustee, securing $6,000,000 5 per cent. gold bonds. Of these, $2,860,000 are to be issued at the rate of $20,000 a mile on the 143 miles now projected, and the remaining $3,140,000 reserved for future extensions. The road has been built from Monroe, La., north to Bastrop, 28 miles, and grading is finished 28 miles further to Hamburg, Ark., and also on the branch to Crossett. Track-laying is in progress on these lines. The 80-mile further extension from Hamburg to Pine Bluff has been surveyed. The company has already received equipment both for operating the completed lines and for carrying on the construction work. J. M. Parker is General Manager of the Southern Development Company, which is building the road.

Arkansas, Oklahoma & Western.—See this company under Railroad Corporation News.

Atlanta, Birmingham & Atlantic.—Work is now under way on an extension of this company's line from Talladega, Ala., west to Birmingham, 75 miles, and on that from Bessemer, Ala., to Mulgay, 14.5 miles. The contractors are the Lane Bros. Company, Atlanta, Ga., and C. D. Smith & Co., Birmingham, Ala.

The company is making surveys for a line from Atlanta, Ga., southwest to New Orleans, approximately 500 miles.

Atlanta, Norcross & Gainesville.—Incorporated in Georgia to build a line from Atlanta northeast to Gainesville, about 50 miles. The incorporators include: H. D. Jaquish, C. C. Sanders, W. B. Smith, J. H. Hunt, R. Smith, A. J. Mundy, H. B. Smith, M. M. Ham, J. W. Bailey, H. H. Denn and J. L. B. Stevens, all of Hall county.

Canadian Northern Ontario.—Work is now under way on a line to Key Harbor, on Georgian Bay, about six miles, to carry iron ore from the Moose Mountain deposits.

Charlotte Harbor & Northern.—This company, which last year built 37 miles of railroad in Florida, is building with its own men a three-mile line known as the Hull cut-off to Hoist No. 7. The company is planning to build an extension from Arcadia to Plant City, 60 miles.

Chattahoochee Valley.—This company, it is said, has filed plans for an extension from West Point, Ga., north through Troup county, Ga., to Standing Rock, in Chambers county, Ala., thence to a point near Texas in Heard county, Ga.

Chicago & Milwaukee (Electric).—This company last year built 38 miles of electric line as follows: From Racine, Wis., toward Milwaukee, 34 miles, and four miles in Milwaukee. Work is now under way by the MacArthur Bros. Co., on the remaining six miles to Milwaukee; also on $3\frac{1}{2}$ miles additional in Milwaukee.

Chicago, Milwaukee & St. Paul.—It is said that this company expects soon to begin operating its Pacific extension from the Missouri river west to Marmath, Mont., 200 miles. The line is now in operation from the Missouri river west to Bowman, N. Dak., 163 miles. Most of the grading between this point and Butte, Mont., is finished, and it is expected to have the line in operation west to Butte about June 1.

Cumberland River & Nashville.—Contracts have been given to the Monticello Construction Company, of Monticello, Ky., for building this proposed line from Burnside, Ky., southwest to Monticello, 20 miles; graded for 12 miles. The line is projected from Corbin, Ky., west to Burnside, and thence southwest to the Tennessee state line, 100 miles. S. Woodward, President, Carlisle building, Cincinnati, Ohio.

Dansville & Mount Morris.—This company has projected a line to be built under the name of the Hornell & Dansville from Dansville, N. Y., south to Burns, 10 miles.

Denver, North-Western & Pacific.—This road, building from Denver, Colo., west to Salt Lake City, Utah, 500 miles, is now in operation to Yarmony, Colo., 147 miles. Contract has been let to Orman & Crook, of Denver, for the section from Yarmony to Steamboat Springs, 6.8 miles, leaving 310 to be built to finish the line to Salt Lake City. A contract was recently signed by which 2,000 men will be put to work to finish the line to Salt Lake City as rapidly as possible. A company has been formed by D. C. Dodge, Charles Boettcher, Thomas F. Walsh, of Washington; C. Phipps, of Pittsburgh, and H. M. Porter to push the work.

Denver & Transcontinental.—This company, it is said, has stopped making surveys for its proposed line from Denver, Colo., southwest to the Pacific coast.

Florida East Coast.—The extension of this road from Homestead, Fla., southwest along to Florida Keys, Key West, 126 miles, is reported opened for traffic south to Knight's Key, 66 miles. From Key West north track has been laid on about 15 miles.

Fourche River Valley & Indian Territory.—Location surveys have been made by this company from the present end of track to the west line of Perry county, Ark., 38 miles. An officer writes that the company has stopped work until times are easier. (March 15, p. 384.)

Grand Trunk Pacific.—Contract has been let to Foley Bros. & Larsen, of Winnipeg, for building from a point six miles east of Edmonton, Alb., to Wolf Creek, 120 miles west. The section will be the most expensive of any so far under contract, the cost being estimated at between $40,000 and $50,000 per mile. On the Lake Superior branch, which is being built by the same firm, there is some difficult engineering and it is not expected that the road between Winnipeg and Port Arthur can be finished before the latter part of 1910. About 100 miles was built last year on this section. Tenders have been asked for building a 100-mile section in British Columbia from Prince Rupert east.

Gulf, Colorado & Santa Fe.—Contract has been given to John Scott & Sons, of St. Louis, Mo., for building a connecting line from Center, Tex., to Zuber, on the Texas & Gulf, 21 miles.

Hillsboro & Northeastern.—This company has projected an extension from Hillsboro, Wis., south to Richland Center, 28 miles.

Hornell & Dansville.—See Dansville & Mount Morris.

Idaho & Washington Noathern.—This company is building with its own men an extension from Grand Junction, Idaho, to McGuires, 1.3 miles.

Indian Creek Valley.—This company has location surveys made for an extension from Jones Mills, Pa., about 10 miles. C. F. Hood, President, Normalville, Pa.

Lake Superior & Ishpeming.—Surveys are being made for a change of main line through Negaunee, Mich., about three miles; also for reducing the grade on a five-mile mining branch and to extend this branch three miles. The work, which will be heavy, is being done on account of prospective caving ground at the mines. It will necessitate the building of a number of steel bridges.

Laramie, Hahns Peak & Pacific.—This company has location surveys made and is about ready to lay tracks on an extension from Centennial, Wyo., south to Hebron, Colo., 77 miles; 33 miles will be in Wyoming and 44 miles in Colorado. Grading has been finished on about six miles.

Mexican Central.—Grading is reported finished on about 40 miles on the line this company is building from Apulco to Tamos, and track laying on this section is shortly to be started. Work is under way on a bridge over the Panuco river. Connection is to be made at Tamos with the Tampico-Aguascalientes branch, which is 25 miles from Tampico. The line is now in operation from Mexico City to Apulco, and when the entire work is finished will furnish a short and direct route from Mexico City to Tampico.

Mexican Roads.—Plans are being made by Robert S. Towns and associates, who own large smelting interests in Mexico, to build a line from Gutierrez, on the Mexican Central, to the Sombrete mining district in the state of Zacatecas, about 100 miles. Final location surveys for most of the way have been made, and construction work, it is said, will soon be started.

A concession is shortly to be granted by the Mexican Government for a line from Comacho, Zacatecas, where a connection is to be made with the Mexican Central to Bonanza, about 100 miles. The names of the projectors are not given.

Mingo & Monongahela.—Surveys made by this company for a line from the mouth of Mingo creek, Pa., northwest to Thomas on the Wheeling branch of the Baltimore & Ohio, 11 miles. C. McK. Watts, President, Elizabeth, Pa.

Missouri Southern.—Contracts let to the S. H. R. Robinson & Son Contracting Company, of St. Louis, Mo., for an extension from Ohlman, Mo., to Bunker, eight miles. The company has projected a further extension from Bunker to Salem, 20 miles.

Montana Railroad.—Contract has been given to Dittner, Bradbury & Co., of Lombard, Mont., for rebuilding this line from Lombard, Mont., east to Minden, 36 miles. Surveys also made from Minden north to Summit, 11 miles.

Nevada County Narrow Gage.—Contract let to Horan Bros., of Grays Valley, Cal., for building a line from Coleman Station to Long Ravine, 3½ miles.

New York Subways.—The necessary consent of property owners has been obtained by the Interborough Rapid Transit Company for its proposed improvements at Broadway, 96th and 102d streets. Three additional tracks are to be laid to make a more convenient junction. (Aug. 23, p. 215.)

Pacific & Eastern.—Surveys are being made by this company for an extension from Eagle Point, Ore., to Butte Falls, 21 miles.

Pittsburgh, Binghamton & Eastern.—Location surveys have been made for extending this line from Cedar Ledge, Pa., to Clearfield, 141 miles, of which 21 miles from Cedar Ledge to Powell were built last year. The Holbrook, Cabot & Rollins Corporation, Boston, Mass., are the contractors.

Randolph & Cumberland.—An officer writes that this company has temporarily stopped work on its extension from Hallison, N. C., northeast to Tillman, 3½ miles. Grading has been finished

San Francisco, Idaho & Montana.—Contract has been given to the Congon Construction Company, of Caldwell, Idaho, for building this line from Caldwell, Idaho, to Homedale, 16.2 miles, and work is now under way. Surveys made from Homedale to Winnemucca Nev., 275 miles. Address F. H. Richardson, Caldwell.

Stephenville North & South Texas.—This company has projected an extension of its line from Stiegler, Tex., north for 38 miles, and from the southern end of the line at Hamilton, south 60 miles.

Texas State.—This road, in operation from Rusk, Tex., west 10 miles, is owned by the state. It is to be extended west 18 miles to Palestine; also from the eastern terminus at Rusk east to a connection with the Southern Pacific, six miles. Plans, it is said, are being made to extend the road from Palestine northwest to Dallas, Tex., 100 miles, and on the southern end southeast to Sabine Pass, on the Gulf coast, about 160 miles from Rusk. (April 26, p. 600.)

Toronto, Hamilton & Buffalo.—Contract has been given by this company to Anderson & Goodale, of Hamilton, Ont., for building the Westinghouse spur to the city of Hamilton, Ont., 1.26 miles.

Tremont & Gulf.—This company, which now operates a line from Tremont, Tex., south to Winnfield, 50 miles, with a branch from the main line near its southern terminus at Menefee, northwest to Pyburn, 10.5 miles, is building an extension of this branch from the main line at Menefee southeast to Rochelle, 18 miles.

Van's Harbor Land & Lumber Company's Road.—Work is progressing in the clearing of the right-of-way on a proposed logging road to be built from Van's Harbor, Mich., towards Cook's Mill, nine miles, and it is expected to begin grading early this spring. A further four-mile extension is projected to finish the line to Cook's Mill.

Waterloo, Pella & Southwestern.—An officer writes that this company, which was incorporated last year to build a line from Waterloo, Iowa, southwest to Charlton, 120 miles, with about 20 miles of sidings, is making surveys and securing rights-of-way. Contracts will probably be let for building the entire line early this spring. E. A. Harris, Vice-President and General Manager, Pella, Iowa.

Wheeling & Lake Erie.—Referring to recent reports of improvements on this road, an officer writes the company has in contemplation a considerable amount of double tracking and minor grade and curvature reduction work and also the completion of the Sugar Creek & Northern, a new cut-off from Bolivar, Ohio, northwest to Orrville, 22 miles, which is now three-fourths finished. This cut off line will save six miles in distance, and will do away with the only severe grades on the main line, also provide greatly improved yard and terminal facilities. This work, however, as well as all other improvement and betterment work, has been for some time suspended, and there is no early probability of its being resumed until the financial conditions are wholly changed.

Wichita Falls & Northwestern System.—This company is building with its own men an extension from Olney, Tex., south to Belknap, 14 miles.

RAILROAD CORPORATION NEWS.

ARKANSAS, OKLAHOMA & WESTERN.—This company, formerly the Rogers Southwestern, has 30 miles in operation from Rogers, Ark., west to Siloam Springs, on the Kansas City Southern. An extension of 65 miles is projected from its western terminus to Pryor Creek, Okla., and an extension of 30 miles from its eastern terminus to Eureka Springs, Ark. Merriam, Smith & Co., of New York, are offering at par the first mortgage, 10-year 6 per cent. bonds of 1947 of this company. The issue of these bonds is limited to $10,000 a mile.

BALTIMORE & OHIO.—See Chicago Terminal Transfer.

BOSTON & MAINE.—The Fitchburg Railroad has renewed for one year at 6 per cent. $500,000 5 per cent. notes which matured January 15. The new notes have been sold at par through R. L. Day & Company.

CHICAGO, ROCK ISLAND & PACIFIC.—This company has sold to Speyer & Company $3,000,000 first and refunding 4 per cent. 30-year bonds and has given that firm an option on $6,000,000 more of the bonds. The bonds are part of an issue of $55,592,000. It is not announced what use is to be made of the proceeds of this sale, but it is believed that the transaction is part of the plan for redeeming $6,000,000 4½ per cent. notes maturing April 1.

CHICAGO TERMINAL TRANSFER.—The stockholders' protective committee has issued a statement to the effect that it was the "alleged lease dated April 1, 1903, to the Baltimore & Ohio at the ruinously low rental of approximately $160,000 per annum which brought the Terminal Company to foreclosure, the property leased to the Baltimore & Ohio being worthy of a rental of not less than $600,000 per annum. The properties leased to the Baltimore & Ohio are among the most valuable owned by the Terminal Company." It was because of representations to this effect made by the committee at the time the Baltimore & Ohio applied to the Court for permission to pay the first mortgage bonds of the Terminal Company that the Court ordered that this action should be done without prejudice to the rights of the Chicago Terminal Transfer to contest the Baltimore & Ohio lease as fully and freely as if the Baltimore & Ohio had not been allowed to pay the first mortgage bonds.

CRIPPLE CREEK CENTRAL.—The quarterly dividends on the common and preferred stocks have been passed. The annual rates have been 4 per cent. on the preferred and 6 per cent. on the common. This action is taken because of losses which the company sustained in the recent failure of the banking firm of Kessler & Company.

ERIE.—Net earnings for November, after taxes and equipment depreciation charges, decreased 68 per cent. Gross earnings were $4,294,239, a decrease of $341,996. Net earnings $449,644 against $1,418,816 in 1906, a decrease of $969,173. The gross earnings for the five months ended November 30 were $23,855,349, an increase of $1,024,667. Net earnings were $5,096,200, a decrease of $1,947,468.

GULF & SHIP ISLAND.—All the lumber mills on the line of this road, many of which were closed during December, are in operation again. The road runs from Jackson, Miss., south to Gulfport.

MICHIGAN CENTRAL.—The Turbine Steamship Company, of Buffalo, is reported to be negotiating to buy or lease the line of the Michigan Central extending from Fort Erie, along the western bank of the Niagara river, north to Niagara-on-the-Lake, 27 miles, as a connection for a line of turbine steamers from Niagara-on-the-Lake across Lake Ontario to Toronto.

MISSOURI PACIFIC.—This company has made application to the New York Stock Exchange to list $1,935,200 additional stock. This is to pay the regular semi-annual dividend of 2½ per cent. recently declared payable in stock.

MOHAWK VALLEY.—The Rochester Railway & Light Company has declared the first dividend of 5 per cent. on its $6,500,000 common stock. The Syracuse Rapid Transit has declared the first dividend of 3 per cent. on its $2,750,000 common stock. Both companies are controlled by the Mohawk Valley Company, which in turn is controlled by the New York Central & Hudson River.

NEW YORK CENTRAL & HUDSON RIVER.—See Mohawk Valley Company.

NEW YORK CENTRAL LINES.—The expected issue of equipment trust notes has been announced. It consists of $30,000,000 5 per cent. 15-year notes maturing in equal annual instalments, beginning November 1, 1908. They are guaranteed jointly and severally by the New York Central & Hudson River, the Lake Shore & Michigan, the Michigan Central, the Cleveland, Cincinnati, Chicago & St. Louis and the Chicago, Indiana & Southern. J. P. Morgan & Company and Drexel & Company have offered them for sale at prices ranging from 93 for the instalment maturing in 1922 to 98¾ for the first instalment.

NORTHERN SECURITIES.—This company's income for the year ended December 31, 1907, amounted to $359,000, an increase of $94,000 over 1906. Its two principal sources of income are dividends on the stock of the Chicago, Burlington & Quincy Railroad and on the stock of the Crows Nest Pass Coal Company. During the year the company acquired 150 additional shares of Burlington stock and 2,067 additional shares of the Crows Nest Pass stock. The one remaining outstanding share of the company's original capital stock was also surrendered to it, thereby permitting the distribution of its former holdings of Northern Pacific and Great Northern shares to be completed.

PENNSYLVANIA.—During the calendar year ended December 31, 1907, the shipments of coal and coke originating on the Lines East of Pittsburgh and Erie amounted to 58,457,932 tons against 49,711,088 tons in 1906. This is an increase of 8,746,844 tons, or 18 per cent.

ROGERS SOUTHWESTERN.—See Arkansas, Oklahoma & Western.

SEABOARD AIR LINE.—Judge Pritchard, in the United States Circuit Court at Richmond, Va., on January 14, announced that as the two present receivers were representatives of two hostile interests, he would appoint a third receiver of the Seaboard Air Line, representing the United States Court and no other interest. Edward C. Duncan, of Raleigh, N. C., a director of one of the constituent companies of the Norfolk & Southern, was on January 15 named as third receiver.

SOUTHERN PACIFIC.—This company continues to report heavy decreases in net earnings. The average mileage operated in November was 9,483, an increase of 175 miles as compared with November, 1906. Gross earnings were $11,692,722, an increase of $539,430. Net earnings after taxes were $3,524,434, a decrease of $1,381,822. For the five months ended November 30, with 202 more miles operated than in the corresponding period of the previous year, gross earnings were $58,030,955, an increase of $7,492,816. Net earnings for the five months were $16,765,486, a decrease of $3,545,848. In explanation of the showing for November the following official statement is made:

"About $866,000 of the increase in expenses is for maintenance of way, structures and equipment. The continuous rains of the spring of 1907, lasting longer than ever before known since the construction of the lines, softened the roadbed of the entire mileage in the states of California, Nevada and Oregon, so that under the exceptionally heavy traffic the track deteriorated very rapidly, and it was found after temporary repairs necessarily put on the line were made, that practically all of this mileage had to be resurfaced, ballasted and retied, and these causes have affected expenses in every month of the present fiscal year. They have added $494,000 to the expenses, of which $320,000 was for roadbed repairs and $174,000 for renewal of ties. Renewals of equipment increased about $190,000, due to increases in wages and heavier repairs required. Expenses for conducting transportation increased $665,000. Of this increase $295,000 is due to the higher prices of coal and fuel oil and a larger consumption. The remaining expenses resulted mainly from an increase of 78,000,000 ton-miles, or about 11 per cent."

TOLEDO & OHIO CENTRAL.—The Ohio Savings Bank & Trust Company, of Toledo, is offering at a price to yield 6¼ per cent. part of an issue of $500,000 4 per cent. car trust notes maturing up to 1818 of the Zanesville & Western, guaranteed by the Toledo & Ohio Central. These notes were issued for 500 steel underframe drop-bottom gondola cars of 100,000 lbs. capacity. The Toledo & Ohio Central owns the entire capital stock of the Zanesville & Western.

TOLEDO TERMINAL RAILROAD.—The reorganization plan of the Toledo Railway & Terminal Company has been declared operative by the bondholders committee. The new company is the Toledo Terminal Railroad.

UNION PACIFIC.—The average mileage operated in November was 5,713 miles, an increase of 120 miles as compared with the figure for the corresponding period of 1906. The gross earnings for that month were $7,406,655, an increase of $806,132. Net earnings after taxes were $3,371,176, an increase of $64,055. With 93 miles increase in average mileage, gross earnings for the five months ended November 30 were $36,389,214, an increase of $4,111,764. Net earnings for the five months were $15,010,174, a decrease of $1,168,019.

VANDALIA.—The $1,676,000 first mortgage 7 per cent. bonds of the Indianapolis & Vincennes, which mature February 1, 1908, are to be paid.

ZANESVILLE & WESTERN.—See Toledo & Ohio Central.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

OFFICERS:

W. H. BOARDMAN, *Prest. and Editor.*
E. A. SIMMONS, *Vice-President.*
RAY MORRIS, *Secretary*
R. S. CHISOLM, *Treas.*
I. B. RINES, *Cashier*
L. B. SHERMAN, *Western Manager*

EDITORS:

RAY MORRIS, *Managing Editor.*
BRAMAN B. ADAMS
CHARLES H. FRY
FRANK W. KRAEGER
GEORGE L. FOWLER
HUGH RANKIN
BRADFORD BOARDMAN

CONTENTS

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Modern transportation affords so many luxuries that we carelessly assume that it can give us everything. Having got a car of oranges through from California in ten days we expect the railroads to bring all cars of all freight through in the same time. Why not? We make close connection at a junction every day for two months; why should we miss connection (and waste two hours) three times in the next ten months? The telegraph is infinitely faster than the locomotive, yet it bothers us in the same way. A broker telegraphs from New York to Chicago and gets his answer in five minutes or less; why do ordinary messages sometimes take six hours? These facts of experience are called to mind by a letter in a New York paper from a complaining passenger. He says:

> My wife and two children boarded the Second Empire for Rochester at the Grand Central Station, New York, on Dec. 23. I accompanied them as far as Albany. An hour before arriving there I was informed that the car we were in would be taken off at that station, and that I had better take my family into the crowded car ahead. The train arrived in Albany promptly at 3:57 p. m., and left on time, 4 p. m. In the interim of three minutes I managed with much trouble and inconvenience, to find a place for them in the car ahead. They were hardly seated when we were told to return to the car we had just left, as it had been decided to take off the car we had been sent into. Meanwhile the crowd at the Albany station was permitted to crowd in. My wife and I managed to carry our boy, two and a half years old, and an infant, one year old, together with winter wraps and baggage, back into the original car we had boarded at the Grand Central Station. I had to jump from the car, going at about seven miles an hour, to avoid being carried beyond Albany. The change-car performance was repeated at Utica, where my wife was compelled to make two trips with children and baggage through two parlor cars and a diner.

That passenger, no doubt, is mad enough to blame the company for all his troubles, even if he were to be shown that he himself was partly responsible; yet his case is not so clear as it seems. In the first place he should have inquired as to the best time to change. He would have been told to go forward just before reaching Albany. The party should have gone to the center of the forward car, there to stand until the Albany passengers vacated seats. Then the woman and children would at least have been somewhat calmed and prepared for the return journey. Remaining in the train to assist his wife to settle herself may have seemed to this man reasonable, as it does to some people to throw kisses after a train till sometime after it has vanished from sight; but it is utterly unreasonable, unless one is willing to limit himself not only to the time allowed by the time table, but to a considerably less time. It is a gross imposition on passengers entering a train to be knocked over by men hurrying out at the last moment. It is a pity that there is no way to regulate these people who lack the fortitude to say good-bye at the gate. (This man's estimate of the actual stop in this case appears to be wrong.)

The car inspectors may or may not have been negligent. Taking off the forward car was probably due to some fault which was discovered after the train stopped; and not even a critical passenger will ask that all defects in trucks shall be discovered while trains are in motion. The limiting of the stop to three minutes is also a feature that the passenger will agree is unavoidable, if he belongs to that great majority who demand that every train shall reach its destination in the shortest possible time. As this man gives no particulars, it is to be assumed that the leaving and entering crowds at Albany avoided each other with reasonable decency; but we should not have been surprised if he had found two-thirds of the passengers entering at the wrong door and many persons waiting for others to get out of their way when they might have been moving if properly instructed. By intelligent co-operation between stationmen and trainmen passengers might be saved a great deal of unnecessary annoyance. Why do not stationmen direct passengers, two minutes before the train arrives, to gather at the most favorable point on the platform? Where there are two or three cars in a train, a trainman ought to be watchful and show passengers where seats are most plentiful, possibly remaining on the car platform or inside the car to stir up the car-seat hogs who are intrenching themselves against newcomers. In a dark train-shed the assistance given by brakemen is particularly welcome to passengers. (Why should not cars be lighted well—instead of by a single burner—when in a dark station?) On local trains where people have little hand baggage, these attentions to passengers' wants are less important, but a through train, stopping only three minutes at a big station, presents another problem. Quite likely the best way to cure these difficulties, in many cases, would be to lengthen three-minute stops to six minutes, and put the corresponding additional burden on the engine; but brakemen and platform men ought to be "jacked up" in any event. As to how this road came to be so unfortunate as to have to cut out two cars on a single trip, our complaining friend should go to the Public Service Commission. That body is going to investigate obscure causes of delays.

The courts have succeeded the legislatures. The opinions now being handed down dealing with the state railroad legislation of 1907 are not temporary restraining orders granted for the sake of preserving equitable rights pending judicial determination of the facts, but the formal opinions of judges arrived at after mature consideration. Two decisions were given on Monday which will serve to remind the thoughtless legislator that railroads as a class are still entitled to be treated with the same careful fairness and justice as private citizens. One of these decisions was by Judge Smith McPherson, in the United States District Court at Kansas City, Mo. It dealt with a statute passed by the Missouri legislature in 1907 forbidding foreign corporations from transferring suits brought against them from the courts of the state to federal courts on pain of forfeiture of their charters. Both in Missouri and in Arkansas and Alabama, which also in 1907 passed similar laws, federal judges had straightway issued temporary injunctions prohibiting the states from enforcing any of the penalties laid down in these laws, pending decision as to their constitutionality. The decision of Judge McPherson is, we believe, the first final decision which has been handed down in one of these cases. As long as we have a federal government and a constitution there can be no great doubt as to the fate of such laws as these, but the gist of Judge McPherson's opinion is worth quoting for the brevity and accuracy with which it sums up the absurdity of such laws. He holds as follows:

> "The Missouri statute of 1907 is void because it allows a resident company to sue in the federal courts if there is a federal question and denies that right to a non-resident company, and because it seeks to take from the complainant a right which is given by the Constitution."

The application of various railroads of the state for a permanent injunction to prevent the secretary of state from enforcing the law was therefore granted. The attorney-general of Missouri has announced that the case will be appealed, but we fail to see any reasonable chance that this law will be upheld. The other decision was given by the Supreme Court of Pennsylvania, which, on a close division—4 to 3—in effect overthrew the 2-cent passenger rate law passed by the legislature in 1907. This was an affirmation of a decision made in September, 1907, by the Common Pleas Court for the district of Philadelphia, which declared the 2-cent fare law could not be enforced against the Pennsylvania Railroad because it was confiscatory. From this last decision there is no possible appeal, and the Pennsylvania, which on October 1 reduced its rates to 2 cents a mile, in spite of the favorable decision of the lower court, is now free to make a general increase in passenger rates. The majority opinion of the Supreme Court was given by Justice Mitchell, who took occasion in the course of it to say in substance:

> The point of injustice is reached long before that of confiscation, and in putting the legal estimate of legitimate profit at 6 per cent. there are other elements which would justify much larger earnings. Injustice is done by any failure to consider these.
>
> Passenger and freight traffic should be separately considered, otherwise freight rates would be inequitable, so that passenger travel might be cheap.
>
> While the public has certain rights, which in case of conflict must prevail, yet it must not be forgotten that even so-called public service corporations are private property, organized and conducted for private corporate profit. Assuming that it fulfills its duties to the public, a corporation is entitled to a fair profit on every branch of its business just as a merchant or manufacturer is.

One of the minority opinions declared that the rate of 2 cents a mile is not unreasonable; another that the exact effect of the law cannot be determined on account of the complex nature of the railroad business, and another that the effect of the act on the gross earnings, and not alone on the earnings from passenger traffic, should have been considered. The practical application of the decision is complicated by the fact that directly it applies only to the Pennsylvania, but in effect it apparently applies to all the railroads of Pennsylvania.

COAL ROADS UNDER THE RATE LAW.

The "commodities clause" of the Rate Law makes it unlawful for a common carrier to transport in interstate commerce after May 1, 1908, any commodity except timber, "manufactured, mined or produced by it or under its authority, or which it may own in whole or in part, or in which it may have any interest direct or indirect," except for its own use. This section of the law affects mainly the anthracite coal roads and also some railroads which own bituminous coal companies. Its strict enforcement four months hence could hardly fail to cause great losses to the holders of many kinds of railroad securities, both because many railroad companies would have to sell property at a time when values are low, and because the uncertainty attending the method of separation of railroads and coal properties combined as security under the same mortgage would reduce current prices. Application of this section of the law would also upset the whole anthracite coal trade, by making illegal the present methods of marketing. It is, therefore, with a great deal of relief that the anthracite coal roads have received the following statement made on January 17 by Attorney-General Bonaparte, covering the "commodities clause":

> It is clear that this clause if valid will make it impossible for many railroads which own coal mines to transport the coal to market after the date named and it is understood that some of these railroads have been advised by their respective counsel that the above quoted provision of law is unexceptional. The Department of Justice contemplates the institution of proceedings, as soon as possible after the date named whereby a prompt determination of this question by the Supreme Court of the United States may be obtained. It is expected that the railroads concerned will cooperate with the Government to this end, and if they do so in good faith and if they in good faith and immediately obey the decision of the Supreme Court when rendered it is not the purpose of the Department of Justice to prosecute them for a failure to comply with the terms of the act pending the decision of the Supreme Court.

There are two railroads which had already made clear their position in regard to this section of the Rate Law. The Buffalo, Rochester & Pittsburgh in December, 1906, sold the Rochester & Pittsburg Coal & Iron Company, whose stock is deposited as part of the security for the railroad's general mortgage bonds of 1937, to the Mahoning Investment Company, subject, however, to the lien of this mortgage. For the \$1,000,000 stock of the coal and iron company the railroad received a little more than \$4,000,000 of the stock of the investment company, which it distributed pro rata among its stockholders. Whether or not transferring coal properties to a separate company, presumably controlled in exactly the same interest as the railroad satisfies this law, is a question. It would certainly seem that in this case the railroad still has at least an indirect interest in the company which mines the coal.

The other company which has outlined its position on this section of the law is the Delaware, Lackawanna & Western. In the annual report for the year ended December 31, 1906, President Truesdale speaks as follows in regard to this section of the Rate Law: "The avowed purpose of this law was to compel companies such as this to dispose of their coal properties, thus separating the transportation of coal from the mining and merchandizing thereof. The management is advised by its legal representatives that this company cannot be required to dispossess itself of its coal properties by the action of Congress under the guise of regulating commerce between the states, especially as by the terms of its charter—one of the early ones granted by Pennsylvania—it has the undoubted right to mine, purchase, transport and merchandize coal." This flat denial of the right of Congress to compel the disposal of their coal properties is likely to be the position taken by all those companies which have early charters granted by the state of Pennsylvania specifically giving them the right to engage in the coal business. One of the anthracite roads holds even a stronger position than this. The Delaware & Hudson, though usually spoken of as if it were the Delaware & Hudson Railroad, is the Delaware & Hudson Company, the direct successor of the Delaware & Hudson Canal Company, which was a canal and coal mining company which owned and leased railroads. However, the general question of the constitutionality of this section of the law is settled by the United States Supreme Court, the case of this road will involve special technicalities.

Besides the anthracite roads, other roads which are in one way or another interested in coal properties, are the Buffalo & Susquehanna, Pittsburgh, Shawmut & Northern; New York Central; Pennsylvania; Baltimore & Ohio, Western Maryland; Norfolk & Western; Chesapeake & Ohio; Hocking Valley; Evansville & Terre Haute; Louisville & Nashville; Missouri Pacific; St. Louis, Rocky Mountain & Pacific; Denver & Rio Grande; Union Pacific; Great Northern, and Lake Shore & Michigan Southern. These last two roads are included in the list because they own stock in subsidiary companies, which subsidiary companies own coal mining companies; the Great Northern, the Lake Superior Company; and the Lake Shore & Michigan Southern stock of the Lehigh Valley and of the Reading Company, which controls the Philadelphia & Reading Coal & Iron Company. The ownership of coal properties by the railroads ranges all the way from direct ownership of coal lands by a railroad company to ownership of a railroad company by a coal mining or by a manufacturing company like the Tennessee Coal, Iron & Railroad Company, part of whose business is mining coal. A decision on the part of the United States Supreme Court that this section of the Rate Law is constitutional will necessarily be followed by much litigation, for there are so many forms and degrees of ownership, control or indirect interest in coal properties by railroads, and *vice versa*, that a large number of individual cases will have to be decided to establish enough precedents to cover the whole ground.

RAILROAD BONDS AS FINANCIAL POINTERS.

The place of the railroad bond in this country as an index of financial conditions is becoming more and more definite. In the first place the volume of that class of security has grown to be immense even allowing for the competition of the industrial bond and, in a localized sense, of the street railway bond. The railroad bond has thus the high status derived from its relative magnitude as a vested interest. It also has the dignity of age based upon a form of property and investment which goes back for more than three-quarters of a century and, contrasted with which, almost all other classes of bonds, except public or realty securities, seem of mushroom growth. Finally it has the reputation of conservatism. To be sure it has had its periods of gloom. Railroads, like other properties, have had their receiverships, their bond foreclosures, their reorganizations; and not many years ago came that vicious form of speculative high finance when the capital stock of high class roads was translated into bonded debt and new and relatively valueless stock issued for purposes of control pure and simple. Still, allowing for all its mutations and vicissitudes, the railroad bond has generally asserted its value. The senior bonds of a strong railroad becomes the first and earliest investment of the capitalist, large or small, in his reaction from the terrors of a panic. The long "drag" of five years following our great panic in the autumn of 1873 depressed greatly railroad stocks and kept them down; but during the same time the interest return on high grade railroad bonds fell from 7 to 4 per cent. or a little more. The railroad share, even of a conservative railroad, fell; the conservative railroad bond rose.

In the present stage of recovery from the panic conditions of the closing months of 1907 the same transfer of funds, many of them lately hoarded, into high class railroad bonds is to be observed. But the situation varies much from that in 1873 and the succeeding years. There was then no great mass of "undigested" securities, many of them railroad bonds, waiting to be poured upon the market. There were practically no underwriters holding such securities in stock awaiting liquidation. There were in 1873 a considerable number of railroads caught by the panic in process of construction; but it is doubtful whether, in their total, they were more than a moderate fraction of the various forms of railroad improvements more or less tied up now and awaiting a better market for loans, and those loans, in turn, depending measurably on a recovery in railroad earnings itself based partly upon an uplift of productive industry. Finally, overhanging the situation like a summer cloud, is the coming period of maturity of the so-called "short notes" of the railroads added to the natural maturity of regular funded obligations. In round numbers about $117,000,000 of these short notes of the railroad companies mature this year; about $71,000,000 in 1909; and about $235,000,000 in 1910. To these are to be added about $215,000,000 of regular railroad bond maturities during the three years besides some $65,000,000 of equipment notes or bonds. The impressive total of the maturities of the three years is approximately $703,000,000, of which $179,000,000 mature during the year 1908. It is an imposing sum; and, as it must be liquidated mainly by railroad securities senior to stock, the railroad bond, both as a liquidating force and as an index of the situation, leaps to fresh prominence.

The pessimist, or in the vulgate of the street, the habitual "bear," naturally lays stress upon the bigness of the figures and talks in the language of despondency. But a blow runs through his major premise. He talks as though the whole of these railroad liabilities must be met with *cash*. They are in fact liabilities actually outstanding to be replaced by others without increase of the debt. Of the total maturities only about 25 per cent. fall due in the present year, and of these about 22 per cent. are old long time mortgage bonds easily refunded. It is noteworthy also that of the old railroad bonds falling due during the coming three years, out of 55 issues 32 represent old 6s and 7s sure to be refunded at a lower rate and with a considerable annual saving of interest. The reverse is true, however, of the equipment issues of the three years of which almost the whole of the $65,000,000 were marketed in low rate interest periods, very few of them as high as 5 per cent., and most of them to be refunded probably at a higher rate than they bear now. Some $22,000,000, or about one-third, fall due in the present year. Of the railroad short notes, so copiously marketed during the last year or two, $423,000,000 fall due within the three years. They are, for the most part, 5 per cents. and refunding at that rate or lower ought to be feasible—considerably lower if a mortgage bond is substituted. Of the whole $703,000,000 to be met during the three year period only a very small part is likely to call for cash and the only question in liquidation will be the market value of the refunding bond.

In this vital question of the future, the potency of refunding bonds, the year, especially considering the fact that the market has but just emerged from panic conditions, starts off very encouragingly. In the face of adverse prophecies the New York Central has refunded the $14,000,000 of Canada Southern bonds and has placed its $30,000,000 of new equipment notes. The New York, New Haven & Hartford has negotiated successfully its $39,000,000 of debentures. On the basis of present market values the index rate of the three loans is about 5 per cent., and only in one case is there high mortgage security. Three new railroad loans alone thus, in amount, represent $83,000,000, or about 71 per cent. of the whole of the $117,000,000 of short notes falling due in 1908, or about 60 per cent. if the 1908 equipment notes of the railroads are included. Taking another test one finds, since the recent recovery of the market, the high grade mortgage bond back at the 4 per cent. basis—for example West Shore 4s—total issue $50,000,000—selling at above par, or Union Pacific first mortgage 4s—total issue $100,000,000—a trifle below par. As a pointer to the future the railroad bond of the substantial and dividend paying corporations thus responds cheerfully. There are, of course, adverse contingencies. Nobody knows just what is the volume of undigested securities, some of them underwritten, waiting for a better market. Nobody can measure with exactitude the length and depth of the industrial drag; and, after the chastening experience of the last few months, every motive urges railroad corporations toward economy and conservatism. But, with that motive harvesting results, the railroad bond, so far as it is a solvent of the situation, points toward clearing weather rather than toward cloud and storm.

Train Accidents in December.[1]

Our record of train accidents occurring on the railroads of the United States in December includes 14 collisions and 10 derailments, 24 accidents in all. This record is not published in full except in the cases of the few accidents which are especially prominent—in the present instance four collisions and two derailments. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—is given at the end in the shape of a one-line item for each accident, showing date, location, class and number of deaths and injuries. The items of which details are given are indicated in the tabular statement by the use of italics. This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager.

The rear collision of passenger trains at Hanover, Md., on the 4th, killing five passengers, appears to have been due to the negligence of the engineman of the following train who had passed two automatic block signals set against him (at Sand Pit and Harwood) one and two miles west of Hanover respectively. The leading train was a local passenger just starting away from the station, and the one following was an express. The men killed were passengers. The passengers injured were mostly in the rear car of the standing train, which was wrecked.

The collision near Worcester, Mass., on the 14th, was due to the presence of freight cars on the main track in the face of an express passenger train, the men in charge of switching operations having moved these cars to the main track without proper protection. An eastbound passenger train running at full speed on a descending grade crashed into and wrecked the freight cars and its engine was overturned. This part of the line is equipped with automatic block signals but the switch at which the freight cars

[1]Abbreviations and marks used in Accident List:
rc........Rear collision.
bc........Butting collision.
xc........Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.........Broken.
d.........Defective.
dr........Defect of roadway.
eq........Defect in car or engine.
n.........Negligence.
unf.......Unforeseen obstruction.
unx.......Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman).
ms........Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.......Cars burned while running.
Pass......Passenger train.
Ft........Freight train (includes empty, engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

were thrown to the main track has no indicator by which the men in charge of the switching movements could know when a train was approaching the entrance of that block section on the main line. A flagman had been sent out by the switching crew, and, a few minutes before, he had stopped a train and the main track had been cleared for it, but it appears that his signal was not seen by the engineman of the passenger train. There was a blinding snow storm at the time. This engineman at last accounts had made no statement, being confined to the hospital. The engineman was the only person seriously injured.

The collision at Camden, N. J., on the 27th, causing the death of three passengers, occurred on a block signaled line, but appears to have happened close to the terminal, where the space interval was not enforced. A train from Pemberton ran into the rear of one from Atlantic City. The speed was not high but it appears that the tender of the engine of the Pemberton train penetrated the first passenger car behind it and that the fatalities occurred in this car. There was a dense fog at the time of the accident. The newspapers say that since the collision an order has been issued to enforce the block system on this part of the line.

The collision near Lenox, Mich., on the 27th, also occurred in a dense fog. The freight train, with two engines, was standing on a side track and it appears that the switch connecting with the main track had not been set right. The five men killed were all trainmen; two enginemen, two firemen and a brakeman.

The derailment at Shenandoah Junction, W. Va., was caused by a rear collision of freight trains. This collision did not do great damage but the wreck fouled the adjacent track, on which the passenger train was running. The conductor and flagman of the freight train which was run into are held blameworthy for not having properly signaled the following train. Testimony was given before the coroner that the conductor was asleep in his caboose.

The derailment at Marshall, Colo., on the 24th, was of a kind which has been heard of before in Colorado but rarely in other states. Two passenger cars and a baggage car were thrown from the track and lodged some distance away and the express car was overturned. The engine remained on the track. In former years the derailment of trains by high wind was reported nearly or quite every winter in Colorado, but the trains which suffered were made up of narrow-gage cars and engines, which were both light and top heavy; but the accident now reported occurred on a line which is recorded in the *Official Guide* as standard gage.

TRAIN ACCIDENTS IN THE UNITED STATES IN DECEMBER, 1907.

Collisions.

Date.	Road	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd.
2.	*Baltimore & Ohio*	Shenandoah Jc.	rc.	Ft. & Ft.	0	0
3.	Tol., St. Louis & W.	Kokomo.	bc.	P. & Ft.	0	5
†4.	*Baltimore & Ohio*	Hanover.	rc.	P. & P.	5	25
5.	Baltimore & Ohio	Adams.	bc.	Ft. & Ft.	2	1
8.	Lehigh Valley	Parryville.	rc.	Ft. & Ft.	1	2
10.	Chic. & North Westn.	Beloit.	bc.	P. & Ft.	0	2
14.	*Boston & Albany*	Worcester.	xc.	P. & Ft.	0	3
15.	Union Pacific	Green River.	xc.	P. & Ft.	1	0
20.	Louisville & Nashville	Calera.	bc.	P. & Ft.	0	4
25.	Baltimore & Ohio	Chicago Junc.	xc.	P. & Ft.	1	0
26.	Lake Sh. & Mich. S.	Franklin.	bc.	P. & Ft.	1	4
†*27.	*W. Jersey & S.*	Camden.	rc.	P. & P.	3	17
27.	*Grand Trunk*	Lenox.	bc.	P. & Ft.	5	1
29.	Southern Pacific	Franklin, La.	xc.	Ft. & Ft.	2	4

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	No. persons reported Inj'd.
2.	Southern	Mobile.	Pass.	malice.	2	3
†2.	*Baltimore & Ohio*	Shenandoah Jc.	Pass.	acc. obst.	3	12
5.	Pennsylvania	Pittsburgh.	Pass.	ms.	0	13
6.	Central, Georgia	Utopia.	Pass.	unx.	0	1
8.	Louisville & Nashville	Montgomery.	Pass.	ms.	1	0
10.	P., C., C. & St. L.	Frazeysburg.	Pass.	unx.	0	3
18.	Union Pacific	Concordia.	Pass.	b. rail.	1	2
22.	Southern	Tallapoosa.	Pass.	ms.	1	1
22.	Pennsylvania	Bolivar.	Pass.	acc. obst.	0	1
†24.	*Colorado & Southern*	Marshall.	Pass.	wind.	1	6

Of the eight street car accidents of greater or less importance reported in the newspapers in December, none is charged with having caused any fatal injury.

CONTRIBUTIONS

The Griffin Double-Tread Car Wheel.

Buffalo, N. Y., Dec. [illegible], 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

On account of absence from home I saw only recently the description of the double tread car wheel, published in your issue of November 8. There are some points in the article that should be corrected. The patent was not issued to the New York Car Wheel Company. It is the intention to arrange for the manufacture of this type of wheel, under proper conditions, with any car wheel makers throughout the country who may wish to make such arrangements, in order that the wheels may be obtained at any desired point or in any desired quantity. I would also like to correct the inference, which might be drawn from your description, that the inner tread would not be subject to brake heating. The friction from brakes would heat the inner tread the same as it does the outer one. The important point is that the heating of the inner tread would not set up dangerous conditions, or interfere with the wearing capacity of the wheel in the manner that such conditions now affect the outer tread. In order to have a proper understanding of the whole matter, I beg to give herewith the reasons that lead me to believe that this new type of wheel will remedy the present unsatisfactory conditions of wheel service.

In order to produce a car wheel that will successfully meet

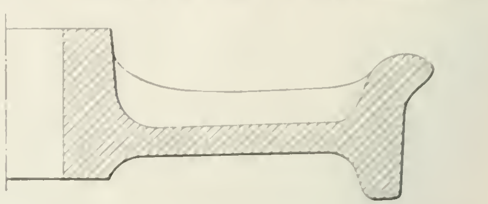


Fig. 1.

the severe requirements of heavy car and locomotive service, there must be some change or improvement in the present type of wheel. Under 50-ton cars and heavy locomotives the wheel load has nearly doubled; in passenger car service, the increased load and speed develop brake service conditions that are proving very disastrous to every type of wheel used, whether steel or iron. At present all of these strains fall on the single outer tread, and it is manifest that if they can be divided so that an outer tread is subjected to rail wear only, while the inner tread takes the strains arising from brake service, the life of wheels will be increased, and the dangers involved in having all strains imposed on the single outer tread will be averted.

During the past 50 years the standard freight car wheel used in America has been the chilled wheel. The manufacture of such wheels began in a limited way in the United States about 60 years ago and the section of wheel first used was known as "single plate" (see Fig. 1). When the weight of cars and locomotives began to increase, in the early sixties, it was found that the single plate wheel would not stand the expansion strains caused by the increased brake friction necessitated by heavier loads and higher speed. Cracks running through the single plate in line with the tread and extending afterwards to the tread became so prevalent,

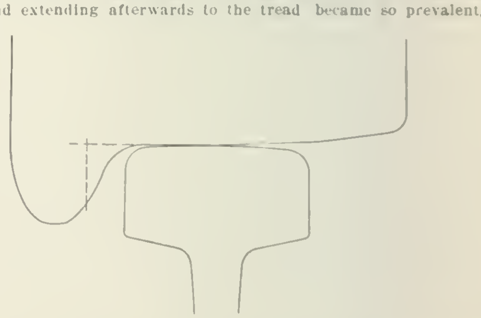


Fig. 2.

and broken wheels became so numerous, that it was necessary to find some means of overcoming the trouble. The double plate wheel was invented to meet the need.

One of the original types of this section, known as the Washburn double plate wheel, soon became the standard section for American railroads. This type of double plate wheel, made heavier from time to time to meet the increasing requirements of service, has remained ever since the standard section. Within the past few years, the rapid introduction of heavy equipment has produced two important results in the life of car wheels: First, more rapid wear on tread and flange; second, disintegration and burning of the metal in the wearing face of tread and flange by reason of increased brake friction.

Fig. 2 shows a section (half size) of the M. C. B. standard tread and flange, and an A. S. C. E. 85-lb. rail section. The vertical dotted line shows the limit of flange wear allowed under M. C. B. rules. When the limit is reached, the wheel must be removed from service. The difference in profile between throat of wheel and corner of rail against which the flange must bear may be noted, and also the actual section of metal that can be worn from the flange at throat of wheel before the latter is condemned as unfit for service. There can be no question but that the factors of wear and strain under 50-ton cars and heavy locomotives have been very heavily increased, and that the life of wheels will be correspondingly shortened.

The causes for which wheels are removed from service under heavy equipment show a marked increase in certain directions, namely: cracks in the face of tread and in the throat of wheel at flange extending through the chilled surface, which arise from the heat caused by heavier braking friction; shelling, or crumbling, out of the metal in the face of tread when the life of the metal has been destroyed by constant heating from increased braking friction; and thin flanges, caused by more rapid wear due to heavier service. It may be seen that these three causes of wheel removals are connected entirely with the tread and flange, and that they arise principally from the results of brake service. It is also evident that proper control of the heavier equipment by means of brakes must produce greater heating on the tread and flange of wheel, and that therefore the life of wheels will be shortened as the use of the heavier equipment becomes more general.

Not only is the question of increased cost of wheel service due to the above conditions a serious matter, involving as it does the removal of the cars from service while wheel repairs are being made, but the factor of increased danger from broken wheels and broken flanges is one that must be provided for in some way. The breakage of wheel flanges due to the formation of cracks as above described is rapidly increasing, and very few wheels removed from heavy equipment fail to show groups of such cracks or long cracks made up of such groups when flanges are broken off with a sledge to determine if such cracks exist. It is not an exaggeration to state that nearly all wheels under heavy equipment will develop such defects sooner or later. Some remedy for these conditions must be found. The use of steel wheels has been proposed, but it remains yet to be seen to what extent steel wheels, or even steel-tired wheels, will be free from like conditions after being subjected for a similar length of time to the heavier car and locomotive service. The burning of the metal due to heavy brake friction produces effects as disastrous on the steel wheel as on the chilled wheel.

The fact that the chilled wheel has been, practically, the standard wheel used under all freight equipment in America during the past 50 years, the low first cost and high scrap value it possesses, and the readiness with which it can be obtained from manufacturers in all parts of the country, certainly make it unique in its position among the important items of railroad equipment. If some way out of the difficulties created by the advent of the 50-ton car and the great increase in weight in all classes of railroad equipment can be found, it will be a very important advance in overcoming one of the great difficulties of present conditions of service. The rail problem is familiar to almost every one; the wheel problem is familiar enough to railroad officials and wheel manufacturers who appreciate its gravity, but it has not yet been publicly discussed as extensively as the rail question.

The standard section of 33-in. chilled wheel weighing 700 lbs., as now used by nearly all railroads under 50-ton cars, seems to possess ample strength in the body for the service required. The entire difficulty seems to lie in the tread and flange. Following the line of development from the single to the double plate wheel, it is now proposed to use a double tread wheel to avoid the increased failures caused by present conditions. Fig. 3 shows the Griffin double tread wheel, developed to this end. The fundamental purpose in the double plate wheel was to replace the straight line and section of the single plate wheel by the curved double plates connected with the hub and the curved single plate connected with the tread, the latter being supported by the curved brackets running from the double plates to the tread. The idea was that when the tread of wheel was heated and expanded by the application of brakes, the curvature of the double and single plates and brackets supporting the tread would permit the expansion of the wheel as a whole without the cracking or fracture which occurred in the single plate wheel. This was exactly what took place, and not only was this valuable object accomplished by the use of the double plate wheel, but the support of the load on wheel tread was distributed over a greater length of wheel seat in a proper manner by means of the double plate wheel section. It may be readily seen that if this type of wheel has carried the load and stood the effects of brake heating all upon the single tread, that by removing the effects of brake heating and wear from brake applications from the outer single tread, the life of the latter and of the wheel as a whole would be very much increased. Efforts have been made to find some means of accomplishing this, and with light equipment braking discs on the wheel, or separate braking discs on the axle have been tried. No satisfactory development along these lines, however, has yet been worked out, and in the case of 50-ton cars and heavy locomotives, the whole effect of brake friction, expansion from brake heating, and all other results of brake service fall upon the single outer tread.

In the case of the double tread wheel, it may be seen that the extra tread can be added to the present section of wheel so that the inner tread can meet all the conditions of brake service precisely as well as the outer tread now meets them, and with the additional advantage that the heating of the inner tread will not lead to the disastrous results now caused by the heating of the outer tread, for the reason that the inner tread never comes in contact with the rail. Brake friction may heat the inner tread, but this will not in any way impair its efficiency for continuous braking service, even if the small cracks referred to heretofore are produced. While it is proposed to add the inner tread to present wheel patterns in order that the manufacture of wheels according to the present standards will not be interfered with, it is also proposed on new or even on present equipment to increase the length of the wheel hub by $1\frac{1}{2}$ or 2 in., in order to obtain an additional length of wheel seat, which experienced railroad officials state is needed under present conditions of service with heavy equipment. The diameter of axle at wheel seat has been increased to 7 in., which is the full length of the wheel hub, and it is manifest that the resistance of the wheel to displacement on the axle is less than it was when the wheel seat was smaller in proportion to its length. The section of proposed double tread wheel with longer hub is the one shown in Fig. 3, and the section of double tread wheel with double tread as adapted to present section and length of hub is shown in Fig. 4. These drawings show a flange on the inner tread to keep the brake shoe from touching the other flange; but if desired the wheel can be used without the second flange.

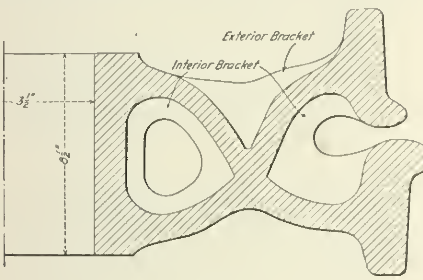


Fig. 3.

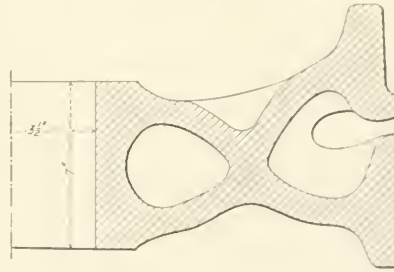


Fig. 4.

It will be necessary to move the brake-head about 5 or 6 in. on each end closer to center, to provide for proper contact with the inner tread. To properly clear all guard rails, switches and special work, the inner tread should be about 3 in. less in diameter than the outer tread, or a diameter of 30 in. as compared with the outer diameter of 33 in. Shortening the distance between points of strain on the brake-beam as stated will decrease the tendency to deflect under heavy pressure, and in case breakage of brake-head or shoe occurs the broken parts will fall between the tracks and not upon them or on the special work.

As a matter of foundry practice the manufacture of the double tread wheel is little more difficult than the manufacture of the present single tread wheel, the division between the outer treads being made with a suitable pan core in the same manner that the division of the double plates in the present type of wheel is now made. It is not necessary to go more fully into this matter at present. It can be explained to any one interested.

The additional weight of the inner tread would depend on the thickness of metal used. In the case of a 700-lb. standard wheel it is probable that the inner tread would add about 200 lbs. to the weight of wheel. As the metal on the inner tread would have the same scrap value as the rest of the wheel, the additional cost on account of extra weight can be determined.

It is proposed to use the double tread wheel for centers for steel-tired wheels as well as for the chilled wheels. As the inner tread will be chilled precisely in the same manner as the outer tread, it will provide the same resistance to wear of brake-shoes as the outer tread now does, and considering the serious damage to steel tires caused by brake application, it is manifest that to move this service to the inner tread would be a very great advantage. As cast-iron centers are now used generally in steel-tired wheels, it is not necessary to dwell further upon their suitability for such use.

If the double tread wheel will prove to be the means of regaining the ground that has been lost in the length of service and other results obtained from the use of the chilled wheel, it can hardly be said that the extra cost of additional metal should prevent its use. The question of safety after all stands pre-eminent. When any important article of railroad equipment becomes unsafe for use through any change in service conditions, it is manifest that the continued use of such material becomes more than a question of economy, it becomes one of responsibility.

The double tread wheel may, or may not, prove a relief from present conditions of wheel service. In the opinion of the writer, based on many years of practical experience and investigation of such questions, it does provide the means of overcoming conditions for which some remedy must be found. This opinion is also strongly expressed by some very competent practical railroad officials to whom the matter has been presented.

F. H. GRIFFIN.

Seaboard Air Line.

Norfolk, Va., Jan. 15, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to your review of the annual report of the Seaboard Air Line in your issue of January 10, I beg to call your attention to one or two inaccuracies therein.

In the third paragraph you say: "In 1906 Alfred Walter succeeded James M. Barr, and would perhaps have succeeded in bringing about the regeneration of the property as he had earlier with brilliant success of the Lehigh Valley, but before his first year of service was over his health failed rapidly, and he died on February 27 1907." When Mr. Walter assumed the presidency of the Seaboard, May 1, 1906, that property required no "regeneration"—this had already been effected; its operating staff was thoroughly efficient; the relations between the official staff and all employees were most cordial; the *esprit de corps* of the service was high; and the character of service rendered the public was fully equal to that of any road in the South Atlantic states.

When I took the management of this road as Vice-President, May 1, 1901, I found its transportation service inefficient, and its track generally in low physical condition. This was especially true of the lines in Florida, whose condition was the worst I ever saw in an experience of thirty years in railroad work. The transportation service was quickly brought to an efficient condition, and the track was improved gradually until its condition equaled that of any road in the same section. On account of light density of traffic, and meeting the cost of the improvements out of earnings, it was necessary to spread this work over several years; as the business handled increased, the expenditures were increased. The disability of the road was confined to its grade line, its inadequate facilities, and its decrepit freight equipment; and the results secured from its operation were as good as could be obtained thereunder. These things are matters of common knowledge throughout this section.

You will see from the statement enclosed that during the five years I was in charge of the Seaboard, there was no increase in the cost of conducting transportation per unit of service performed, notwithstanding the increased cost of wages and materials used in operation and maintenance, and that the rate received per passenger and per ton mile for the year ended June 30, 1907, was as high as that received therefor during a part of the period named.

When Mr. Walter took hold of the Seaboard he was a sick man, and in consequence did not possess the physical and mental vigor necessary to successfully cope with the conditions confronting him, and the resulting worry unquestionably hastened his death. At the time Mr. Garrett was placed in charge of the operation of the Seaboard by Mr. Walter, as Vice-President, the ratio of expenses to earnings was above 75 per cent.

Since May 1, 1906, the efficiency of the service secured from its employees by the Seaboard has declined, as the enclosed figures show, due in part to the many changes in its official staff, but the primary cause of its inability to earn interest charges was the failure of its owners to provide money to remove its disabilities, and thereby enable it to handle its business economically and efficiently.

I am writing you in this connection because I feel the reference to me, in your comments above quoted, is unfair. I have been a subscriber to and reader of your journal for many years and this is the first time I have seen any attempt made therein to place responsibility where it did not belong.

J. M. BARR.

[The following is the statement enclosed by Mr. Barr.—EDITOR.]

SEVEN YEARS' RESULTS ON THE SEABOARD AIR LINE RAILWAY

	Year ended June 30						
	1901	1902	1903	1904	1905	1906	1907
Average miles operated	2,592	2,601	2,607	2,611	2,611	2,611	2,611
Gross earnings	$10,426,280	$11,068,478	$12,156,928	$12,750,271	$13,619,271	$15,116,948	$16,427,943
Operating expenses	7,401,421	7,329,800	8,441,096	9,113,217	9,092,36.	10,512,461	12,948,042
Earnings over operating expenses	3,024,859	3,738,679	3,715,832	3,637,054	4,526,911	4,603,487	3,479,901
Operating ratio, excluding taxes, per cent	70.98	66.22	69.43	71.47	66.76	69.55	78.82
Operating ratio, including taxes, per cent	73.88	69.66	73.00	75.66	70.70	72.97	81.97
Surplus	$252,676	$765,832	$750,132	$294,295	$1,084,062	$992,121	*$458,[illegible]
Capital expenditures	.....			650,537	181,784	925,564	1,487,293
Gross earnings per mile of road	$4,022	$4,251	$4,663	4,883	5,216	5,790	6,292
Net earnings per mile of road	1,167	1,436	1,425	1,393	1,734	1,763	1,333
Gross earnings per train mile	1,394	1,430	1,521	1,558	1,640	1,695	1,780
Net earnings per train mile	404	483	465	447	545	516	.379
Cost of maintenance of way, per mile of road	$539	$493	$569	$613	$694	$715	$846
Per cent. cond. transportation expenses to gross earnings	41.87	40.79	41.25	40.31	36.92	40.72	47.65
Rate received per ton per mile in cents	1.188	1.068	1.114	1.177	1.180	1.121	1.118
Rate received per passenger per mile in cents	2.480	2.357	2.286	2.342	2.327	2.382	2.362

*Deficit.

Pennsylvania Two Cent Fare Law Void.

The Supreme Court of Pennsylvania has decided by a vote of 4 to 3 that the two-cent passenger rate law passed by the Legislature of 1907 is invalid so far as the Pennsylvania Railroad is concerned.

The decision applies specifically to the Pennsylvania Railroad because its appeal was the only case before the court. Chief Justice Mitchell wrote the opinion of the majority, Justices Fell, Elkin and Brown concurring. Separate dissenting opinions were written by Justices Mestrezat, Stewart and Potter.

The majority opinion says:

"The exact question to be determined on this appeal is not the general constitutionality of the act of 1907, but the right to enforce it against the appellee. The same clause in the Constitution that authorized its passage provides that such legislation shall do no injustice to the corporators of any company whose charter is thereby altered. Would the provisions of the act of 1907 do injustice to the corporators or the appellee?"

Chief Justice Mitchell finds that it would, and continues:

"Corporations are private property, organized for private profit, and unless necessary for the fulfilment of their corporate duties they should not be required to do any part of their business in an unbusinesslike way with a resulting loss. If part is unprofitable it is neither good business nor justice to make it more so because the loss can be offset by profit on the rest. Freight must not be made dear that travel may be cheap. The corporation is entitled to make a fair profit on every branch of its business, subject to the limitation that its corporate duties must be performed, even though at a loss."

Justice Mestrezat in his dissenting opinion declares that the majority conceded the right of legislative supervision of rates of common carriers, but declined to pass upon the immunity of the plaintiff company from such supervision. The reason given for this neglect, he says, is that counsel did not argue that question. He says that in determining whether a rate for transportation is reasonable or not all the revenues should be considered, including all the revenues from freight, expressage and all other sources. It is impossible to accurately determine what revenue the company receives from each of the several sources. It is clear that under the evidence, considering only the revenue from the passenger traffic, that the rate is not unreasonable, much less confiscatory.

Justice Stewart in the second dissenting opinion declared that the two-cent rate act violated no contract between the state and the railroad, and Justice Potter says that the evidence has not shown that a flat rate of two cents would prevent a fair return upon the capital invested by the railroad. Justice Potter agrees with Justice Mestrezat that the company's revenues from all sources should have been included when considering the question of reasonableness of the rate. (The lower court had decided that the reduced rate would not produce a fair interest on the capital invested by the Pennsylvania in passenger facilities.)

There is a report that the road will put into effect the old rate, but no definite announcement has been given out.

Attorney General Todd, who made the principal argument in support of the act, says that the matter is ended. No appeal can be taken to the United States Supreme Court. Mr. Todd said further: "The court has merely affirmed the judgment of the lower court in granting an injunction against the enforcement of the law against the Pennsylvania Railroad. It refused to pass on the question of the constitutionality of the law. Two points were raised by the railroad: The first that, under its contract rights, the legislature could not compel it to carry passengers for less than 3 and 3½ cents a mile, the amount specified in its charter; the second point was that it could not be compelled to carry passengers for so low a price, which, it contended, would mean a loss. The court refused to decide the question of contract right, but passed upon the other question merely; so that the law remains in force against all other railroads in the state."

The two-cent fare law was enacted by the last legislature, the bill passing both houses by a practically unanimous vote. The railroads fought the bill vigorously, and after it became a law the Pennsylvania Railroad instituted suit in the Common Pleas Court of Philadelphia restraining the County of Philadelphia from enforcing the law. The court sustained the company's contention. The County of Philadelphia then took the case to the State Supreme Court. Other railroads brought similar action in several counties of the State.

The Trials of a Master Mechanic.*

The problem of engine failures to all of us is synonymous with, "please explain," "can you tell us why," etc., and all the attending evils—briefly, the handling of an amount of correspondence which would be staggering to a layman. It requires a cool, well-balanced head, either to interrogate the engineer or to subsequently present the explanation on an acceptable basis to the superintendent of motive power, who as a rule is equally well-versed, if not sharper, than yourself. Some of these things are knotty in the extreme. For instance, two minutes are lost on a certain important run, account of low steam: should we say it is "up to the fireman," they would probably tell us to take him off, or question our judgment in using an incompetent man; if we state "blower-pipe tipped over," or "exhaust base leaking," we are called upon to explain why we despatched the engine in that condition; if we claim that the engineer is incompetent, or did not take proper advantage of his opportunities, and discipline him in accordance with our ideas concerning the gravity of the offense, he will point to his 20 or 25 years' successful record, and no doubt send his committee after us; should we on the other hand fall back on the time-honored and time-worn "bad coal," the superintendent of motive power, if he is on to his job, and he generally is, will likely come back, asking us to state definitely wherein the coal is bad, in other words how much slate, sulphur, bone, ash and other inert substances figure in its composition.

Explanations of engine failures truly place a man between Scylla and Charybdis, because the middle ground is restricted to a degree, and once or twice worked over there is no more to it. Some of the explanations would make a dead man turn over in his grave, to wit: "This failure was due to an old concealed defect, which could not be detected in an ordinary roundhouse inspection"; another, "Owing to a high northwest wind which prevailed while the engine was being sanded some particles were blown into the truck box, resulting in delay of ten minutes from box heating, subject of your letter such a date"; and still another, "Pipe to auxiliary reservoir, engine 2,397, failed, causing delay of 27 minutes. This failure was due to pipe being short-threaded, and was a builder's defect of a concealed nature. This part has never been removed since engine was received here."

A great many of these explanations are soundly based on fact, but many are not so. To handle the matter intelligently an observant man will make each case an object lesson, and will insure, so far as his facilities will permit, against its recurrence. Sometimes letters come from up the line stating that "bad coal" will no longer be accepted as an excuse, but this does not alter the fact that very often the coal is bad, in the broadest acceptance of the term, and the best thing to do then is to read up thoroughly on the subject and try to prove it—if you can.

Having to do with the coal problem, one of a master mechanic's trials, and certainly not the least, is for the rumor to go broadcast over the division that the fuel is not up to the standard; and it requires many days, if not weeks, to swing the firemen back into line. Some of my most exacting days have been spent in missionary work among the latter, preaching always from one text, "Fine coal does not necessarily mean bad coal." Logical and scientific arguments, coupled with practical demonstration, sometimes turn the trick, but a number always remain outside the fold.

Some engineers are prone to resent any questions regarding an engine failure, and patience and tact are both requisites to secure the facts "Why, that was only a minute," some of them will say, and they don't seem to grasp the idea that just as long a letter is required to explain one minute as 20. It is only fair to add, however, that to a man they fight hard to keep a delay off the run slip, and this is all the more commendable in view of the fact that it is exercised irrespective of any feeling which they may have against the master mechanic or the shop. I cannot recall a case in my entire experience where a delay was wilfully brought about.

Under a divisional organization the superintendent is practically general manager in his own territory, and the master mechanic will be sorely tried if he fails to gain his good opinion on the very start. Primarily the superintendent wants his trains to run on time, and, just as important, he wants power to move them when a movement is necessary. Thus is brought about another complex situation with which many of us have contended. A man could never be placed more curiously between two fires than in trying to please both the superintendent and the motive power department, when the freight movement is heavy. The natural inclination of the master mechanic is to keep peace at home, and to this end he turns the power as fast as possible. If it runs down, he will likely fall into disrepute with the general offices; while on the other hand if he holds the engines in and painstakingly and thoroughly does all the reported work, a lament will go up from his own people in regard to slow movements from the roundhouse. This situation requires the middle ground again, and all the common sense, judgment and diplomacy you can ram into it.

Engineers with an imperfect understanding of what is meant by a divisional organization are inclined to criticise the authority of the superintendent to assign the power, claiming that this belongs properly to the master mechanic. They also blame the master mechanic for not taking the business in his own hands. In my own case I was very fortunate in having a superintendent who simply insisted on the best possible train service, and was more interested in the results than in the means employed to reach them. To digress a little, this man truly had the so-called knack of handling men, and certainly understood the true meaning of a divisional organization. We all knew, however, that he meant every word he said, and we were very anxious to please him, as he did not consume time in exploiting trivialities which might be much better employed at something else. I can't exactly say why suiting the superintendent should be thought a trial. I have found that if a man will make the honest effort to do all that his resources will permit, the superintendent will come to his aid more frequently than he will be censured.

The question of providing for material is probably as vexatious, if not more so, than the engine failures. There is certainly no greater trial for any man's patience than to have a bunch of orders returned to you every day, marked "not in stock." Always it is something of which you are in the greatest need. In particular, the locomotive equipment is a serious problem. I venture to say that with possibly two or three exceptions this matter of keeping supplies on locomotives is nothing more than a bluff or a farce.

This situation is extremely embarrassing to a master mechanic, and too often a temporary remedy is sought in robbing one engine for another; and I may as well say now, that this thing once started, it never stops. I have known an engine to be laid in about two weeks waiting for some minor casting, and to be so stripped in that time, owing to storeroom shortage, that scarcely more than the boiler and wheels remained.

The extremes to which a man may be driven would scarcely be credited. I worked for one road some years ago which possessed more than its share of able-bodied requisition slashers. It was not out of the accepted order of affairs to see an engine go out on an important passenger run with a lantern stuck up in the headlight case in lieu of an interior When an engine would come on the ash pit a gang of men would be waiting to remove the grease-cup plugs, coupler knuckles, headlight reflector, and occasionally the air hose, with which to get something else into service. Even the fire hooks and shovels, especially the latter, ran first in, first out, and when they began chain-ganging the tanks and reverse lever latches, I left for a place where the pay was less but things were not quite so strenuous. This was the only instance in my career when I voluntarily threw up the sponge. This same road, by the way, also ran out of nuts. They had plenty, of course, 2½ and 3 in., which would have filled the bill all right in some marine engine works, but none of the common sizes, seven-eighths or inch. In consequence a machinist at 30c. an hour would spend half a day rooting in the scrap pile, and the other half tapping the few nuts he was lucky enough to find. The entire situation was distressing in the extreme.

From my experience all roads are short in locomotive equipment. The majority have a system of tool inspection and accounting beyond criticism, but it is an almost impossible task to live up to the requirements. The situation may be held within reasonable bounds when the engines are assigned to regular crews, but it is practically hopeless in the pool. The engineers do not stop short of the master mechanic in filing complaints along this particular line: "Mr. So-and-so I have a hammer and a broken chisel on my engine, and no monkey wrench. I will go out if you say so, but I will not be responsible if I have to disconnect." What are you going to do in that case? Time may be pressing: perhaps he should then be on his train. You try the storehouse, and they have

*From a paper read before the New England Railroad Club by R. H Rogers.

no monkey wrenches. In this last extremity, and to prevent a terminal delay, you order one off another engine, and away goes your tool system.

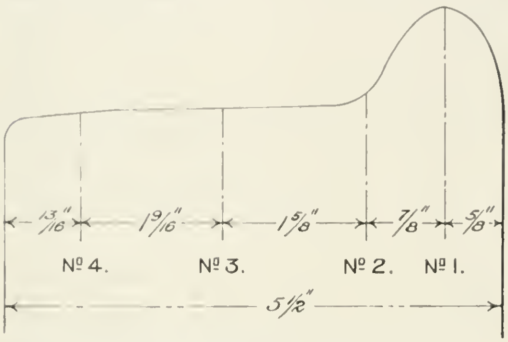
I do not mean to suggest a remedy for this condition, indeed I am not qualified to do so, but take it all in all, it is a menace to the peace of any master mechanic. Although I am naturally of a stoical and rather optimistic temperament, it has cost me many anxious hours.

Microphotographs of Steel Wheels and Tires.*

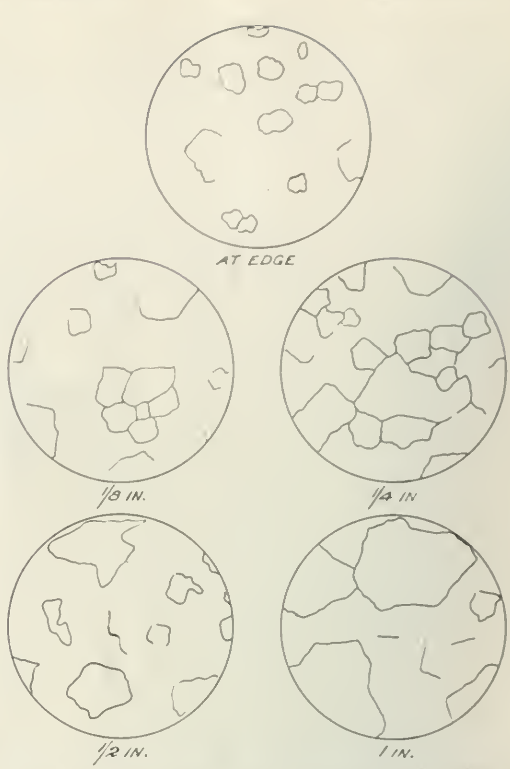
BY GEO. L. FOWLER.

(Reprinted from volume of reports made to the Schoen Steel Wheel Co.)

The physical properties of the steel in these wheels and tires having been determined, an examination with the microscope was made of samples from each. In the preparation of the specimens for this work strips were cut from each wheel and tire in accordance with the lines shown on the diagram. The numbers 1, 2, 3 and 4 are for the identification of the strips and are used in connection with the photographs, all of which were made with a magnification of 88 diameters.



Section of Tire, Showing Location of Microphotographs.



*Interpretation of Grain Structure in Tire A at Varying Distances Below Surface of Tread.

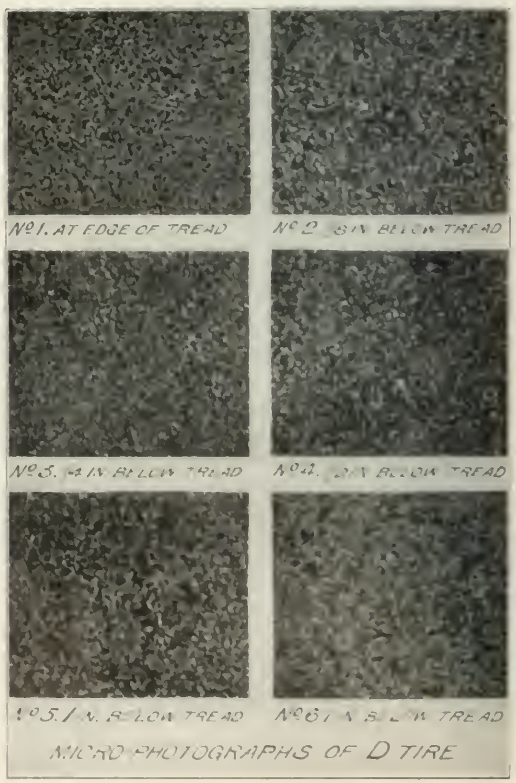
Referring first to the microphotographs of the D tire, Nos. 1 to 6. Nos. 1 to 5 were taken in strip No. 4, at the tread and at 1/8 in., 1/4 in., 1/2 in. and 1 in. below the tread, respectively, and No. 6 at 1 in., below the tread in strip No. 3. These photographs show an exceedingly fine granular structure, indicating careful heat treatment, a low average percentage of carbon and an abundance of ferrite. The structure becomes somewhat coarser as the metal is penetrated and the normal structure is reached at a depth of about 1 in. It will also be seen that there is a slight difference between the structures of the metal as illustrated by the two photographs Nos. 5 and 6 which were taken at a depth of 1 in. below the tread in strips 1 and 3 respectively. No. 5 is the finer, showing that the metal received more work at that point than it did deeper in on strip No. 3. This D tire had the finest grain and the most uniform structure of the samples examined. On the other hand, the photographs corroborate the chemical analysis of low carbon content, possibly down to 0.50 per cent. as indicated by the proportion of ferrite (white) and pearlite (black).

Next in order of fineness of grain comes the C, B and A tires respectively. Here again the relative amounts of ferrite and pearlite give an approximate indication of the amount of contained carbon from which it would appear that the B and C tires would not run over 0.60 to 0.65 per cent. while the A may rise to 0.70 per cent.

The material of the B tire shows a practically uniform texture of grain throughout its whole depth, with no decarbonization at the tread due to heat treatment, although this is undoubtedly due to the tire having been turned before being examined.

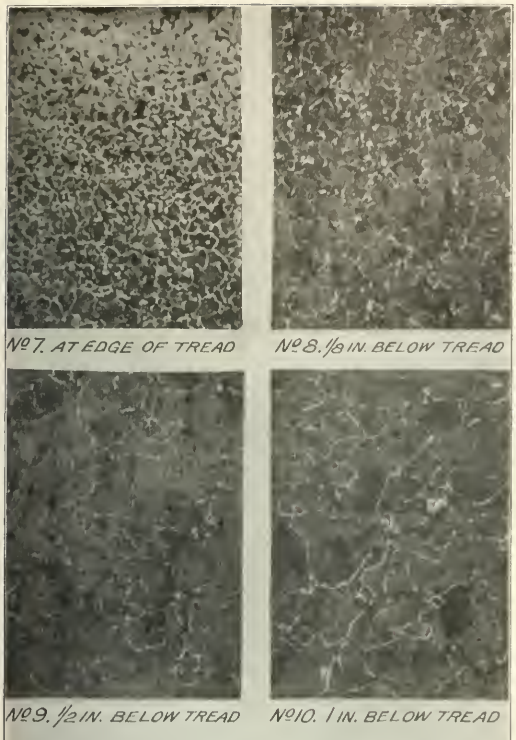
In the C tire, which was new, it will be seen that the outer layer of the material next to the tread, as indicated by the photograph No. 7, was decarbonized by the action of the heat treatment to which it was subjected. The presence of ferrite is very marked all the way across the tread, but below the surface, as indicated by the photographs Nos. 8, 9 and 10, which were taken at depths of 1/8 in., 1/2 in. and 1 in. below the tread respectively, the grain assumes the normal condition for the steel at its finishing temperature, although it is somewhat finer at the edge strips Nos. 1 and 4 than in the center strips Nos. 2 and 3, indicating failure of the work to penetrate the center.

The A tire has such a high carbon content that the absence of excess ferrite causes the grain to become obscure. It was possible to bring the formation out in part only by oblique illumination. When viewed under the microscope with the light adjusted to the best advantage a decided coarsening of the grain is noted at suc-

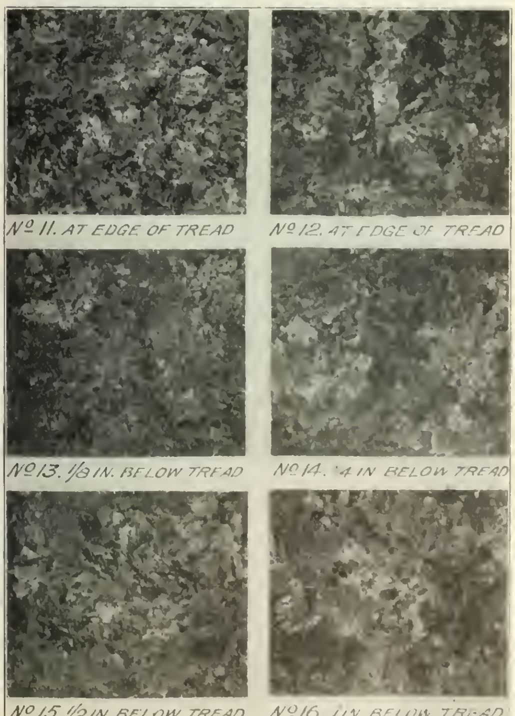


MICRO PHOTOGRAPHS OF D TIRE

*Copyrighted by the Schoen Steel Wheel Co. and published by special permission.



MICRO-PHOTOGRAPHS OF C TIRE

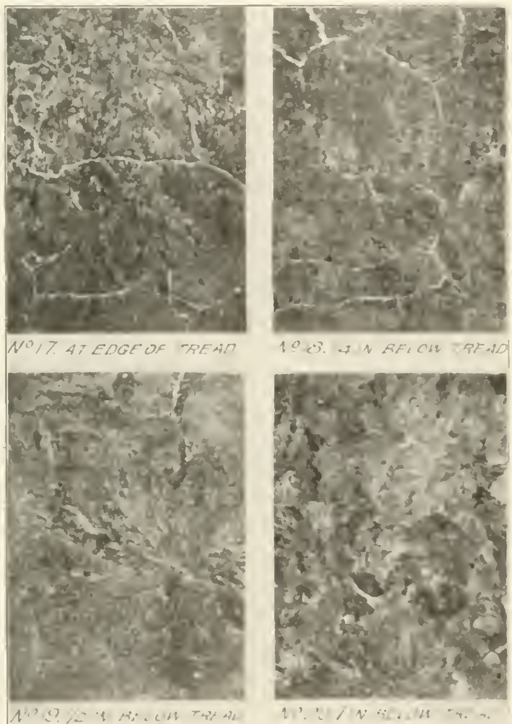


MICRO-PHOTOGRAPHS OF A TIRE

cessive points below the tread. For example, at the surface the grains are apparently about the same size as those immediately below the decarbonized shell of the tread in the C tire, but the grain coarsens rapidly and at a depth of 1 in. it is somewhat coarser than that of the C tire. The structure is interpreted from the microphotographs in the accompanying diagram made at the same magnification.

The E wheel has an exceedingly coarse structure with traces throughout of inequality of carbon content and disappearance of the grain. This is especially noticeable in photographs Nos. 19 and 20 and appears in the others to a greater or less extent, showing an unevenness of structure that is suggestive of cast steel. This is discussed elsewhere in connection with a shelled-out wheel of the same make. The penetration of work was apparently very slight as is shown by the large size of the grains in No. 17, taken at the surface of the tread, and the increasing size of structure as shown in Nos. 18, 19 and 20 taken at depths of 1/4 in., 1/2 in. and 1 in. respectively.

The F wheel has a coarser grain than the A, B or C tire and is slightly coarser than that of the D tire. The carbon content appears to be about the same as that of the C tire or somewhat above

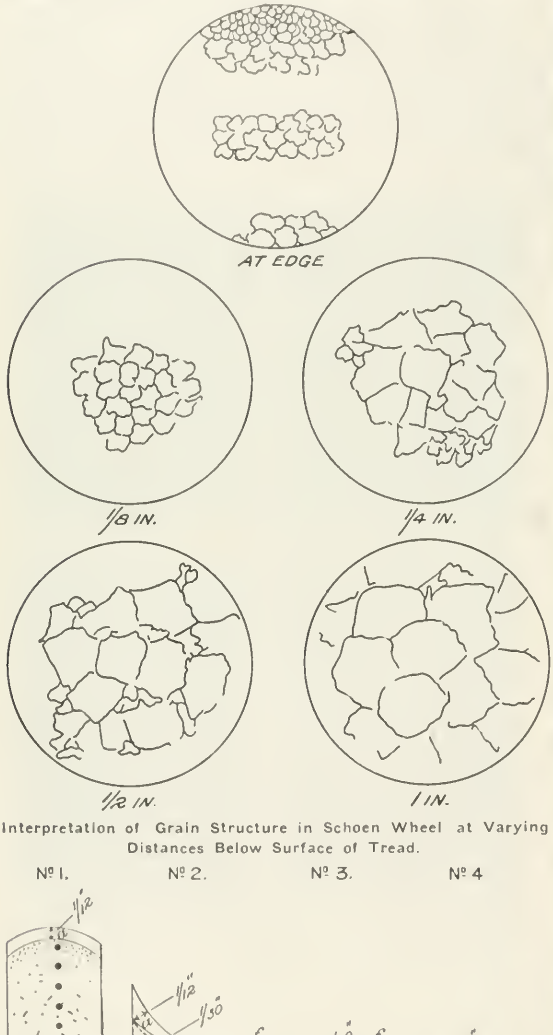


MICRO PHOTOGRAPHS OF E WHEEL

0.60, and this is checked by the chemical analysis. The surface decarbonization which is so marked in the case of the C tire appears in this one also, as indicated by the increase of the amount of ferrite accompanied by softening of the surface. The large size of the grain in this wheel, as illustrated by photographs Nos. 21 to 26, is caused by the peculiar heat treatment to which this wheel was subjected, as there is no work put upon it after the final heating. This also explains why there is comparatively little enlargement of the grain going down from the surface of the tread. The photograph No. 21 was taken at the surface of the tread and the others followed at depths of 1/8 in., 1/2 in., 1 in., 2 1/8 in. and 2 3/8 in. respectively.

The B tire is typical of the others and needs only a word of explanation of the microphotographs Nos. 27 to 30, which were taken at the surface of the tread and at depths of 1/8 in., 1/4 in. and 1/2 in. respectively. From these the gradually increasing size of the grain is apparent, though from its large dimensions, even at the tread, it would appear that this particular tire was finished at a rather high temperature.

The microphotographs of the Schoen steel wheel show that for the first 1/8 in. of depth it has the finest structure of any of the wheels and tires examined, but below this depth its grain increases in size in a comparatively uniform manner though with a variation to be noted later, until, at a depth of 1 in. it is slightly coarser than any of the tires. On the other hand, it contains but a trace of ferrite, indicating that the carbon content is about the same as that in the A tire. Here again owing to the absence of sufficient ferrite to outline the grain clearly, it was necessary to photograph by oblique illumination, and it was under this light that the accompanying sketches to show the grain's size were made. The microphotographs closely check the abrasion tests and the determinations of specific gravity.



Interpretation of Grain Structure in Schoen Wheel at Varying Distances Below Surface of Tread.

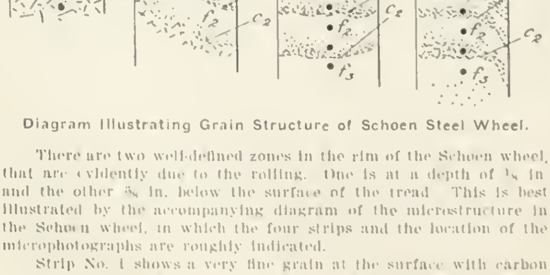
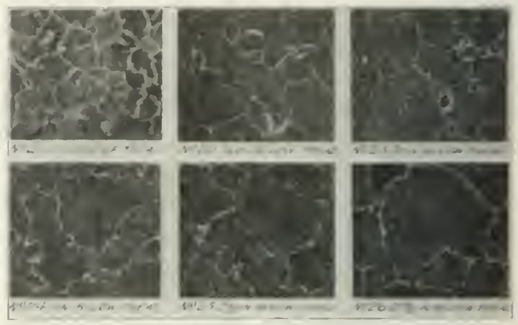


Diagram Illustrating Grain Structure of Schoen Steel Wheel.

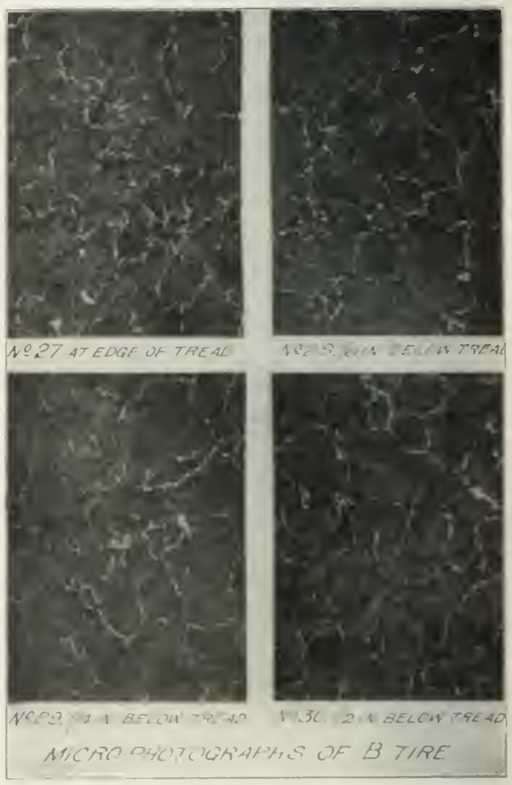
There are two well-defined zones in the rim of the Schoen wheel, that are evidently due to the rolling. One is at a depth of 1/8 in. and the other 3/8 in. below the surface of the tread. This is best illustrated by the accompanying diagram of the microstructure in the Schoen wheel, in which the four strips and the location of the microphotographs are roughly indicated.

Strip No. 1 shows a very fine grain at the surface with carbon well below 0.50 per cent. This structure runs down for about [illegible] in. where there begins a gradual increase of the grain size until the normal dimensions are reached at about [illegible] in. below the top of the flange. The first [illegible] in. is formed of a very fine mixture of about equal proportions of ferrite and pearlite, and below this the ferrite gradually disappears and the grains increase in size. At a depth of [illegible] in. the ferrite appears as a discontinuous band or envelope around the grains of pearlite, indicating that the carbon content is about 0.70 per cent. This increase in the size of the grains continues downward until they reach their maximum at a depth of about 1 in.

In strip No. 2 there is the same fine-grained surface structure

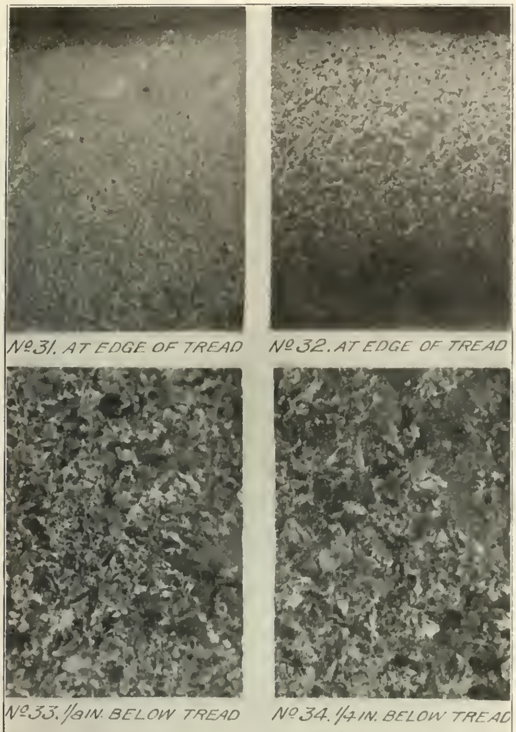


Microphotographs of F Wheel.



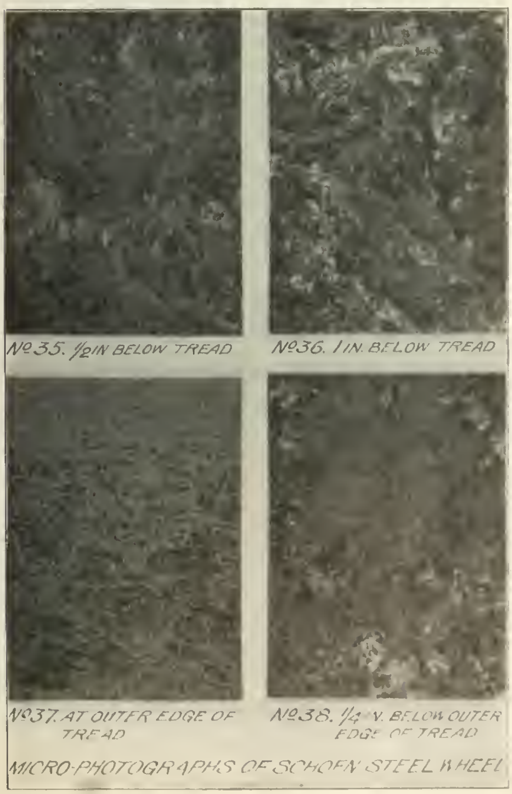
(a) corresponding to that of No. 1. The depth of this decreases from one side of the strip to the other and is about [illegible] in. thick at the corner. This structure is shown in the photograph No. 31. On the right hand side, two zones will be seen; one of which, starting at $f1$, is of very fine pearlite. The point of maximum coarseness is at $c1$. This is not really a coarse grain in itself, for it is fine even when compared with that of the D tire. Below $c1$ there is an abrupt change to extreme fineness again at $f2$. This is followed by a gradual increase in the size of the grain down to $c2$, where the normal structure is found at a depth of about 1 in.

In strip No. 3 there is the same fine grain at the surface, as



№ 31. AT EDGE OF TREAD — № 32. AT EDGE OF TREAD — № 33. 1/8 IN. BELOW TREAD — № 34. 1/4 IN. BELOW TREAD

MICRO-PHOTOGRAPHS OF SCHOEN STEEL WHEEL



№ 35. 1/2 IN BELOW TREAD — № 36. 1 IN. BELOW TREAD — № 37. AT OUTER EDGE OF TREAD — № 38. 1/4 IN. BELOW OUTER EDGE OF TREAD

MICRO-PHOTOGRAPHS OF SCHOEN STEEL WHEEL

shown in the photograph No. 32, which extends down to a depth of about $^1/_{50}$ in. The extreme outside shows almost entire absence of carbon, or nearly pure ferrite. This is followed by a gradual increase in the amount of carbon until, at a depth of about [illegible] in. a fine grain structure almost wholly of pearlite is indicated at *f*1. Next comes a uniform increase in the size of the grains, until they reach their maximum at the point marked *c*1, where there is an abrupt change to a structure of great fineness, which, in turn, increases in size to a maximum at *c*2, when there is a second abrupt change to extreme fineness at *f*3. Below this there is a gradual increase in the grain size until the normal structure is reached at about 1 in.

In strip No. 4 there is the same decarbonized outer layer (*a*) which is about $^1/_{30}$ in. thick at the center, thickening towards the right in the direction of the edge of the wheel rim. This structure differs in appearance from the corresponding area in No. 3 due to the distortion of the grain by mechanical treatment of the metal after ferrite or pure iron became excessive as the result of burning out the carbon on the surface of the steel. The size of the grain increases from fine at *f*1, to a maximum coarseness at *c*1, $^1/_8$ in. below the surface where there is the same abrupt change as before to a fine structure at *f*2. This will be seen by a reference to photograph No. 38. The grain again increases to a maximum coarseness at *c*2, with another change to extreme fineness at *f*3, at a depth of about $^1/_2$ in. Beyond this point the grain increases uniformly until the normal size is reached at a depth of 1 in. as indicated by photograph No. 36, and the diagram of grain sizes.

These changes in grain size are accounted for by the successive heat and mechanical treatments to which the Schoen wheel was subjected.

The conclusions drawn from this work with the microscope are practically the same as those reached by a study of the physical and chemical tests. It is apparent that the Schoen wheel is quite equal to the best tires, as regards depth of finish and the fineness of the grain in the steel.

Influences Affecting Train Resistances.

C. Carns Wilson read a paper before the Institution of Civil Engineers in London on Dec. 10, 1907, in which he discussed the forms of train resistance formula, and concluded with a resumé of the various causes affecting that resistance and the effects which they produce. They were as follows:

(1) *Journal-friction in its relation to train-resistance and its possible reduction by roller-bearings.*—The real value of roller-bearings in railroad traction is shown to lie in the reduction of running resistance and consequent saving of energy, and not in the reduction of starting-effort. The results of tests with roller-bearings on the Eastern Bengal State Railway show a saving actually obtained of 1 per cent. greater than that calculated by the use of the resistance-formulas.

(2) *The influence of the truck on the resistance of bogie-coaches.*—The resistance of a coach is shown to depend largely upon the wheel-base of the truck, and the relation of the weight of the bogie-trucks to that of the whole coach.

(3) *The effect of electrical driving on the resistance of bogie-coaches.*—The weight of the motors and the extra weight of the motor-trucks in electrically-driven coaches increases the flange action and the total resistance of such coaches. The resistance of electrical motor-coaches is in some cases as much as 54 per cent. greater than that of trailing coaches running at the same speed under similar conditions.

(4) *The reduction of the resistance of goods-wagons by the use of bogies.*—The influence of the bogie on train-resistance is shown to be greatest in the case of goods wagons.

(5) *The relation between the tractive efforts required to haul loaded and empty bogie goods-wagons.*—Since flange-action depends upon the ratio of the weight of the bogie to that of the whole wagon it must follow that the resistance per ton of a loaded bogie-wagon must be less than that of the same wagon empty. This is a matter of general experience, and can only be explained on the above hypothesis. The results of tests in which a train of bogie-wagons was hauled over a considerable distance backwards and forwards, first loaded and then empty, show that the ratio of the mean draw-bar-pull in the two cases was 0.56. When the resistances are calculated by the formulas, the ratio is found to be 0.62.

(6) *The incidence of train-resistance on flange and rail-wear.*—The energy expended in overcoming flange-resistance is represented by the wear of tires and rails. This wearing action is much greater in some cases than in others.

(7) *The reduction of flange-action by mechanical contrivance.*—It is shown that by giving the bogie a lead, as is done in Timmis' bogie-lead, the flange-action of the bogie can be reduced, and that the saving depends upon the ratio of the bogie wheel-base to the distance between the bogie centers, and also upon the ratio of the bogie weight to the total weight.

(8) *The effect of side play on train-resistance and its possible*

limitation.—The amount of play between the flanges and the rails is an important factor in train resistance. The want of uniformity in current railroad practice in this matter is illustrated by the amount of side play adopted on different railroads in Great Britain, in the United States, and on the Continent. The increased resistance and wear occasioned by large flange-play suggests the importance of a reduction of the play to a standard ⅜ in. as on the London & South-Western and other railroads.

(9) *The relative importance of air-resistance.*—The resistance of the air with a train of bogie-coaches, running at 60 miles per hour, amounts to about one-half of the total tractive effort required to haul the train. The experiments conducted by the St. Louis Electric Railway Test Commission show that a large reduction can be made in the front and rear air resistance by shaping the ends, and that by this means a saving can be effected of 10 per cent. of the total tractive effort with a long passenger train, and 30 per cent. with a single coach.

The Car Wheel and Its Relation to the Rail and Car.*

In going back to the period of the 24,000-lb. capacity car, and comparing it with the present 100,000-lb. capacity car, the increase in load capacity is 76,000 lbs., increase in tare weight, formerly 18,000 lbs., now 42,000, is 24,000 lbs.; increase in permitted excess load, 10 per cent., formerly 2,400 lbs., now 10,000 lbs., or 7,600 lbs., making a total increase which the eight wheels of the car have to carry, of 107,600 lbs., which is 240 per cent., or 3.3 times as much load.

The wheel used under a 24,000-lb. capacity car weighed 525 lbs. and the wheel used now under a 100,000-lb. capacity car weighs 700 lbs., an increase of 175 lbs., or 33 per cent. The brake pressure applied to the eight wheels of a car was formerly 12,600 lbs. and at the present time is 30,000 lbs., an increase of 138 per cent. In addition to these changes, there have been other changes that have had a material effect upon the service, viz., greater rigidity of car trucks and car bodies, higher speeds, and a general introduction of the air brake, involving a much greater and more general absorption of energy at the periphery of the car wheel. It thus appears that the work generally imposed upon the wheel in service at the present time is very much more severe than formerly, and in this there seems to be little opportunity for disagreement.

I might state here that during this period between the general use of the 24,000-lb. capacity car and the introduction of the 100,000-lb. capacity car, the requirements of the cast iron wheel imposed by railroads upon manufacturers have been made considerably more severe and comprehensive. The time guarantee has been raised from two to four and five and, in some cases, six years. Physical tests of car wheels have been generally imposed, and the thermal test has been added to the drop test. The increased exactions of the railroads in this way have been met by the manufacturers at an actual reduction in price of about 25 per cent.

It has been suggested of late that the cast iron car wheel is no longer equal to the conditions imposed by modern service, unless a very material improvement in quality can be obtained, which no one has thus far been willing to suggest as probable, but it does not follow by any means that such a thing is not possible. While the question of improving the quality to meet these new conditions is under consideration, it occurs to me that possibly other developments might be brought about which would greatly mitigate the difficulties that are being experienced.

The development of the steel car wheel has been taken up actively by several concerns in this country with the idea of providing something to meet the needs of modern service, and there are others who are about to embark in this line of work. They have received a good deal of encouragement, and there are those who believe that the real remedy for the present difficulties lies in the use of steel instead of cast iron. Steel has many qualities that commend it for the purpose, but I do not think it is going too far to state that the use of steel should not be expected to completely eliminate the present troubles, and that whether or not the steel wheel shall be considered essential and come into more general use, it would appear that it, as well as the cast iron wheel, should be protected, as far as possible, from some of the very trying conditions to which all wheels are now subjected.

The particular failure of wheels that is attracting most attention at the present time is that of the breaking off of the flange. This is not so frequent as might be supposed, but its consequences are often most disastrous, the number of removals of wheels whose flanges might easily break is much larger than the number of those that finally fail in service. In addition to this, I find that of all wheels removed from service, not less than 50 per cent. are removed on account of worn flanges, and in this percentage I include those that are worn away from the flange, usually found on the opposite end of the axle and which cannot be remated. Fifty per cent. is the minimum percentage, the maximum that I have found is 85 per cent. My data for this statement is obtained from four heavy service eastern railroads and two typical western railroads. Taking up first the question of broken flanges, I would state that my conclusions are based on personal observation of a large number of wheels examined on several railroads. Comparatively few broken flanges come from the flange being worn thin and broken off laterally through the smallest section at the base of the flange. By far the larger number come as a result of the development of a seam opened on the tread of the wheel and oftentimes beneath the surface close to the base of the flange, and often before the flange is worn to any considerable extent. Sometimes this seam exists and is not apparent at the surface, in fact, I have seen cases where the seam has existed beneath the surface for some time before reaching it, but in the majority of cases the seam extends to the surface at about the same time. In most of the cases examined it has been noted that the fractured metal has a blue discoloration, an indication of oxydization from heat. In thus stating the facts I am confirmed by experienced railroad and mechanical men and wheel makers. Several explanations for this failure have been made to the writer, but the most logical explanation seems to be as follows:

Fig. 1 illustrates the relation between a wheel with a 25 to 1 taper on the tread and the rail head. This shows the wheel and the rail in their normal relation; that is to say, the wheel occupying its proper gaging position with reference to the rail, and it will be seen from this that the contact between the two is reduced to a very small area, in fact, theoretically it is a point. If the wheel occupies a position such that the flange or the throat of the flange is against the rail, the contact will be changed as shown by Fig. 2, so that the contact will be practically on the tread at the base of the flange. Frequently heavy loads are carried for some time on the wheels in this way, so that under this condition there is an extreme concentration of the load at this point, which is, as a rule, the point at which these seams are developed. At the same time severe application of the brake occurs, the brake shoe bearing heavily on the tread at the base of the flange. Such a combination of conditions as this might occur on a down grade and in passing around a curve. In addition to the heat developed by the brake shoe there is a material increment of heat developed as a result of the abrasion between the flange of the wheel or the base of the flange and the rail. Here, then, is a combination of extreme conditions; in other words, concentrated load and concentrated heat, together with considerable lateral pressure against the flange if the car happens to be passing around a curve at considerable speed.

During the period of the lighter capacity car these same conditions prevailed and occasionally the flange of the wheel failed in the same way as it fails at the present time, but such cases were so infrequent and so much less disastrous in their effect than at the present time that little notice was taken of them. It sometimes occurs to-day under 60,000-lb. capacity cars.

In considering greater frequency of flange failures at the present time it must be borne in mind that the number of freight equipment cars in service has increased very greatly during the last few years and the average mileage that these cars make is very much greater than it used to be—as nearly as I can ascertain about 100 per cent.—and the application of air brakes to freight equipment cars is now universal, so that the increased number of flange failures is readily accounted for, allowing the causes to be practically the same as formerly.

As to the manner, in detail, by which this seam is developed, I suggest the following explanation. The sudden application of heat to the tread of the wheel at the base of the flange has the effect primarily of making the metal at the surface expand quickly. The metal below the surface cannot expand so quickly and so resists the expansion of the surface metal. The surface metal is therefore put under compression while below the surface the metal is put under tension. The one is working against the other with the result that the metal will yield at the weakest section, which would be that part that is under tension. Subsequently, if the conditions prevail for a sufficient length of time the surface will crack also and a thrust against the flange, as in passing around a curve, would remove a portion if not the entire flange. The operation of heat in this way may be illustrated in large metal ingots. It is not infrequently the case that when a large body of hot steel is poured into an ingot mold, that that part of the metal which comes in contact with the metal mold cools rapidly while that at a distance from the surface cools very much more gradually, with the result that, as the surface metal tends to contract and is resisted by the body of metal within, the surface metal, which is subjected to a pull or tensile stress, yields, and a crack or check develops.

This operation is the reverse of that which takes place in the wheel, but the forces at work are identical and operate in the same way. To these conditions brought about by the application of heat, add the concentration of load at the same locality with lateral thrust against the flange, and it would seem strange if failures did not occasionally occur.

The writer has seen flanges of steel tired wheels that have failed

*A paper presented at the January meeting of the Western Railway Club by S. P. Bush, Vice-President and General Manager of the Buckeye Steel Castings Co., Columbus, Ohio.

in the same way as cast iron, but it is a question whether the causes were precisely the same, although it would appear the same causes were largely contributory. Where the load is concentrated as here described it would seem that a peening action must take place to some extent, probably more with the steel than with the cast iron, inasmuch as steel is ductile and there is at times what is generally designated as a flow of metal under pressure. This peening action would necessarily seem to have a considerable influence in the case of the steel wheel, but the chill of the cast iron wheel being so hard, the metal cannot flow as in the case of the steel, but may wear or disintegrate very rapidly if the pressure is extreme. But this peening action, in the case of the steel wheel, and the concentration of heat together with considerable and constant lateral pressures, do not appear as unreasonable causes for the failure of the flanges of some steel wheels. It should be borne in mind that on a straight track a wheel is often running to one side constantly and lateral flange pressure is produced.

I might here call attention to the fact that the chills in which car wheels are cast develop such cracks in the surface in time, as a result of sudden heating and cooling. In fact, it is one of the chief reasons for the discarding of chills and the requiring of renewals. It is not at all an unusual thing for heavy castings to crack in a foundry as a result of internal stresses caused by a difference in temperature between the surface of the casting and the metal within. In fact, the process of annealing is for the purpose of preventing very large internal stresses which might cause failure in use, and the practice of soaking wheels or slowly cooling them is provided for the purpose of eliminating internal stresses.

I present some samples of broken flanges which are typical of the failures that I have described. I desire to lay particular stress on the fact that that part of the fracture which exists at the base of the flange extends vertically for a considerable distance into the tread, as shown in Figs. 3 and 3A. If the flange itself were not sufficiently strong to successfully resist the lateral thrust it would seem that the fracture, instead of going vertically down into the tread, would go transversely across the base of the flange. There are comparatively few cases that have come to my notice where the fracture has been transversely across the base of the flange. In nearly all such cases that I have examined the flanges have been worn thin vertically and the wheel should not be held responsible.

One prominent car builder with whom I have talked in connection with this matter expressed a belief that at points where these seams develop there is already an internal stress which might be considered a seam in embryo, and one manufacturer of cast iron wheels suggests that this might occasionally occur, depending upon the conditions of manufacture and particularly depending upon the rapidity of pouring and the temperature of the metal.

The superintendent of motive power of a very prominent railroad that removes from service a large number of seamy wheels states as follows: "The most serious cause for flange failure is the development of seams at the throat of flange and subsequent breakage. We consider that these seams are the result of concentrated load and heat in combination with poor quality of wheels. We believe that the discontinuance of the use of the proper proportion of charcoal pig iron, together with the inauguration of the thermal test and the more liberal use of ferromanganese in connection with the inferior wheel mixture has had more to do with the development of seams at the throat of flanges and the breakage of the latter than any other items."

As has been said, the fracture in the case of flange failure starts in a vertical rather than a horizontal direction, as shown in Fig. 3. The thickening of the flange in a horizontal direction will not therefore materially assist in the elimination of this trouble. In considering this matter I think it is generally felt that the flange of the cast iron wheel is weak, possibly too weak to perform the service required, but in the light of my investigation I cannot see that such a conclusion is fairly reached.

This particular question was of sufficient importance to one railroad to enlist the interest of Purdue University in making some tests for it with a view of determining the pressure required to remove a piece of flange as if it were in contact with the rail. The wheels were mounted on a suitable support under a heavy service press and the ram of the press was brought down on the flange until the latter gave way.* Three of the wheels tested were taken from service under 100,000-lb. capacity cars after having been in service about eight months. A number of others which were tested had not been in service. In all, 23 tests were made, the results of which are shown by the following tabulation:

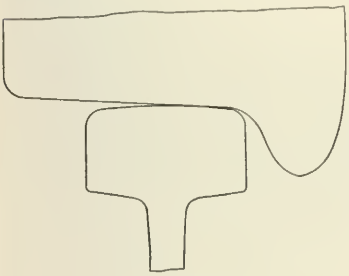


Fig. 1.

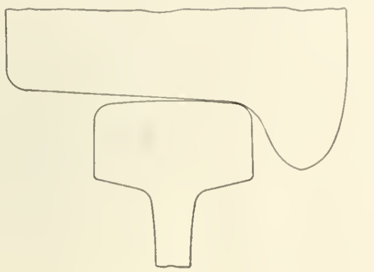


Fig. 2.

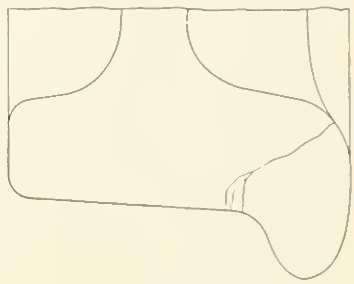


Fig. 3.

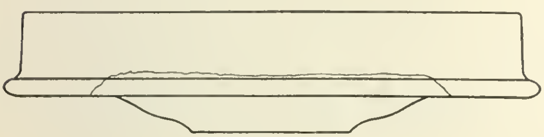


Fig. 3 A.

Results of Flange Tests.

No. of test.	Breaking load.	No. of wheel.	Point of application of load on flange.	Remarks.
1.	52,850	H. 19,413	Between brackets.	
2.	47,750	H. 19,413	Opposite bracket.	
3.	49,350	H. 19,413	Between brackets.	
4.	53,400	H. 19,413	Opposite bracket	
4a.	105,000	H. 19,413	Load applied on rim.	No fracture.
5.	62,850	H. 19,410	Between brackets.	
6.	48,700	H. 19,410	Opposite bracket.	
7.	58,250	H. 19,410	Between brackets.	
8.	58,000	H. 19,410	Opposite bracket.	
9.	74,850	H. 19,254	Between brackets.	
10.	72,200	H. 19,254	Opposite bracket.	
11.	87,000	H. 19,254	Between brackets	
12.	68,550	H. 19,254	Opposite bracket	
13.	99,300	A. C. & F. Co. wheel 650	Between brackets.	
14.	100,000	A. C. & F. Co. wheel 650	Opposite bracket.	
15.	105,900	A. C. & F. Co. wheel 650	Between brackets	
16.	68,200	A. C. & F. Co. wheel 650	Opposite bracket	
17.	79,350	A. C. & F. Co. wheel 650	Opposite bracket	Wheel broke through rim.
18.	52,300	H. 19,558	Between brackets	Broken wheel, one half submit'd for test
19.	111,600	1904 M. C. B. pattern (Tape 1) 700	Opposite bracket	
20.	87,000	1904 M. C. B. pattern (Tape 1) 700	Between brackets	
21.	109,900	1904 M. C. B. pattern (Tape 1) 700	Opposite bracket.	
22.	98,900	A. C. & F. Co. wheel (Tape 2) 700	Opposite bracket	
23.	98,900	A. C. & F. Co. wheel (Tape 2) 700	Between brackets	

From this it will be seen that the minimum load was 47,700 lbs., maximum 111,600, the average about 60,000 lbs. In the case of wheels that have been in service for some time it is probable that the average would be less than this.

The strength of the flange of the steel wheel made by the Schoen Steel Wheel Co., tested at Purdue University with the same apparatus, showed that a pressure of 526,612 lbs. was necessary to remove a piece of the flange. This would indicate that the strength of the steel flange was over eight times that of the cast iron, but as I have stated the flanges of steel wheels sometimes fail, also indicating that lateral thrust is not likely to be the primary cause of such a failure, although it may be the ultimate cause.

Geo. L. Fowler has recently written for the Schoen Steel Wheel Co. a very interesting publication on the subject of the steel wheel and makes comparisons with the cast iron wheel.† His arguments are based on the belief that the failure of flanges

*Railroad Gazette, Sept. 1[illegible], 1907, p. [illegible]

†Railroad Gazette, Dec. 20 and 27, 1907, Jan. 3, 1908.

is primarily and ultimately due to pressure alone, but in this I cannot agree with him. The evidence that I have collected thus far indicates that the number of cases of flanges broken as a result, primarily, of lateral thrust is almost negligible and that the other causes already described are more likely to be the real ones. He points out, however, and very truly, that the lateral thrust between the flange of the wheel and the rail is oftentimes very considerable, and he has taken great pains to determine accurately just what the lateral thrust is. He has made an exhaustive series of experiments on the Pennsylvania Lines West of Pittsburgh with an apparatus designed by himself for carefully measuring the lateral thrust in the case of moving cars or trains passing around curves.‡ His measurements were taken at the outer rail near the end of a 4 deg. 25 min. curve, or a radius of 1,307 ft., the elevation of the outer rail being $3\frac{7}{8}$ in., which, as he states, is correct for a speed of 36.66 m.p.h. Most of his results are obtained from a single car allowed to run alone around these curves at different speeds. At a maximum speed of 30.60 m.p.h. his maximum pressure recorded 12,865 lbs. No doubt the lateral thrusts considerably exceed these figures at times, in fact there can be no doubt about it. I am fully convinced that they do, and have seen evidence within the past 30 days to indicate that such is the case. I have seen a number of arch bars, $1\frac{1}{4}$ in. x 5 in. material, used under 100,000 lb. capacity car trucks bent laterally $\frac{3}{4}$ in., not as a result of wreck or derailment but extreme service conditions. I was told at the time I was shown these bars that similar cases are found from time to time. The cars under which these trucks were used were of very rigid construction, both body and truck, and such evidence as this, together with the information presented by Mr. Fowler from actual measurements, should, I think, confirm anyone in the belief that in the designing of modern cars this item has been greatly neglected.

When the new M. C. B. axles were designed a very important item of allowance was made on account of lateral thrust which reached the axle through the wheel, yet on many railroads, at least, the thought of relieving the wheel has been given little or no consideration. Some railroads have taken this into account and provide in their truck construction for lateral motion or yielding resistance. The old swing motion truck provided this, and it would seem that some provision for yielding resistance would be highly desirable. Here, I think it is fair to state, that some provision of this kind should not be considered as a complete remedy but as a means for alleviating the difficulty somewhat; in fact, it would seem that a satisfactory provision of this kind would be very material in its effect.

In conclusion on this point, I would state that it would seem that if the flanges of cast iron wheels were not sufficiently strong to stand the thrusts of modern service we would have very many more failures than we do. In fact, to my mind we could not have gone as far as we have in the use of the cast iron wheel. The thickness of the flange has been increased and the limit of wear for the flange has been decreased, with the idea that more strength might originally be had and subsequently maintained. Greater coning of the wheel has been recommended and adopted by some, for the purpose of keeping the flange of the wheel away from the rail as much as possible.

With reference to the increased coning, the consensus of opinion seems to be that it has rendered some assistance in the matter of making the wheels under trucks in service track better or maintain a proper alinement on straight or tangent track. I call attention to the fact, by referring to Fig. 1, that the increased coning has also served to concentrate the load on a smaller area and that, too, closer to the flange of the wheel. It would appear that little consideration has been given the matter of dissipating or distributing the load rather than concentrating it, and similarly little attention seems to have been given the matter of the application of brake shoes to the wheels in the way of preventing the concentration of heat at the throat of the flange. When new brake shoes are applied to new wheels it is almost generally the case that the bearing is at the throat alone, and in the case of worn wheels at the throat and the outer portion of the tread. It is often the case also that brakes are so hung that the brake shoes themselves wear into the flange at the throat. I have examined a great many cases of late and find this statement to be entirely correct. When a new wheel is put in service on a new rail or even on old rails, the bearing between the two would be as indicated in Figs. 1 and 2. As wear takes place, which must be very rapid in so small a bearing, the area of contact increases until finally the coning is all worn off except a small portion near the flange, but the tread of the wheel in time increases its bearing so that $1\frac{1}{2}$ or 2 in., sometimes more, of the width of the tread will be found in contact with the rail. Apparently this is a condition to which it is desired the wheel should come and it may be said that if wheels are successful in reaching this condition they are likely to continue in successful service giving a normal life unless for some reason there is an extreme condition brought about at some time whereby the heat is concentrated as indicated heretofore. It would appear then that that portion of the coning which remains is reasonably effective in preventing the wheel from running to the rail. I think it is clearly understood at this time that it is difficult, if not impossible, to mount a large number of wheels on axles and for each two wheels mounted on the same axle to have exactly the same diameter, and the coning, therefore, has for its principal object the equalization of the differences in diameter. The wheel of smaller diameter will have a tendency to run to the flange and the wheel of larger diameter will have a tendency to run away from the flange. In time they seek a level if not prevented from so doing by other causes which will be spoken of later, and accomplish the result desired. I wish here to draw attention to the fact that with such

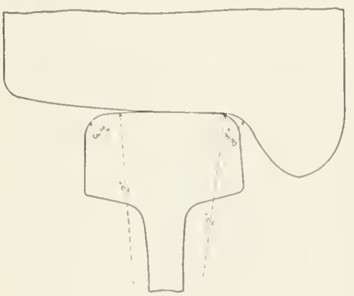


Fig. 4.

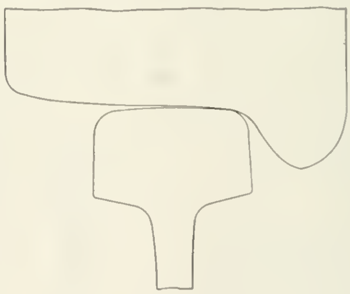


Fig. 5.

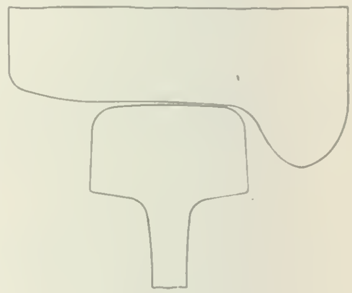


Fig. 6.

a limited bearing between the wheel and the rail as is shown by Fig. 2, the larger diameter on which the wheel rolls could not be expected to last very long, in fact, it would naturally break down very rapidly and therefore the purpose of the increased diameter might be defeated, particularly if the influence of the greater diameter to turning the truck is not at least equal to the resistance. As a matter of fact, the resistance to turning is probably very much greater than this influence, in many cases, and therefore a wheel may run constantly for a limited period on this larger diameter without accomplishing the purpose for which the coning is intended.

In my judgment it would seem that having reached this working basis by wear, the coned wheels are in far better condition to withstand service successfully than they were when first put into service for the reason that gradually the load is changed from a concentrated condition on a small area of tread near the flange to a very much larger area extending outwardly toward the edge of the tread.

So far as I have been able to ascertain from railroad mechanical men this statement of what I have described as a good working basis is regarded by them as correct; at any rate I regard it as correct. If this working basis that I have described is a desirable one to reach, why should it not be brought into play when wheels are first put into service by making the contour accordingly? From an examination of the treads of a large number of wheels I have obtained a composite contour which corresponds very closely to that shown in Figs. 4, 5, 6 and 7, and it will be seen that this contour bears quite a different relation to the rail from that shown by Figs. 1 and 2. In the former case the bearing is of considerably greater extent, going as a rule beyond the crown of the rail from the flange, and instead of the existence of straight coning, as is originally applied, there is the equivalent extending a short distance from the base of the flange outward and having a radius

‡Railroad Gazette, Sept. 13, 1907.

from 1½ in. to 2 in. before meeting the fillet at the base of the flange which is usually worn to 1½ in. or less.

It is my contention that a contour of this kind bears a much better relation to the rail, is quite as effective in equalizing the differences in diameter, has the material advantage of dissipating the load on the rail and wheel tread and makes the wheel more serviceable with less opportunity for failure than would the straight coning of 1 in 20 or 1 in 25 recently recommended and now constituting the practice of the country.

It would appear from the facts as found in service that an increase of the radius of the fillet at the base of the throat beyond ⅝ in. is a positive disadvantage rather than an advantage, inasmuch as in a short time it must be reduced, and provides an opportunity for more extreme concentration of the load on the tread than with the smaller radius. It would appear that a coning beyond this fillet, having some relation to the top edge of the rail so as to avoid extreme concentration of load but which would permit the wheel to roll for a short time on a larger diameter, would be a more effective means of protecting the flange than that at present provided.

In conclusion on this point I do not state that this alone would be a cure for existing difficulties, but I do state that it seems reasonable to me, at least, that it will tend to mitigate the difficulties somewhat if I am right in my premises that it is desirable to dissipate loads on the tread of the wheel rather than concentrate them.

With reference to the matter of improving the quality of the wheel it would seem that after consideration of the conditions under which wheels operate at the present time as compared with formerly, there must have been a considerable improvement in the process of manufacture and in the quality, but it is possible that the larger use of ferro-manganese and the introduction of the

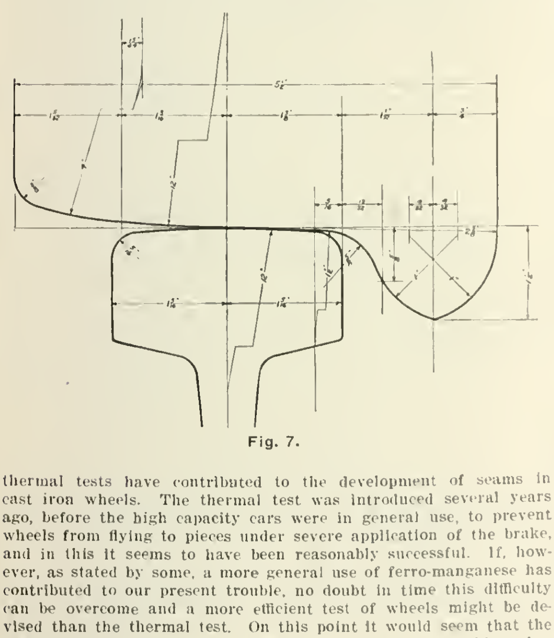


Fig. 7.

thermal tests have contributed to the development of seams in cast iron wheels. The thermal test was introduced several years ago, before the high capacity cars were in general use, to prevent wheels from flying to pieces under severe application of the brake, and in this it seems to have been reasonably successful. If, however, as stated by some, a more general use of ferro-manganese has contributed to our present trouble, no doubt in time this difficulty can be overcome and a more efficient test of wheels might be devised than the thermal test. On this point it would seem that the manufacturers of cast iron wheels might present something that would be helpful.

I have already set forth the greatly increased work required of wheels at the present time. I am of the opinion generally speaking, that unless an improvement is effected in the quality of wheels the failures will be very much more numerous than they are at the present time. If physical tests are of any practical value in determining quality there can be no doubt that the quality is better, although it may be entirely possible that a change in chemical composition such, for instance, as the increased percentage of ferro-manganese used, may have had some effect on the chill whereby it is not so well able to withstand the application of heat.

It is a fact in making slight variations in the chemical makeup of irons and steels that certain relations are oftentimes very radically changed. I can only say that in making my investigations in this direction so little seems to be actually known and so much unknown that this matter must be approached most conservatively. I am prepared to state beyond question, as a result of actual experience in making wheels, that it is entirely possible to produce a cast iron wheel the body of which will be very much tougher and stronger than is the case to-day.

A short time since, wishing to ascertain something about this matter, I made a number of wheels with the idea of eliminating some of the elements that usually make cast iron what it is, viz.: brittle. By greatly reducing the phosphorus and sulphur content I succeeded in making a wheel, the flange and body of which were incomparably stronger than anything that has been commercially produced up to the present time, but I am not at all prepared to state whether the chill of such wheels, if subjected to the conditions of concentrated load and heat at the present time, would withstand existing conditions any better than do the average wheels, although it appears quite probable. It is well known that sulphur is an element that makes for brittleness, yet it also makes for hardness. It is well known that phosphorus makes for brittleness, yet it also makes for red shortness and greatly reduces the strength, but it also increases the fluidity of iron in the melted state and assists in the process of pouring, and it is possible that with a reduction of sulphur and phosphorus content some other element might be substituted which might greatly improve the quality of the chill. There has, however, been little done in the way of investigation along these lines, and I am led to believe that wheel manufacturers have had little inducement to pursue investigations of this kind. I might here state that if an improvement in the quality of the wheels is desired it is absolutely certain that an increase in the cost will be unavoidable. I hope to be able to pursue this phase of the question later, but at the present time it is my desire to point out other possible remedies which may materially alleviate the difficulty of broken and worn flanges, not only in the case of the cast iron wheel but of the steel wheel as well.

While the matter of improving the quality of the wheel must necessarily be a very gradual one and worked out by experiment covering, no doubt, a considerable period of time, the question arises in the meantime what other things suggest themselves as partial remedies. I have already pointed out that the concentration of heat is one of the probable causes of failure at the present time and it has occurred to me that probably something might be done to avoid this. Would it not be possible to so design our brake shoes as to prevent any material bearing or development of friction and heat either at the flange or on the tread of the wheel near the flange where the load is often concentrated? In discussing this matter with one railroad man a short time since, he suggested that he thought the area of brake shoe contact with the wheel was already rather limited, and that if contracted any further it would be a disadvantage rather than an advantage. Since that time I have taken occasion to inspect a large number of brake shoes in service and find that probably not more than one half of those in service have effective use of more than 50 per cent. of their full area. I found also, some years ago, when conducting brake shoe experiments for the Master Car Builders' Association, that when the surface of the shoe in contact with the wheel became hot the metal expanded, changing the shape of the brake shoe so that the bearing was considerably greater at the central part of the shoe and very little at the ends, and that upon cooling, the shape of the shoe was again changed as a result of the wear of the central portion and when thoroughly cooled the brake shoe would take its bearing at the end portions only; so it would appear that little or nothing would be lost by removing almost entirely that part of the shoe which now bears on the tread of the wheel at the throat. This might necessitate some modification of the brake shoe holder and of the point of bearing of the brake-beam, but I am led to the belief that a great deal can be done by changing the shape of the brake shoe alone, that is, by cutting away the bearing near the flange. I wish to point out again that I do not present this as an absolute cure for the difficulties that exist, but as something that would tend in the direction of mitigating the difficulties. In fact, I believe that the means suggested for diffusing the load and preventing the concentration of heat would have a decided influence towards reducing wheel failures.

From one railroad where the service is exceedingly heavy I have obtained the following facts concerning the removal of wheels during the year 1907: Total wheels removed for all causes, 79,000; wheels removed on account of seams at or near throat on tread, without failure of flange, 3,312.

I might say here that this condition is typical of the conditions on a number of other roads with which I am familiar and which I have investigated, and it seems to lend considerable weight to the argument that I have here advanced concerning the concentration of heat and load.

I have already made the statement that of all wheels removed from the service on two typical western roads and four heavy service eastern roads, about 50 per cent. are removed on account of worn flanges, with a maximum of 86 per cent. on one road. The enormous loss of wheel service on this account, to say nothing of the necessity of holding cars out of service for the purpose of renewing wheels and of increased train resistance, seem to be a waste and expense that should be avoided somewhat, at least if possible. Whether the quality of the cast iron wheel is improved or whether the steel wheel is brought into more general use, this item of worn flanges will continue and be more expensive with the increased first cost of wheels. Considerable has already been said by others concerning this matter and also about means for preventing it. A few railroads have taken some active steps towards minimizing this waste but the majority seem to have done little. The difficulty seems to lie in the fact that wheels under cars do not track as intended, that is to say, the alinement of the wheels is not coincident with the alinement of the rails.

It is well understood that this flange wear is not produced as a result of passing around curves; it takes place on straight or tangent track; it is so general and has extended over so long a time that it seems fair to state that the wheels are not permitted to track. I say this for the reason that in some cases where they are permitted to track they do track. It is often the case, as stated previously, that wheels mounted on the same axle are not of exactly the same diameter, and it is the tendency for a wheel of smaller diameter to wear toward the flange. The coning is intended to overcome this difficulty. In some cases it seems to be effective, and in other cases to the extent already noted it does not seem to be effective. There is considerable evidence to show that coning might be made more effective if the resistance of the trucks to pivoting or turning about their pivotal center could be materially reduced.

It has been well established that the resistance of trains has considerably diminished in the case of cars where the body and truck side bearings are free or clear of each other, and where the resistance to pivoting is principally at the center bearing. Numerous papers have been presented and numerous discussions have taken place before this club covering this point, and I think it is safe to say that this principle is so well established that it is regarded as right and necessary to construct cars that shall have the side bearings free and continue so for some time at least. I would call attention, however, to the fact that on some roads, if not on most, where this effort has been made with considerable success to keep side bearings clear, that the percentage of wheels removed on account of worn flanges has, instead of decreasing, actually increased; in fact, on one heavy service railroad, in comparing the service of wheels under 40,000 and 60,000-lb. capacity cars with those under 100,000-lb. capacity cars, I find that the average life of the wheels has been reduced until now it is but 33 per cent. under high capacity cars of that which it was formerly under the lighter capacity cars, and that 75 per cent. of all the wheels removed are on account of worn flanges, which, as I have said, includes those that are worn away from the flange and cannot be remated, but which are not worn through the chill. This would seem to indicate that this condition, while possibly reaching the extreme on this particular railroad, exists to a marked extent on all railroads, or nearly so, and that enough has not yet been done to provide an efficient or partially efficient remedy.

Some years ago one railroad in this country having its interest aroused, determined to pursue this matter with a view of ascertaining what might be done. L. H. Turner, S.M.P. of the Pittsburgh & Lake Erie, has kindly furnished me with a resume of his experiments in this direction. After making preliminary tests about seven years ago and reaching the conclusion that an anti-friction center bearing would relieve the worn flanges, they commenced to equip some of their cars with the ball bearing center and side bearings, so that at the present time they have a total of 8,600 cars so equipped and 6,961 cars without. The latter are older cars of ordinary design, largely coal cars or gondolas. The average life of the ball bearing cars at the present time is between three and four years, quite long enough, it would appear, to ascertain whether the tendency of the ball bearings has operated in the direction of avoiding worn flanges. Covering a period of 36 months, ended May 31, 1907, I find that 19,608, or 86 per cent. of all the wheels removed, both from their own and foreign cars, were removed on account of worn flanges, that 472, or 2.1 per cent., were removed from cars equipped with ball bearings, that 8,926, or 39.2 per cent., were removed from the non-ball-bearing cars of their own equipment and 10,207, or 44.8 per cent., were removed from foreign cars, out of a total of 22,806 wheels removed from all causes.

It is true that these figures may not accurately and comprehensively state the entire situation, but it would seem to be reasonably clear that with 8,600 cars in service an average of over three years that only 2.1 per cent. of the wheels removed in that time were due to worn flanges, is considerable and important evidence to the effect that if wheels have a better opportunity to track they will do so.

It may be true that the particular device which the P. & L. E. used has not been all that might be desired. It is true that balls have broken and that they have become imbedded in the plates, and there is considerable that may be desired before pronouncing this anti-friction center bearing entirely satisfactory, but there is no gainsaying the fact that if the accomplishment in saving wheels were one-half that which he states, the results should be well worthy of serious consideration.

Some shop tests made recently by one railroad with a view to determining the difference in resistance between anti-friction center bearings and plain center bearings show that the resistance to turning of a dry cast steel or malleable iron center bearing as compared with the anti-friction center bearing is as 6 to 1 and in one case over 50 to 1. Mr. Turner, in his shop tests, gives the relation as about 5½ to 1, but there is reason to believe that in service this relation might be somewhat changed and not be quite so great. In case of the bearing used by the P. & L. E.§ the construction is such that in passing around a curve the action of the balls on their seats raises the body of the car slightly and when passing off the curve on to a tangent this elevation of the car body is applied to return the truck to its normal and proper position, with relation to the rail. Other anti-friction center bearings thus far developed do not appear to have included this feature and it is not evident at this time to what extent this is an advantage, for with an efficient anti-friction center bearing without this feature the wheels themselves would be expected to return the truck to the same normal position.

I feel that the Pittsburgh & Lake Erie is entitled to a great deal of credit in carrying this work as far as it has, and am convinced that in these results which Mr. Turner has presented there must be enough reliable substance to warrant the belief that many railroad men have had, that something of the kind would be valuable for the purpose intended. What I desire to point out in this connection is that one railroad has tried and obtained results, and that if attention and effort are concentrated on this subject by other railroads, or by railroads in general, an entirely efficient means will be developed for relieving the car wheel from what appears to be an unnecessary burden. It is usually the case that where there is concentration of effort, results are forthcoming.

The inability of wheels to track, it would seem, has some bearing on the failure of flanges, in that a wheel would be crowded constantly toward the flange and would necessarily have its load concentrated near the flange. In this way I am of the opinion that some additional relief might be given the already over-burdened wheel.

Finally, to summarize the points that I have endeavored to make, and laying aside for the present the matter of improving the quality of the wheel, which is a work that must necessarily go on, I would suggest (1) avoid the concentration of load by the use of a more satisfactory relation between the contour of the wheel and that of the rail; (2) avoid the concentration of heat at or near the flange of the wheel by a modification of the brake practice; (3) relieve the oftentimes existing high pressures against the flange by introducing the feature of lateral motion in truck construction, so that a considerable yielding resistance will be offered instead of an abrupt one; (4) for the purpose of avoiding the excessive wear of wheel flanges of all kinds modify the contour and provide means whereby the resistance to the pivoting of the truck and of the wheels to track may be very materially reduced.

Foreign Railroad Notes.

The Italian State Railroads have been authorized to contract, in Italy and elsewhere, for 330 locomotives, 270 passenger cars, 250 baggage cars and 10,951 freight cars, at an aggregate cost of about $28,000,000.

A world's electrical exhibition is to be held in Marseilles, beginning April 19 next and closing Oct. 31. The French Prime Minister, Clémenceau, is honorary president, and the Minister of Public Works and other high public functionaries are among its officials.

The Executive Council, to which is committed the oversight of the Italian State Railroads, has had its pay fixed at $2,000 a year for each member, and $6 additional for every day it meets. This council is supposed to represent the people whom the railroads serve.

Putting obstructions on a railroad in order to cause a derailment seems to be regarded as a serious matter in Prussia. Two young men, thinking to amuse themselves in this way, first put heavy iron hooks over the rails and hid nearby to see the fun. The engine shoved these hooks several hundred feet before it was stopped, but did not leave the track. Then they put a number of rails across the track in front of another train, and again the engine was stopped after shoving them some distance. The men were caught, brought to a confession, tried and sentenced to six years in prison—and we may be pretty sure that they will not be pardoned within a year or two.

§Railroad Gazette, Jan. 30, 1903, p. 82.

The Railroads of Canada.

BY J. L. PAYNE,
Comptroller of Railway Statistics, Dominion of Canada.

Canadians, with a genuine appreciation of the relationship between transportation facilities and commercial expansion, find satisfaction in watching the growth of their railroad system. In public regard this question is of first importance, as the course of events has demonstrated. To the lavish appropriation of public money, and still more generous gifts of land, in aid of railroad enterprises, no objection has been offered. Federal and Provincial governments alike have opened their treasuries to the owners of charters, while municipalities all over the Dominion have cheerfully assumed heavy debenture liabilities in order to provide the wherewithal for railroad construction. No other people under the sun have done as much to help themselves in this respect as have the sturdy citizens of this northland; and in thus proceeding they have been nudged as much by the stern call of necessity as by the instincts of optimism.

The extent to which our railroads have grown may be gathered from the following statement of mileage in five-year periods:

1863	2,189	1888	12,585
1868	2,270	1893	15,005
1873	3,832	1898	16,870
1878	6,226	1903	18,988
1883	9,577	1907	22,452

For the year ended June 30, 1907, the addition of 1,099 miles must be regarded as satisfactory, in view of prevailing conditions. Scarcity and cost of labor, coupled with swelling prices for supplies, have retarded construction very seriously. For example, the new Grand Trunk Pacific three years ago estimated the cost of their prairie section at $17,500 per mile; it actually cost them during the past year from $22,000 to $23,400 per mile. They were required to pay 50 per cent. more for labor and 100 per cent. more for supplies. The same influences are restraining projectors and contractors generally throughout the Dominion. In this land of forests ties are now costing from 75 to 90 cents each in the West, as compared with 20 to 25 cents when the Canadian Pacific was built in the early eighties.

Over and above the 1,099 miles referred to in the preceding paragraph 324 miles of second track were laid down during 1907. This is practically encouraging. It brings the double track mileage up to 1,067 miles, and completes a total of 27,611 miles of all tracks in Canada. Ontario heads the list with 7,638 miles of line, Quebec has 3,074, and the Western Provinces which were without a single road in 1883, have 8,198 miles. In fact, the Dominion, by one vital test, is the best served country in the world in respect of railroads. With a population of 6,500,000, she has one mile of railroad to every 289 persons, as compared with 381 in the United States, 1,821 in Great Britain, 1,590 in France, 686 in New South Wales, and 10,119 in India. The reverse is true, however, by the territorial measurement, for Canada has but one mile of railroad to every 161.80 square miles of her area, as against 13.61 in the United States, 5.29 in Great Britain, 8.46 in France, 146.09 in New South Wales, and 61.09 in India. These figures will, of course, be materially altered when the 3,500 miles of line now building in Canada are completed.

The 22,452 miles of railroad in Canada represent a capitalization of $1,171,937,808, divided into $588,568,591 of stocks and $583,369,217 of funded debt. This sum is the equivalent of $53,117 per mile, as compared with $65,926 in the United States, and $273,437 in Great Britain. The railroads of Australasia and India are owned by the government, and cannot therefore be compared on the capitalization basis; but the fact that those at the Antipodes cost $63,100 per mile, and those in India, although more than half of narrow gage, $56,800 per mile, would seem to make the Canadian showing relatively satisfactory. Net earnings of $42,989,537 last year yielded 3.67 per cent. on the total capitalization, although the actual results as applied to all the principal railroads were much more favorable. Hundreds of millions included in the statement never have earned, nor never will earn, a penny of dividend. It must also be remembered that Canada has 1,815 miles of line, built, owned and operated by government, the capital cost of which, amounting to $100,958,402, is not included in the figures given above.

In dealing with this question of capitalization, the element of aid assumes an important place. As has been said, no other people in the world have been so generous in this regard. In subventions and land grants the contributions have been as follows:

Dominion Government	$128,827,649
Provincial Governments	35,123,131
Municipalities	17,316,633
Dominion lands	31,762,954 acres
Provincial lands	20,420,109 "

Here is a total of $181,298,412 in money and 52,183,063 acres of land, quite apart from the cost of government-operated railroads. The cash payments alone amounted to $8,074.93 per mile for the total mileage of Canada, and are over and above guarantees of interest on possibly $100,000,000 of bonds. In 1882 the policy of giving a subsidy of $3,200 per mile to railroads was adopted by the Dominion Government, and in 1898, as an encouragement to the construction of high-class lines, this was increased to a maximum of $6,400, on a basis of half the cost over $15,000 per mile up to $21,400. This was not, however, the commencement of the giving of aid. The $3,200 was in 1882 taken to be the cost of steel rails per mile, and was adopted as a general measure of assistance to practically all new roads, but without any definite policy many millions had been appropriated in preceding years. Time will probably demonstrate, however, that the granting of from 7,000 to 10,000 acres per mile to lines in the West was the more valuable subvention. The experience of the Canadian Pacific leads to this conclusion. This line was in 1881 given $25,000,000 in cash, 25,000,000 acres of land, and the mileage which had been built in the West by government at a cost of $62,785,319. In 1886 the bargain was modified by taking back 6,793,014 acres of land and substituting $10,189,521 additional in cash. This left the company with 18,206,986 acres of land, which amount it has added to very largely by the purchase of charters from other companies. The Canadian Pacific commenced by selling land at $1.50 per acre; but as settlement progressed this price was increased year by year, until last year it reached an average of $7.15. The company still has approximately 16,000,000 acres for sale, and, with settlers coming into the West at the rate of 200,000 a year, it will be seen that these land holdings, in a rising market, must eventually yield an enormous sum—probably sufficient to pay their total funded liability.

It cannot be assumed, however, that the policy of granting liberal subsidies toward railroad construction will continue indefinitely. Much as Canadians feel the need of transportation facilities, and freely as they approve what has been done to meet that need, there is a growing conviction that the time must be near at hand when the government should close the till against further payments. This judgment is accentuated by the fact that the railroad bill is only part of the total. Canals have cost $92,000,000, and a proposition is now before Parliament for the construction of a waterway between the Georgian bay and Montreal involving probably $150,000,000 more. The cost of administering the present canal system of the Dominion is $1,000,000 per annum. The government, too, is engaged in building 1,800 miles of the new transcontinental railroad through a different country, and when that work is completed another $100,000,000 will likely be added to the gross capital outlay; so that, resourceful as the country may be, the fixing of limitations for the future will soon be imperative.

The total earnings of Canadian railroads for the year ended June 30 last amounted to $146,738,214, which, after deducting $103,748,672 for operating expenses, left a net balance of $42,989,537. Gross earnings have grown more rapidly than has mileage, as the following statement shows:

1882	$29,027,789	1897	$52,[illegible]278
1887	38,841,609	1902	83,666,503
1892	51,685,768	1907	146,738,214

Thus, while the betterment between 1882 and 1892 was 78.0 per cent., it was equal to 180.3 per cent. for the latter decade. Perhaps no other test of growth could be so comprehensive. Certainly no other country within the same period has done quite as well. To make up that amount $95,738,079 was received from freight service, and $45,730,652 from passenger service. Other sources contributed $5,269,483. The proportion of operating expenses to earnings was 70.70, a relative increase over 1906 of 1.2 per cent. Canadian railroads have not fared differently from American railroads during recent years in realizing a steady encroachment on their net earning power. Higher wages and ever-increasing prices for supplies have been the chief influences in this movement.

A summary of items growing out of the results of operation for the year is as follows:

Tons of freight carried	6[illegible],866,1[illegible]5
Passengers carried	32,137,319
Earnings per ton	$1.472
" " passenger	1.423
" " mile of railroad	6,5[illegible]64
" " train mile	1.953
" " passenger per mile	2.083 cents
" " ton per mile	.702 of 1 cent
" " freight train mile	$2.216
" " passenger train mile	1.513
Passengers carried one mile	2,049,549,813
Tons hauled one mile	11,687,711,8[illegible]
Average journey per passenger miles	64
Average freight haul, miles	18[illegible]
Passenger train mileage	[illegible]0,220,461
Freight train mileage	[illegible]
Total train mileage	75,115,765
Locomotive mileage	100,151,966
Average cost, one mile, all trains	$1.24
Fuel consumed by locomotives, tons	5,6[illegible]8,951

In connection with the rate of .702 cent per ton per mile a word or two of explanation is called for. This was the first year in which specific information was gathered of this nature under the schedules and classifications of the Interstate Commerce Commission adopted by Canada in 1906, and the returns in some instances were obviously too high. There are about 70 strictly commercial operating lines in Canada and some of these in the West, with a low mileage, have exceedingly high rates. The average of these western roads was 12.352 cents per ton. Including these, the average of all lines was 3.655 cents; while 59 roads showed a rate of 2.328. The average, however, for the railroads which hauled 75 per cent. of all the freight was .702 cent. The rate for the Dominion Government railroad system was the lowest returned—.584—on a total of 3,695,611 tons hauled. The average of United States railroads for 1906 was .718.

The operating expenses for the year were, as has been said, $103,718,677, divided as follows:

Maintenance of way and structures	$20,887,092
Maintenance of equipment	21,666,373
Conducting transportation	57,325,543
General expenses	3,869,669

Owing to important changes in classification these figures can not be compared with those of preceding years.

The average operating expenses per train-mile have increased within the decade from .772 to $1.249, but the gross earnings, which had grown from $1.178 to $1.953 within the same period, more than met this advance. In other words, while the operating charges went ahead by 60.5 per cent., the earnings showed a betterment of 65.8 per cent. This result was due almost wholly to higher traction power, heavier units and road improvements. Earnings per mile of line, amounting to $6,536, were considerably below the $10,460 returned for the United States in 1906, while the comparison of operating expenses was as $4,621 is to $6,912. This reveals a difference in favor of American net results as between 51.3 and 41.4 per cent.; but the measure of growth on the Canadian side has been quite as large as on the other.

An agitation has been begun in Canada for the reduction of passenger rates to 2 cents per mile. The question is now before Parliament, although the sentiment behind the movement is not as yet strong. Hitherto the average revenue per passenger per mile has not been available; but, under the new statistical reorganization applied in 1906, the rate is found to be 2.083 cents. This is but a trifle above the rate of 2.002 which obtained in the United States last year. At the present time the standard ticket charge in Canada is 3 cents per mile with a return rate of 5 cents. There are no 2-cent rates on any of the railroads. The fact, however, that the average passenger journey in Canada was 64 miles, as compared with 30 miles in the United States last year, shows a low proportion of suburban traffic. In the Colony of Victoria—which is typical of all British colonies south of the equator—with a population of 1,200,000, the number of passengers carried was 65,000,000, as against 32,000,000 in Canada; but the average journey was slightly over six miles, revealing a very large suburban business. It is this class of travel which also swells the British returns. So that, having regard to the railroad situation in Canada, a 2 cent rate would practically mean a reduction at least of 20 per cent. in the earnings from passenger service, and it is scarcely likely Parliament will be disposed to impose such a heavy tax on the railroads. This agitation, however, demonstrates the hostile feeling which is steadily, although in large measure unreasonably, gaining force against corporate interests.

For several years past complaints with respect to the available car supply of the Dominion have been persistently made. The Railway Commission has been fairly obsessed by the clamor from shippers, Boards of Trade and other bodies. To laymen the matter, of course, has always appeared simple and the remedy easy of application. "The railroads should buy more locomotives and cars," they say. In this situation special inquiries were made under my direction to ascertain what would be the number of cars obtainable if all the car shops in the country were run at their full capacity. The answers were complete. They showed the annual producing capacity of all the plants, whether owned by railroads or private corporations, to be 227 locomotives, 9,994 box cars, 212 stock cars, 2,221 flat cars, 113 vans, 37 refrigerators, 134 first class cars, 14 second class cars, 44 sleepers, 83 combination cars, 756 other cars for freight purposes and 122 other cars for passenger service—a total of 227 locomotives, 14,333 freight and 397 passenger cars. In 1906 there were 99,884 cars of all classes in use on Canadian railroads, of which 96,565 were in the freight service and 3,319 in the passenger service. On June 30, 1907, the account stood: Freight cars 113,418, and passenger cars 3,632—an increase in the former of 16,853, and in the latter of 313. With regard to locomotives, the number had increased from 2,911 to 3,499. In all these classes of equipment it will be observed that the betterment was beyond the actual number turned out of Canadian shops during the year. A bare 41 locomotives and 155 box and flat cars had been imported from the United States, which were probably all that could be had from that source. The explanation probably lies in too low a return in 1906, and a full accounting under the new schedules.

There is, however, another phase to the matter. Just how many cars were put out of commission during the year could not be ascertained. The railroads fought shy of that question. On an equipment of 99,884 cars in 1906 what should have been the normal depreciation? In trying to determine this important point I soon found that there was a wide divergence of opinion. The estimate of the Master Car Builders' Association is alleged to be too low; it probably is. But who can say what is the life of a freight car? Until the principal railroads join in an honest effort to follow the history of a given group of cars on each system, and something like the actuarial work of insurance companies is applied to this problem, the whole question will remain in the field of conjecture. No value can be attached to the displacements which take place year by year, having regard to the changing character of the units.

Be this as it may, it is apparent from the figures given above that our Canadian railroads did all that was possible to meet the demand for more cars. They bought or built every car that could be turned out in Canada, and probably imported as many more as could be had from United States shops already working under pressure. Yet they were short. The total supply for the year was equal to but 5,218 freight cars per 1,000 miles of railroad, as compared with 8,810 on American railroads. By the same test, the number of locomotives on this side of the line was 156, as against 232 on the other. This shortage of equipment arose from a variety of causes. The increase in freight tonnage, the addition to the mileage in operation, plus the rolling stock put out of commission, combined to keep the railroads in despair notwithstanding the fresh supplies brought in during the year. Producing plants are being increased; but with the growth of railroads and traffic it is doubtful if more locomotives and cars will entirely solve the difficulty. To these agencies must be joined more double tracks, more yard room and increased terminal and siding facilities.

The public side, however, cannot be ignored. Shippers have not added to their warehouse accommodation to the extent of trade expansion. Delays are constant from this cause. Last year the average volume carried per freight car was 594 tons, as against 888 in the United States, clearly demonstrating that our railroads have not obtained the maximum of service from their car supply. These hindrances have been aggravated by an element which does not exist in the United States. Just when Canadian railroads were distracted by the appeals for rolling stock the Lord's Day Act came into operation, practically stopping all traffic on Sunday. I shall not guess at its effect in limiting the movements of trains. The Assistant Traffic Officer of the Railway Commission spent months in studying the matter, and he has officially declared that it has reduced the carrying capabilities of the Canadian Pacific by 21 per cent. That estimate no doubt fits to all lines. Then in the West the Manitoba Grain Act has borne very severely on the railroads by its arbitrary provisions with respect to the distribution of cars, and to protect themselves from heavy penalties the C. P. R., in particular, has had to skimp the East. So that, taken altogether, the car supply problem is not likely soon to be solved in Canada.

During 1907 the number of railroad employees in Canada and their rates of remuneration were ascertained. Even the census had systematically disregarded this important matter. The results are most instructive. Altogether 124,012 persons were employed, and the aggregate compensation was $58,719,493. This sum was equal to 58 per cent. of the operating expenses, and a careful estimate of the relationship of employees to population makes it clear that probably one person in six obtains a livelihood, directly or indirectly, out of the transportation interests of the country. In this calculation shipping is, of course, included, together with all collateral industries.

The accident record for the year is both alarming and distressing. Altogether, 587 persons were killed and 1,698 injured, both numbers being the highest in our railroad experience. The division of the total is as follows: Passengers, 70 killed and 352 injured; employees, 249 killed and 1,126 injured; trespassers, 195 killed and 125 injured; non-trespassers, 70 killed and 88 injured; postal clerks, three killed and seven injured. One passenger in every 459,105 carried was killed, and one in every 91,290 injured. Relatively, there have been two worse years by a small percentage; but the tendency has been steadily in the direction of an annually longer casualty list. Trainmen were killed at the rate of one in 137, and injured in the proportion of one in every 26. This is considerably below the United States record for 1906; but measured by train mileage the Canadian showing is the darker. One or two features of the year's returns are surprising. For example, with the universal application of the automatic coupler and the air-brake two or three times as many trainmen were killed while coupling cars, and by falling from trains, as in the days of the link and pin and old hand-brake. The level crossing cost 69 lives, and the broken rail was much in evidence among the causes of accidents. Collisions and derailments involved the sacrifice of 108 persons, and the injuring of 439 others.

The railroad situation in Canada at this juncture is particularly interesting. The Canadian Pacific has spanned the continent, the Canadian Northern has pushed its western terminus to the Rocky Mountains, and the Grand Trunk Pacific is under construction from ocean to ocean. All this outlay and effort has in view the new Canadian commonwealth which is springing up in the far West, and which during the past year has grown in population at the rate of 700 souls per day as the result of a swelling tide of immigration. Nearly 60,000 settlers came over from the United States during the twelve-month. The peopling of the prairies with producers creates almost at once an urgent need for additional transportation facilities. These newcomers must have the manufactures of the East, and they must at the same time have an outlet for their pastoral products. In view of these conditions, the Grand Trunk Pacific has made strenuous efforts to complete its central section from Lake Superior to Edmonton. In October last part of that line was opened for grain traffic, and before another harvest has been reaped it will probably have 800 miles in full operation through the center of the great wheat belt. This will mean practically three trans-continental roads in close competition in the West, and before another five years have passed that section of the Dominion, which until 1882 had not heard the whistle of even a construction locomotive, will have more than half the railroad mileage of the country. Out of this development has come a marvelous stimulation to industrial life in the older provinces, and to it are attached the larger hopes of the Canadian people.

At least one enterprising American has made extensive plans to reach out for a share of this new Canadian traffic. James J. Hill has already pushed eight lines connected with the Great Northern system across the boundary, representing a total of 388 miles within the Dominion. He has done this wholly without aid from the government, and at considerable cost. These encroachments are naturally resented by Canadian railroad interests, and rumors of a retaliatory invasion of Great Northern territory are being given currency. Meanwhile, the people of the West are not saying nasty things to Mr. Hill. But just what may be his ultimate ambition cannot very well be guessed from the somewhat seattered nature of his existing enterprises on Canadian soil. Whatever it may be, he at least has the example before him of many United States lines doing business in eastern Canada. The New York Central, the Michigan Central, the Wabash, the Maine Central, the Boston & Maine, the Vermont Central and the Pere Marquette have lines and connections in Ontario, Quebec and the Maritime Provinces, with a considerable passenger and freight traffic. It is to the future they are shrewdly looking, and in that prospect the citizens of Canada are just beginning to discern the measure of their great heritage.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

III.

*The Origin of the Common Carrier on the Sea.**

The year 1815 brought peace in Europe and America, and what was of particular importance, peace upon the Atlantic. Commerce, freed from the risks of war and increased to greater dimensions than ever before, was now in every respect ready for organized transportation by lines of vessels performing the service of common carriers. The speedy American vessels, built for privateers and with occupation gone, were well suited for this new service, to which they were now turned. Promptly after the peace of December, 1815, a line was established between New York and Liverpool. Others quickly followed. Boston and Philadelphia were soon included. These new lines of sailing packets carried passengers, the mails and valuable freight, and from that time to the present we have had a steady development in the extent, efficiency, permanency, and regularity of line service across the North Atlantic Ocean.

The first line, the famous Black Ball Line of 1816, was founded by Isaac Wright & Son, Chas. H. Marshall and others. Their vessels, of 400 to 500 tons burden, were considered very large and fine and sailed regularly on the first of each month from New York to Liverpool. For the first nine years the average time to Liverpool was 23 days, with a record of 15 days and 18 hours, and the return voyage against the North Atlantic winds averaged 40 days. A second Liverpool line, the Red Star, was founded in 1821 by Byrnes, Grimble & Co., with a monthly sailing day on the 24th. The now prosperous Black Ball Line met this rivalry with enough new ships to despatch one on the 16th. Promptly thereafter the interval in the weekly calendar was filled by the Swallow Tail Line (Thaddeus Phelps & Co. and Fish, Grennell & Co.), which had its sailing day on the 8th, and for the first time New York had the advantage of a weekly packet to Liverpool.

In 1821 Thomas P. Cope & Son, of Philadelphia, merchants, who had for 14 years been in the Liverpool shipping trade, established a packet line from their city to Liverpool, which was sustained through all circumstances. For nearly half a century this was a famous line, and for many years it was Philadelphia's only line.

In 1823 the proprietors of the Swallow Tail Line from New York to Liverpool established a line of packets from New York to London, which survived until about 1870. The founding of this first line of London packets resulted in a second line being founded about the same time by John Griswold (later E. E. Morgan's line).

"About" 1822 the first line was sent to Havre by Francis Depau, and ten years later William Whitlock started the third, the second having been established somewhere in the interval by Messrs. Boyd & Hincken.

The line traffic of the packet ships, now well established to Great Britain and the continent, went on increasing and prospering, new lines being established, new and better ships added, until past the middle of the century. This is the much-boasted period of American leadership upon the seas. Nearly all of our commerce was carried under our own flag and much of the commerce of other countries. We outsailed the ships of other nations and got the lion's share of the passenger traffic. The packets were the most elegant, comfortable and commodious ships afloat. A packet for London in 1823 was advertised as having a physician and a piano on board, and one enthusiastic American writer, with a mind full of details and performances of ships, declares that "in their presence the English and French trading vessels were absolutely insignificant. Their agents, builders and captains speedily became rich, for all were owners—the agent owning, say, an eighth of the vessel, the builder another eighth, in order that he might secure the job of repairing her, which cost about $500 a round trip; the captain another eighth, that he might have the strongest of all motives to vigilance and prowess, the blockmaker and the sailmaker each a sixteenth, perhaps; and the other persons the remainder, a packet of 500 tons being worth about $40,000."

These sailing ships were steadily improved and enlarged, but it is stated that the Mississippi, of 750 tons, was the largest American merchant ship when she was launched in 1833. In 1843 there was a marked increase in size, and in 1846 the New World held the size record and was regarded as a wonder with her 1,400 tons. In 1854 the two Morgan liners, "Palestine" and "Amazon," reached the highwater mark of 1,800 tons. In that year one of these ships put her passengers in London two days ahead of the Cunard Line steamer, having landed them at Portsmouth on the 14th day out from New York. This 14-day record for the packet ships was an unusual, though repeated, occurrence.

The New York packet service to Europe greatly stimulated the coasting trade. In addition to having the local market, the coasting vessel had the surety of being able to forward goods to Europe by the packets, proceeding at regular intervals. Goods came from New Orleans, Charleston, Baltimore, Philadelphia and Boston to be forwarded. The development of coasting lines was the next natural step. In 1818, two years after the origin of the packet service, there was a line of 180-ton sloops running from Boston to New York. There is mention of a "regular packet" to Charleston in 1825. In 1832, E. K. Collins established a line of full-rigged packets to Vera Cruz. The prompt success of this line caused him to send a schooner line to Tampico, and in 1832 the first regular line of packets to New Orleans.

No one should let this account of the packet lines create the impression that the era of the merchant carrier with his individual ship was at an end. The packet lines were limited to the North Atlantic and to the trade of a few ports in America with a few ports in Europe. The long-distance trade of all the rest of the world went on as of yore, while line traffic grew and improved in the one little corner of the world's ocean that separated the commercial metropoli of Europe and North America.

It is rather remarkable that this period of the origin of line traffic should have been also the period of the greatest brilliance in the whole history of single ship enterprise. Yet such was truly the case, through the fame that attended the clipper ship era from 1840 to 1855. The clipper was among tramps what the packet was among liners. The trade with India and China, and later with California, was over routes so prodigiously long, that line traffic was practically impossible, but speed was none the less desirable. So the clipper, profiting by all the experience of the packets, was built, long, sharp and narrow, with every possible regard for speed, so that she might distance all rivals in the race for the ports of the Antipodes. This speed was particularly valuable, because the English tea purchasers coveted the first new teas, and there was an annual tea ship race to get the new crop to the British market. The captain of the ship carrying the first cargo was in an exceedingly fortunate position, because he could sell it out at a fancy price, yielding an exorbitant profit. The time of tea harvest in South China saw annually a fleet of vessels there waiting for the chance to hasten away with the first cargo. This fleet of clippers was largely American, because in the preceding thirty years it had been so repeatedly demonstrated that no other ships were so fast. In 1853, the little clipper "Architect," built in Baltimore, won distinction by placing her tea in London in 107 days from Canton and getting her whole cargo sold before any of the British fleet arrived. The "Architect" took scrap iron to New York and there loaded flour and cotton goods for China. Her next tea voyage showed the value of a speed record, for she was at once chartered to take tea to London for £8 per ton, while the English vessels were glad to get £3 or £4 per ton.

The first of the clippers to demonstrate the differentially high value of speed was the "Rainbow," 750 tons, of 1843. She was quickly copied by the leading merchants of the day, but they rather

*References: Harper's Magazine, Vol. 68, p. 217; Scharff & Westcott, History of Philadelphia, Vol. 3, p. 2,216; Harper's Magazine, Jan. 1884, Feb. 1892; Quarterly Review, Vol. 62, p. 207; Hunt's Merchants' Magazine, 1840, British Admiralty.

overdid the matter of speed, for many of these vessels were so light that they were easily strained and the repair bill cut into profits. Then came fast clippers of greater strength and size, reaching up to and passing 2,000 tons. One of these larger vessels, the "Comet," made the record voyage from New York to San Francisco in 76 days and the "Flying Cloud" made the San Francisco-New York voyage in the astonishing time of 84 days, breaking all records.

In 1851 the "Dreadnought" reached Sandy Hook from Liverpool the same day that the Cunarder reached Boston, and the Cunarder had started one day earlier than the clipper.

The "Sea Witch" was another of these famous ships, which netted her owners $50,000 above all expenses by the freights earned on the voyage from New York to London via San Francisco and Canton. In 1852, 157 vessels arrived at San Francisco, and of these 70 were clippers.

These clippers were often owned by the leading merchants of the period, and they brought a world renown to the American sailor and the American flag, which the Americans of that day enjoyed to the fullest and which the historians of the present make the most of.

The change in the names of the ships from 1815 to 1850 is suggestive of the changed spirit of the men of the time. At first, as they crept out from under the right of search, their ships were named "Hope," "Endeavor," "Perseverance," "Traveler," etc. Then came a period when the names of merchants and captains were commemorated, and lastly came the confidence of triumph, and the ship was named "Challenge," "Invincible," "Flying Cloud," "Sovereign of the Seas."

Several causes contribute to this double triumph in both branches of ocean carrying. It is all included by saying that it was a superior class of men commanding and manning a superior class of ships. This period was dominated by the men who went to sea or went to the counting room in the period preceding the peace of 1815. Most of these men came from New England, where the opportunities for employment were not numerous. The Great West was a wilderness unapproachable by any except those who chose the emigrant wagon and the life of the frontier farmer, whose opportunities for marketing produce were exceedingly meager. Other than this the young men could go to town or go to sea, and they did both. Young men of parts, of family and of education went to sea in those days and began before the mast. The quarter century preceding the peace of 1815 was a time when the risks and prizes of the sea trade were a particular temptation to a lad of courageous, hardy and venturous equipment. Combining this with stagnation at home, we have a reason why some of the ablest men in America should be found dispatching ships and striding the deck between 1820 and 1860. The New England whaler was a schoolship of the most efficient sort for the graduation of the sons of New England into the sea life which they helped to elevate to its most distinguished epoch.

Harried by privateers, pirates, hostile navies and British captains exercising the right of search, the American ship had come to beat the world at running away, and hence was the fastest thing on the surface of the salt sea. The good American sailor had a good ship. The merchants of the day had also often come to the counting house after having risen to the command of ships. With such men having such experience, the era of packets and clippers was natural. There are occasional records of whole crews on an American ship in which all but two or three of the men could perform feats of navigation only known to the officers of foreign ships.

In 1880, with possibilities of safety considerably advanced, insurance rates on the same kind of vessel had gone down 50 per cent., a direct measure of efficiency of navigation.

The captain of a packet or clipper was a man of more financial and social importance than is now to be found on the ships of peace. He was absolute master of the ship and all on board. The engineer on some great steamer lines is not responsible to the captain. The captain of 1840 was commander, part owner, often attended to the cargo and met merchants on an equality. "His income was often $5,000 a year, consisting of 5 per cent. of all of the freight money, 5 per cent. of all the steerage passage money, 25 per cent. of all the cabin passage money, the entire receipt from the carriage of the mails, two pence a letter from the British Government, and two cents a letter from the American Government and a salary of $360 per annum, and, moreover, he had the privilege of taking his wife and sometimes even her sister, board free."

Forty years later the steamship lines had driven these noble old captains and their ships from the sea, but the steamer captain had not secured his emoluments. The captains of the Hamburg and Bremen liners received $1,200 per year and the Cunard commodore got only $2,500.

The lines, firms and shipping enterprises of the period from 1815 to 1850 grew up naturally and gradually as is the case with nearly all great enterprises. The inception of the famous and record-breaking Collins Line is due to the energy of E. K. Collins, whose career is typical of the period. He was born in 1802, the son of a sea captain. He was reared on Cape Cod, and at 15 was a clerk in a New York store. At 20 he was a supercargo, sharing the profits of voyages to the West Indies and testing his nerves in shipwreck and pirate fray. At 23 he became partner with his father in mercantile business in New York. One day a returning Liverpool packet reported a phenomenal rise in the price of cotton. Straightaway the speculators bought all they could find and engaged passage to Charleston on the packet which departed that afternoon. A rival syndicate was formed to try for this Charleston prize. Their representative was the young Collins, now 23, who much to the merriment of the speculators on the packet crossed the bar beside them in a pilot boat. But he had been down that coast before, and his shallow draught boat followed inshore passages and when the New York packet crossed the Charleston bar young Collins was sailing out, master of all the cotton in Charleston and on adjacent rivers. His fortune was half made and the next year he married an heiress. Four years later he established a line of full rigged packets to Vera Cruz, then a line of schooners to Tampico, and in 1832 he established the first packet service to New Orleans.

He knew enough about ship building to introduce some new designs for the New Orleans packets, and when in 1835 he sent his "Shakespeare" to Liverpool she created so much interest that she had to decline three times as many passengers as she could carry. Mr. Collins took the hint from this profitable and auspicious voyage and founded the Dramatic packet line to Liverpool.

But scarcely had he got his transatlantic line running when in 1838 the British steamers, "Sirius" and "Great Western," successfully and profitably crossed the Atlantic and were followed by others. In 1840 Mr. Collins is reported to have said, "There is no longer chance for enterprise with sails. It is steam that must win the day. I will build steamers that shall make the passage from New York to Europe in 10 days and less." It took him 10 years to keep this promise, but he did it.

These glowing accounts of success and speed of the sailing vessel are not the whole story. The best sailing ships in the world sometimes had their exceedingly great difficulties in the perverse winds of the Atlantic. There is an account of a vessel that made 5,000 miles and crossed the Gulf Stream three times on the 3,050-mile route between Liverpool and New York. The bark "Ellen," 103 days from Leghorn, hoisted her flag at Sandy Hook and was then driven off to sea for another month with her crew subsisting on macaroni and sweet oil. In February, 1837, the British ship "Diamond," 100 days from Liverpool, reached New York with 163 passengers, having lost 17 from plain old starvation. The packet record for tedium from Liverpool to New York was 110 days. Truly the passenger on such voyages needed many resources for entertaining himself.

These extremes of slowness, like the extremes of speed, should be compared with the average performances of the packet ships. New York to Liverpool, Liverpool to New York.

	Days: New York to Liverpool.	Days: Liverpool to New York.
10 year average, 1829-39	21	36
1 year average, 1839	22½	[illegible]
Record voyages for 1839	18	22
Average of the two new steamship lines, 1838-39	13	

The era of the prosperous and triumphant clipper ships was short-lived; 1855 may be put down as the last year of their heydey. A few years before a Yankee offer of $20,000 on a race from Canton had had no takers, but in 1855 a British clipper won a notable race from the East. In 1856 the Panama Railroad was completed and thereby a great prop was knocked from clipper ship prosperity. California trade had been one of its main standbys. Linked in with the China trade the clipper ship made fine voyages round the world. By our coasting trade reservation the Atlantic coast trade to California was an American monopoly. But here came the Panama Railroad joining its steam wagons with the steamers that came down from San Francisco on one coast and went up from Colon to New York on the other, cutting into the clippers' boom of prosperity with a mercilessly quick and regular connection between New York and San Francisco. Eighteen hundred and fifty-six was a black year in shipping rates and a blacker year in the almost abandoned ship yards. The next year brought the panic of 1857 and four years later came the Civil War and the clipper had descended to the inconspicuous common place.

The downfall of the packets was less sudden in that it was a gradual decline spread over a period of 30 years from 1840 to 1870.

The first successful crossing of the Atlantic by steamer was really the doom but by no means the cause of immediate death of the packet ships, despite the graphic journal entry of a passenger on one of the "Black Ball" packets as the "Great Western" overhauled and passed her on this maiden trip to New York: "Then (the steamer) dashing ahead * * * the brave old 'liner' (packet) is no more seen. Her owners will scarcely know her when she reaches port at last. She brings no news. She will soon bear no letters, no species. Nobody will watch for her, nor speak of her, alas! her day is gone by. Who can think of her suffering without a sigh?"

But the steamer did not do all this suddenly. Her struggle upward was slow and painful. In five years after the "Clermont," the first of the steamboats run on the Hudson, 1807, the steamer had conquered the western rivers by ascending the Mississippi and opening a continent by putting lines of steamers on its rivers; but it took more than five times five years more to develop the ability to compete with packet liners on the Atlantic. In the interval the lines of steamers on short voyages and coasting voyages had far outstripped all rival sailing lines. The sailing vessel is good for the open sea, away from the impediments of coasts where sailing ships so often come to grief. The sailing vessels that carried the mail were, when winds were adverse, sometimes many days in making a hundred miles between some British and some continental port. In 1815 a 63-ft. steamer passed from the Clyde to the Thames—the first to be upon that river. Other voyages were soon made and the fitness for coasting service was observed.

The action of the British government concerning the mail service during the decades 1820-40 throws interesting light upon the efficiency of the new lines of sailing vessels and the limitations of their service in competition with steamers on short voyages. About 1820 it was found that steam vessels could satisfactorily carry the mail from Great Britain to the continent of Europe. But there were no private owners in a position to do this work, and from 1822 to 1851 the British government provided its own steamers, the mails being carried in vessels owned and operated entirely by the British government upon regular service, carrying some freight in addition to the mails.

When the government began this service private enterprise in shipping lines was at a low ebb, but it soon seized the new tool for the development of common carriers and the coasting trade is thus glowingly described by a writer in the *Quarterly Review* of 1838 (Vol. 62, page 188):

"There are at this hour scarcely two ports in the United Kingdom of any consideration between which steamers do not regularly ply. In 1818 the most sanguine never dreamed of their being available for much more than inland navigation, with here and there a little circumspect sallying out and skirmishing along the curves of the coast something after the style of the ancients. * * * Who would have believed that by this medium would be maintained our regular communication with all the neighboring ports of the continent and through them with Europe at large?—that every week at least, in some cases daily, London boats would be visiting Hamburg, Holland, Belgium, the French coast, Lisbon and Cadiz?"

At this time the steam coasting service that had survived upon the American coast was limited to Long Island Sound, although in 1818-20 a steamer had made several trips from New York to New Orleans via Charleston and Havana. There had also been some other isolated voyages, but all were of small significance.

During this 20 years, 1818-1838, when the steamer line had been proving itself in the English coasting, continental trade and upon the American rivers and lakes, there had been various sporadic and unsuccessful attempts at long ocean service. The famous voyage of the "Savannah" to Liverpool was not a commercial success, nor was the ship steam-driven all the way. In 1825 a steamer with auxiliary sails went from England to India, but she stayed in the Indian service. In 1830 one went to Australia, but instead of being the founder of a line, she was a heavy loss to her owners. In the late twenties a steamer made a few trips from Europe to Guiana, but she soon stopped and no others followed.

The occurrences of 1838, however, showed that after all of these experiments the steamer was at last ripe for the Atlantic trade. In that year the transatlantic steamer proved itself to the satisfaction of business men and even of the conservative British government. Since 1833 Junius Smith, an American merchant in London, had been laboring on the scheme and finally his company, the British & American Steam Navigation Company, succeeded in landing a steamer in New York from Portsmouth, England, on April 23, 1838, the same day that the Great Western Steamship Company landed the steamer "Great Western" from Bristol. The people of New York went into transports of joy. Later in the year the Transatlantic Steamship Company of Liverpool also sent a steamer to New York, but despite this auspicious start for the record-making year these new steamship companies were not yet able to give a line service of the regularity afforded by the weekly packets.

During 1838-39 their service was irregular, some of them being taken off entirely during the winter. In the words of a writer in *Chambers Journal* (15, 390): "From the absence of method in the departure of the several steamers arising principally, perhaps from the rivalry and non-accommodating spirit more or less characteristic of all competing companies, there was a wanting that faultless regularity in the despatch or receipt of intelligence, which, whether in matters of politics or commercial information, is of the first importance."

The British government also recognized this along with the fact that the steamer was capable of regular line service, and in October, 1838, six months after the crossing of the "Sirius" and "Great Western," advertised for bids for a fortnightly steam service from Liverpool to the United States via Halifax. The bid of the Cunard Company, of Halifax and Liverpool, at about $15,000 per voyage was accepted, and on the fourth of July, 1840, the "Brittaina," a wooden paddlewheel steamer of eight knots per hour, sailed under this contract from Liverpool for Boston, via Halifax. This is the date of the founding of line traffic by steamer across the Atlantic following a regularly maintained schedule that survived in winter and summer and calm and storm.

It should be noted that the introduction of steam made no revolution in the form of service by ocean carriers. It simply gave a new and improved tool for the old work. The line traffic was already established and the Cunards, with their steamers, merely substituted the new type of vessel in the North Atlantic service. It was merely a better line, that was all. The packet lines had taken the passengers, mail and fast freight from the occasional sailing vessel. Now the steamer, faster than the packet, took from it the mail and the freight and the passengers possessing the highest ability to pay.

From that day to this there has been nothing new in the sea service except continuous and rapid improvement of the then existing services and the substitution of new types of vessels for the obsolete.

(To be continued.)

The Era of Steel and the Passing of Wood in Car Construction.*

BY ARTHUR M. WAITT.

The standards of 10 or 15 years ago are considered entirely insufficient and unsatisfactory to meet the demands of the public and the increased business of the present time, and the track, bridges, stations, terminal and transfer yards, locomotives and cars of many of our progressive trunk lines have been almost entirely replaced. It is the purpose of this paper to consider, somewhat briefly, the progress and changes which we see to-day in car construction, especially in the United States and Canada.

There are those living who have seen the development in car construction from a car which, aside from the wheels, axles, journal box and bearings, center plates and couplers, and the necessary rods and bolts for tieing the structure together, was composed almost exclusively of wood, these cars being built to carry a load of only 10 tons. From this very primitive car to the modern one of almost exclusively metal construction, development has been rapid, and yet only by gradual steps. The modern steel car was not created full-fledged and perfect by the mind of a god as was the goddess Minerva by the power of Jupiter; it has been developed by the plodding, persistent study and work of the human minds and human hands of the master car builders, whose ruling motto was, "To do with their might whatsoever their hands found to do." The substitution of metal for wood came gradually, necessitated by the rapid wear and frequent breakage in service of parts too weak for the duty demanded of them.

John Kirby formerly General Master Car Builder of the Lake Shore & Michigan Southern, who is probably the oldest living representative of American master car builders and who has been largely responsible for the highest development of the American wooden freight car, stated to the writer that his first knowledge of metal car construction in this country was in 1853, when the New York Central had a few hundred box cars made principally of metal, although the body bolsters, inside sheathing, floor and roof boards were of wood. These cars gave fairly good service for a few years, but corrosion took place just above the sill line in the outer metal covering, and considerable patching was required; nevertheless, they continued in use many years. As early as 1860, Mr. Kirby put in passenger car service the cast-iron brake-head and shoe as a substitute for the wooden block and the wooden block with an iron lining, again, in 1868, he designed and put in service the double, metal body bolster as a superior substitute for the old wooden bolster.

So far as the writer can learn, the earliest metal cars used in this country were a large number of four-wheel iron cars built by the Baltimore & Ohio prior to 1853. These were built for carrying coal, and were in constant use for that service up to the time that all four-wheel cars were discarded from service, which was some 20 years ago. In 1861 the Eastern of France began substituting iron sections for wood in car construction. In 1895, 34 years later, this company had over 20,000 cars with metal framing or of all metal construction. The first 50-ton pressed steel hopper bottom car built in America was exhibited at the Master Car Builders' convention at Old Point Comfort, Va., in 1897. This was the first year that modern metal cars were built in any large number in this country. They were designed and built especially for the coal and ore trade, and, though of much lighter design than cars for similar purposes constructed to-day, they have been in continuous service

*Abstract of a paper presented at the January meeting of the New York Railroad Club.

tor 10 years, and on the average show very little deterioration from service or corrosion. Steel cars in service on the Eastern of France since 1869 are said to have shown a loss of only 6 per cent. in corrosion as a result of the first 28 years of service. Only in a very few cases, and those where exceptional and unusual conditions existed, has there been publicly reported any serious deterioration of modern steel cars from excessive corrosion.

M. L. Tolmar, Chief of Shops on the Eastern of France, has, within a few years, published in the *American Engineer* an interesting series of articles in connection with the company's long experience with the metal car. Mr. Tolmar estimated that the life of cars with all metal underframing would be about 50 years, so far as the body frame is concerned. Where the upper frames are of metal, he found that these give out first, while the underframes are still good. In general, his conclusions were that the steel underframe car would have double the life of the car with a wooden underframe. Some of his further conclusions were:

"In the design of the cars the smaller the number of pieces the better. Rivets are better than bolts. Good rivets give no trouble. Cars of all steel construction should, if possible, have the inside at exposed places cleaned and repainted every three years." The use of all steel upper frames for box cars is not encouraged by Mr. Tolmar. He further says: "We have never been able to prove, even in shops where 30,000 cars a year are repaired, that damage to the frames was attributable to disappearance of rivets or the premature weakening of sections by rust." The final conclusions regarding the use of steel cars in preference to wooden ones are as follows: "First—In an enterprise or an undertaking of a transitory nature one can be content with wooden cars, which for 15 years will not involve expense greater than those of mixed or iron frames. Second—The enterprise of long duration should seek permanence in its construction at the risk of diminishing a little the benefits accruing during the earlier years, and to this end must use metal frames."

Shortly after the appearance of the first steel hopper-bottom coal cars in 1897 some very interesting comparisons were made by C. T. Schoen, designer of these original pressed-steel cars, as to the cost, life and maintenance of such cars as compared with wooden ones. Any one interested in learning the basis for the claims made in favor of the steel car at that early date can see them by referring to the *American Engineer* for February 25, 1898.

The early advocates of steel cars made a great deal of the advantage due to the lighter weight as compared with wooden cars of similar capacity. In the early days of steel car construction the additional cost as compared with wood was quite considerable. To find favor in placing the new cars on the market it was necessary to show some material offset for the added cost. In order to accomplish this by reduction in weight the earlier steel cars were made somewhat too light to stand in an entirely satisfactory manner the strains of service. In later designs this fault was gradually rectified so that the cars turned out at present are almost always fully capable of resisting the shocks in the heavy trains in which they are run, and they are standing up quite satisfactorily. With the exception of the results of collisions or accidents the steel car of to-day is for the first few years of its life nearly free from repairs other than the renewal of wearing parts, such as brake-shoes, wheels, axles and journal-bearings. The deterioration from corrosion and other causes is hardly noticeable in cars from eight to ten years old, except in a few cases where they are used under unusual and exceptional conditions. Foreign roads, as well as some American roads who have reported on the subject, have found that there is almost no cost for repairs to steel underframes in the first four years.

According to the *Railroad Gazette*, in the year 1907 there were 289,645 cars built in the United States and Canada by car building companies, and of this number 280,216 were for domestic use. About 72 per cent. of the freight cars built were of steel or steel underframe construction. This is a growth of over 400 per cent. in the proportion of steel cars as compared with the record of 1901. The capacity of the steel car works in the country has been materially increased during the past four years; at present the total available capacity for building steel cars has been increased to about 150,000 cars a year, and the total available capacity for all kinds of freight cars approximates 1,000 cars per day, which would seem to provide amply for the number of cars required yearly for some years to come.

In the statistics of freight cars ordered during 1907, it is interesting to note that, with the exception of a few built for private companies, for small railroads, or for special purposes, the great majority are of 80,000 lbs. and 100,000 lbs. capacity except for roads in the southern states, in New England and in Canada. For roads in the latter groups, many cars of 60,000 lbs. capacity are still being built.

The "passing of wood in car construction" is not only due to the greater economy in maintenance, the greater stability and efficiency and the much greater safety of the steel car, but is being forced by the scarcity of suitable lumber, as well as its rapid increase in cost. In a paper prepared by R. L. McCormick, President of the Mississippi Valley Lumber Men's Association, on "The Exhaustion of the Lumber Supply," he states: "The present stand of yellow pine in the southern states has been stated by R. A. Long in a paper read before the annual meeting of the Southern Lumber Manufacturers Association to be about 137,000,000,000 feet. For the census of 1900 the total cut of yellow pine was given as nearly 10,000,000,000 feet. These figures show that at the present rate of consumption the present stand of longleaf yellow pine will be exhausted long before a second crop could be produced." In a pamphlet published by the United States Department of Agriculture on the "Waning Hardwood Supply," the following statements are made: "The hardwood lumber cut in 1899, according to the census, was 8,634,021 thousand feet, in 1906 it had fallen to 7,315,491 thousand feet, a decrease of 15.3 per cent. That the decrease is due to diminished supply rather than to lessened demand seems to be proved beyond question. During the same period the wholesale price of various classes of hardwood lumber advanced from 25 to 65 per cent. The most notable shrinkage has been in the leading hardwoods to which the public has been long accustomed. Oak, which in 1899 furnished one-half the entire output of hardwood lumber, fell off 36.5 per cent." As to the supply of hardwood lumber in sight for wooden car construction, Mr. Hall says further: "The plain truth is that in the Appalachians, as in the other regions, the hardwood lumbermen are working upon the remnants. The supply is getting short and the end is come into sight. The largest estimate sets the figure for hardwoods at 400,000,000,000 feet. If we are using hardwoods at the rate of 25,000,000,000 feet per year this would mean a 16 years' supply. There is no hardwood supply in the far West. When the supply in the central and eastern states is gone there will be no other source to which to turn." The Norway pine supply in the United States is about exhausted. The most available substitute for yellow or Norway pine for car sills is the Oregon fir, of which there is an ample supply for many years to come; but which must necessarily be high in price as well as less suited in strength for the requirements of service for freight car framing.

There are three distinctly different theories and systems in connection with the design for steel cars, each supported by able advocates. With one system the designers endeavor to carry the load on the side sills, using the center sills for buffing only. Another school of design endeavors to distribute the load nearly equally over all the sills. This design necessitates somewhat heavier construction than the former. The third school, which has the support of several car builders, endeavors to carry the load largely on the center sills, which are made very deep (even up to 30 in.); the center sills thereby not only carry the load but are also exceptionally strong to resist buffing. With the rapid introduction of steel car framing and its permanence in future practice, it seems at this time desirable as far as possible to eliminate the present great diversity of designs; such diversity makes it impossible to keep in stock the necessary parts for interchange repairs in the shops and repair yards of the various roads in the country. Not only is it desirable to simplify and eliminate this great diversity of design, but there are also many strong arguments for working toward a body framing in freight cars, which will permit of an underframing interchangeable for box cars, gondolas and flat cars. The system of body framing which carries the load largely on the center sills seems to have a basis which will make it readily possible to have the body framing interchangeable as above suggested.

Much has been done in past years toward unifying and simplifying the design of wooden cars, and it would seem that sufficient experience has now been had with cars of all metal construction, or at least of all metal underframing, to make it desirable for the Master Car Builders' Association to take similar steps soon in regard to them. It seems perfectly feasible at this time to adopt as recommended practice, and later as standard, some rolled and pressed sections, at least in the main members of the body framing. A move in this direction would before long be felt in increased simplicity and economy in interchange repairs. It would seem even possible at this time to adopt standards in lengths and widths for steel box, gondolas and flat cars, and then as a natural sequence many standard shapes and sizes would follow. It would be also practicable to standardize many of the rolled sections for angles and channels which are used in the superstructure of many styles of cars.

In freight and in passenger car construction during the development period in the past the cars were strengthened where found necessary; there were all sorts of makeshift methods and devices, such as truss rods, flitch plates, etc., and malleable iron was introduced in place of cast-iron. All this was done to make the cars stand up in service, with their increasing size and the increased severity of the work imposed upon them. All proved ineffectual and unsatisfactory, and the needs of our present-day service can be met only by a car with steel body framing.

During the past year one prominent road in the country has designed and constructed box cars with not only a steel underframing, but a steel superstructure. This is a daring attempt to further develop "the era of steel" for car construction, but the practice is one which would seem open to decided doubt as to whether entirely satisfactory results will be obtained in service. On first impression the observer might assume from the description or examination of the all-steel box car that it was in every way a decided advance step. It is to be hoped that railroads will very carefully consider the history of steel box cars both abroad and at home before going heavily into their construction. In a communication which the writer published in the *Railway Age* in reference to this all-steel box car, it was stated: "From a standpoint of structural design and practical construction no serious difficulty may be feared in this departure for American railroad service, but from the standpoint of service conditions, the development should be approached with great care. In America, freight cars go from north to south and from east to west without territorial restrictions. Any satisfactory car adopted in America for general use must be one suited to the hottest as well as to the coldest temperatures, and they must be adapted to the rapidly varying climatic conditions of an enormous area of diversified country.

"If one has spent hours in midsummer in large railroad yards where great numbers of steel gondolas are stored they need not be further enlightened as to the enormous heat in such yards due to the accumulation stored up in the sides of these steel cars. Many times in midsummer the steel sides and ends of the cars are too bad to be grasped with the bare hand. If such cars were covered with a roof of sheet steel on which the direct rays of the sun would fall, and in addition have steel sides and ends, the heat emanating from them would be enormously increased, and the temperature inside such cars would not only be destructive to any forms of life in them, but would be seriously injurious to a large variety of the different classes of freight ordinarily carried in box cars.

"In summer time in a yard where large quantities of all-steel box cars might be stored, the heat would be sufficient to seriously injure, and possibly kill cattle, hogs or sheep that might be in trains which were held any length of time in such yards. With cars carrying grain, the heat in summer-time would be injurious to such grain and would seriously depreciate its value. In winter, with sudden changes of weather from hot to cold, the deposits of moisture from the atmosphere which are so frequently noticed on the sides of locomotive tanks would occur with many classes of lading, on either the inside or outside of such cars.

"It is argued that steel grain elevators have been successful, and that they do not require lining in order to prevent the grain from sweating or becoming dampened as the result of sudden changes of temperature. The writer has been advised, however, that considerable trouble has been experienced with steel storage elevators for grain, and in order for them to be at all satisfactory for general use in climates subject to considerable variations in heat and cold and variations in humidity, it is necessary to have them lined, giving an air space between the inner and outer casings.

"In the design of all-steel box cars which have recently been illustrated in several of the technical papers, there seems to be no provision made for an inside lining either at the ends or the sides. For carrying grain, as well as many other classes of freight, such a lining made of wood would seem absolutely necessary as a protection from heat as well as cold, as a non-conducting air space between the outside sheeting of the car and the inside lining is always necessary to prevent damage to many classes of lading. The addition of such a lining, which in an all-steel car would be necessary for the roof as well as the sides and ends, will so add to the weight of the car as to give the all-steel car no advantage over its wooden superstructure predecessor so far as weight is concerned.

"When one realizes that in box cars heavy machinery and automobiles are often loaded, and when it is remembered that in properly blocking the lading as well as properly stowing it in the car, it is often necessary in some manner to get a good hold on the floor in order to readily move the machinery or other articles to a convenient place, and furthermore, when it is remembered that many classes of freight, such as automobiles, carriages and machinery, it is necessary to fasten blocks on the floor to prevent the lading from shifting, it will be seen that no small amount of difficulty will be experienced with a box car floor composed of steel sheets. It should be remembered that in a large number of cases the load is put in the cars at points where the men doing the loading do not have conveniences for making and adjusting long braces to properly hold the lading in position. In case of renewal, convenience of moving and securing the lading, a floor composed of $1\frac{3}{4}$-in. or 2-in. plank has many advantages over thin steel plates.

"It would seem wise in the development of the steel box car construction that progress should be made slowly and with great care, and to this end it would appear first desirable to design a car with a steel underframing and a steel framing for the superstructure, which is entirely practical, but to protect the car both on the sides, ends, roof and floor by a covering of wood, which, with present experience as a guide, is much more suitable and better adapted to the peculiar and varied climatic service conditions met with in freight traffic on the lines of our American railroads." In the construction of gondolas and flat cars, except where such cars are likely to be used in service for hot cinders, hot billets, or some similar lading, it would seem to the writer the wisest policy to use a wooden flooring rather than steel.

In a paper read before the New England Railroad Club in 1904 by John F. MacEnulty, he said: "It has been determined by two of the largest railroad systems of the country that the drawbar pull required to move a ton of freight in a properly constructed car of 100,000 lbs. capacity is 24 per cent. less than that required to move the same load in an average wooden car of 60,000 lbs. capacity." This is not only a strong argument in favor of steel car construction, but also for the use of large capacity cars.

Ease of renewal of the worn or broken parts in steel car construction is a feature of considerable advantage in favor of such cars as compared with those made of wood. Another great advantage is found when trains are wrecked, for steel cars withstand successfully punishment which would mean the total destruction of wooden cars. It has been found that the parts bent or torn in damaged steel cars can be readily renewed or put back in their original shape at a comparatively reasonable cost. The cost of steel cars per ton of carrying capacity is in general less than that of wooden cars. In large wooden cars it is found that the ratio of light weight to carrying capacity is altogether too high for comparison with steel cars. In cost of maintenance the steel car has a decided advantage.

The life of wooden cars built to-day must necessarily be shorter than those built 15 years ago, for at present it is impossible to get lumber anywhere approaching in quality that which was required in first class freight cars in 1892.

The demand for cars has, during the past few years, been so much in excess of the supply that cars have not been taken out of service for needed repairs so long as they could be kept going and pass inspection for safety. Under such conditions the wooden car has suffered very materially and depreciated rapidly. The increased cost of all kinds of material going to make up the car has so added to the cost price that one of the principal arguments against steel cars has been nullified. Length of train and increased size and weight of the average car, together with the very great increase in size of locomotives, during the past decade, has subjected cars to such increased strains as to make the strength of the wooden car of 10 years ago insufficient for economical service in heavy trains on our trunk lines. The continued construction of the so-called wooden cars for general use and interchange on trunk lines is an uneconomical proposition, and cannot longer be justified except on the narrow policy of a temporary saving of slight amount in first cost, regardless of the following increased cost of maintenance, and increased amount of depreciation, which the officers ordering such cars do not expect to have to justify during their own terms of office.

As showing the conclusions arrived at on one of the prominent railroad systems of the country, the writer has had before him a report recently made to the chief executive officer of the company. The report recommends retiring 4,600 coal and coke cars ranging from nine to 23 years in age, and having from 40,000 to 60,000 lbs. capacity. It was shown that these cars, on the average, cost $95.98 a year for repairs, or 37.8 per cent. of the average value of the cars. It was shown conclusively that the company could buy 3,000 new steel cars having a total capacity 20 per cent. greater than that of the 4,600 wooden cars, and out of the amount that it would cost to maintain the wooden cars for one year they could pay 6 per cent. interest on the cost price of the new steel cars and have remaining over $215,000.

There are, unfortunately, some executive officers whose policy is to make a great financial record for themselves for a few years, regardless of the consequent depreciation of the property entrusted to them, and regardless of the fact that their successors will have to spend much money later to correct the evils resulting from a selfish, shortsighted and necessarily short-lived policy of those who preceded them. On railroads dominated by such a "penny wise and pound foolish" policy (or lack of policy), it may be expected that the "era of steel" for underframing for all freight cars will be deferred as long as possible, even in the face of undoubted evidence that the wooden-framed car is an uneconomical structure.

It is only during the past three years that much has been done in this country to adapt steel construction to the various styles of passenger equipment. During several recent yearly visits to Europe, the writer found that the use of steel underframing for passenger equipment is now quite general both on the Continent and in Great Britain; but the use of practically all-metal construction has been quite limited in the past, abroad as well as in America.

The many serious railroad accidents of the past few years, and the use of electricity as a motive power, both as a substitute for steam in heavy railroad service as well as its use for lighter service in subways and elevated railroad traffic, has given the design of all-metal cars for passenger transportation a rapid impetus. Very satisfactory designs have been developed for baggage and postal cars, as well as for suburban and regular passenger service and within the past year, also for Pullman sleepers. It is too early yet to predict the outcome, but it seems to the writer that in future development of designs for steel passenger equipment a happy medium may be found and generally adopted, where the underframes and the superstructure framing will be of metal, but a reasonable use be made of wood or some fireproof substitute, other than metal, which will permit of a decorative treatment more pleasing to the eye than thin metal, and which will also have all of the reasonable and necessary elements of safety for those who entrust their lives in such cars.

In the early days of steel cars the matter of repairs was looked upon with many misgivings by the average master car builder and car repair foreman. Experience in handling these cars in large numbers has shown that there was no cause for any uneasiness on this score. In the repairs of steel cars it is not necessary to employ specially trained labor, and very few extra tools or facilities are absolutely necessary, though, of course, a few especially adapted tools and appliances will greatly facilitate the work. On roads having large numbers of steel cars in service it has been found that not more than one-half of 1 per cent. of this equipment need be out of service at any one time, needing repairs, while in the case of wooden cars from 2 to 4 per cent. is not unusual.

Relations Between Interurban Railways and Steam Railroads.*

You have a territory that is probably 20 to 30 miles wide, between the main lines of your steam railroads. Apparently all of the business that can be secured in that territory is being well and efficiently handled by the steam railroads. Until five years ago there were no evidences that such conditions were not satisfactory or ideal to the people in between those main lines, simply because these people had no idea of any better or more efficient transportation service. As the country further east became more thickly settled, the merchant, manufacturer and farmer found that a greater degree of prosperity attended the locality where it was easy to get about quickly. The result was that between main lines of steam railroads in territory that was reasonably densely populated, there was usually not sufficient additional business in sight to cause the steam lines to spur out 15, 20 or 30 miles and put on the mechanical appliances necessary to efficiently operate that spur. But the people in between demanded additional service. Your electric railway man in cities then began to reach out his line 15, 20 and 30 miles. As he reached out, it was found not only that he did not impair the freight and passenger business of the steam railroad, but he generated business in between those main lines and brought it into the stopping places of the steam railroads, adding to their receipts. For instance, take as an illustration two railroads 20 to 25 miles apart. A man would have cattle enough on the place for the milk supply of the family and possibly a few gallons over. He would raise vegetables enough in the garden to supply the family, and have a few bushels over. There would be a certain amount of farm produce, for instance hay, that was not consumed. All that was wasted, the steam roads did not come in and take over that sort of business. The electric railway man came into the field, and people found it profitable not only to keep cows enough to supply themselves, but to send off a half dozen cans or a dozen cans of milk to market. They also found, at times when they could not work the large crops in the big fields, that it was possible to attend to smaller products, cabbages, celery, etc., and to take care of the orchard, to plant plum, peach and pear trees, and they found a ready sale for all that sort of stuff whenever they got to a point where they could reach the market. The electric lines developed that business, and where you find electric railways and steam railroads in contact with each other, you will find territories that produce 50 to 60 per cent. more in any line of small produce than they do where there are no electric railways. The electric railway takes up the commodity and delivers it to the next nearest stop for the long distance haul of the steam railroad, and any railroad that has such shortline feeders pays more per mile than the line that does not have them. I do not believe that steam railroad managers have given this subject attention enough to appreciate the ratio of increased business.

The profit from the operation of any railroad depends directly upon the population and productiveness of the territory it reaches. Take the case of the more newly settled parts of the country. We have between the Mississippi basin and the foot hills of the Rocky mountains five or six transcontinental lines that are absolutely losing propositions in the local territory, for the reason that the population is sparse and the productiveness of the country, outside of livestock, is absolutely nil. If there can be any conditions brought about whereby the population of these localities is increased, and whereby the productiveness of these localities is increased, it will add revenue to the long-haul transportation company's treasury. Wherever electric railways have been installed connecting two cities with a country strip of territory intervening they have resulted in an increased population ranging from 10 to 15 per cent. for the first three years after the installation of the electric railway.

Following the electric railway, there is an increase in population and in production, and that increased production gives additional freight traffic and passenger traffic to the road that goes to New York or San Francisco. I have figures here taken from the records of the railroad commissioners at the State House, showing the increase in population in interurban localities in Iowa. The railroad officials in Iowa recently called attention to the increased population that had been brought about by interurban railroads while the population of the state as a whole, decreased 30,000 between 1900 and 1905. Between Waterloo and Waverly, which are connected by electric railway, the population in the townships, exclusive of towns, increased from 3,845 to 4,895. The population in the townships between Iowa City and Cedar Rapids, outside of the towns, increased during the same period from 11,512 to 13,456. The townships between Des Moines and Colfax, exclusive of the towns, increased from 8,633 to 9,178.

At the commencement of interurban development around Indianapolis, the population there ranged from 168,000 to 170,000. At the present time, I am informed by the president of the American Engineering Company of Indianapolis that the population exceeds 250,000. Every steam railroad that runs into or out of Indianapolis gets its proportionate share of the passenger traffic of that 250,000 people and its proportionate share is greater than it would have been had there been no interurbans to add to the population of Indianapolis. In addition to that there is the proportionate share of the freight over their road that is manufactured by the increase in population. The same thing is true of every center in the United States which has fostered the building of systems which reach out over the adjacent localities; the centers have an increased population and that increased population increases every line of business in the territory.

For the last two years I have been driving across this country that we expect to occupy. The people pay no attention except to the farm business. They possibly go either to Creston or Des Moines and they don't think about going back to make the folks down east a visit; they don't think of going to the Exposition, they don't think of going to California or Florida for the winter. Why? Simply because they haven't the vision of a car just passing their door every day. They have got to climb into a lumber wagon or surrey, which is an inconvenient way of riding, and drive six or eight or ten miles to get to the nearest steam railroad station. The result is, they do not think about going back to see the home folks. The same class of people, in those states with the advantages that we have in Iowa, see an interurban car go by their door every day, and the first thing they do is to get on an interurban and go down six or eight miles to see John Smith about a bunch of cattle, and then the good wife gets on a car and goes six miles the other way to see Sarah, and the first thing you know, they get the riding habit and they go to the interurban man and want to know how to get to some point in Indiana or Ohio. The interurban man can only carry them 25 miles, but he is foxy enough to know there is a little bit of commission in selling the ticket, and he goes to the steam line ticket man and gets the price, and the result is that the steam line gets four or five passengers that it would not have got in 20 years unless the electric railway people had started them. The percentage of long distance travel at Jackson, Mich., to New York City, New Orleans and San Francisco has increased some 18 per cent. in six years. That is the effect of the interurban, building the electric railway has opened up new steam railroad business.

So long as any of us are alive, I believe that trains of eight, 10 and 15 cars will always be hauled through the medium of steam, and I sincerely believe that the day will come when the ability of man to build a machine big enough to haul the people who are teased into the desire to travel by the electric railway, will be taxed to the utmost.

*From an address by A. L. Park before the Iowa Railway Club.

The Swiss Diet has declared that the Simplon parallel tunnel shall be enlarged, lined and made ready for a second track immediately. Brand, Brandau & Co., the contractors who built the tunnel now in operation, contracted also to complete the parallel tunnel for a given sum if notified to do so by Feb. 8, 1908. The firm does not wish to undertake it. It made only $210,000 on the work heretofore done, or 2 per cent. on the expenditure. One of them died before the tunnel was completed, a second became an invalid and a third is 70 years old. Moreover, the traffic so far is abundantly accommodated by a single track. But the State Railroad authorities say that the parallel tunnel must be enlarged and lined to preserve it and to prevent the deformation of the other tunnel where the track is. Moreover, if the work is not begun till the second track is needed, it will be much more difficult to do it. While there are few traffic trains on the existing track it can be utilized for the new construction.

GENERAL NEWS SECTION

NOTES.

The conference of railroad commissioners called by the Commission of Oklahoma will meet on January 28 at Oklahoma City. The states to be represented are Missouri, Kansas, Arkansas, Texas and Oklahoma.

The State Railroad Commission of Wisconsin has ordered six of the principal railroads of the state to reduce by $33\frac{1}{3}$ per cent. their rates for carrying pulp wood. The paper makers have been asking for this reduction for over a year.

In the Federal court at Kansas City, January 20, Judge McPherson decided unconstitutional the law of Missouri forbidding railroads to remove to the Federal courts suits begun against them in the State courts to compel compliance with the rate laws of the state.

The State Railroad Commissioners of Montana have issued demurrage regulations to be adopted for freight cars throughout the state on February 8. On coal, lumber and precipitates three days' free time must be allowed. The demurrage charge after five days is increased gradually to a maximum of $2 car per day.

The Supreme Court of New Jersey has decided in favor of the railroad a suit brought four years ago by J. G. Montgomery asking to have condemned as extortionate a charge of 10 cents made by the railroad for the storage of a package in the station at Pemberton, which Montgomery had brought with him from Philadelphia, but which he did not take away for several days.

The Subway lines of Manhattan, New York City, operated by the Interborough Rapid Transit Company, having been extended from the southern terminus beneath the East river to Brooklyn, are carrying more passengers than ever before. On Monday last the total was 704,879. On the same day the Elevated lines, operated by the Interborough, carried 910,215, making a total of 1,625,094 passengers on the Interborough system.

The time of the Twentieth Century Limited Express trains over New York Central lines between New York and Chicago has been shortened. The westbound train is now scheduled to run through in 18 hours 30 minutes, one hour less time than by the schedule abandoned, but still 30 minutes slower than the summer schedule; and the eastbound train runs through in 19 hours, which is a shortening of 30 minutes, but still is one hour longer than the summer schedule.

The Philadelphia & Reading has announced in Philadelphia that at the end of this week 60 local passenger trains will be withdrawn, passenger receipts having fallen off seriously. Nineteen trains will be taken off the Chestnut Hill branch, six from the Norristown division, six from the Frankford division, seven from the Glenside division, three from the New York division and smaller numbers from other divisions. The announcement says that it is believed that the trains will not be seriously missed by the public.

The disagreement between the New York, New Haven & Hartford and its connections appears to be the subject of varied and successive complaints before the Interstate Commerce Commission. The Central of New Jersey and its connections have now filed formal proceedings alleging discrimination on the ground that the New Haven continues with the Pennsylvania and the Lehigh Valley arrangements which it threatens to break with the complainants. There are rumors that a compromise will be reached, but no substantial grounds are given for the rumors.

The Governor of Tennessee has invited the presidents of the principal railroads of the state to meet him January 27 to see what can be done about reducing passenger rates and obviating the necessity of calling a special session of the Legislature for that purpose. In the meantime, the State Railroad Commission, apparently looking upon the action of the Governor as too slow, has issued an order requiring the railroads of the state to reduce their fares to $2\frac{1}{2}$ cents a mile on the first of April. The railroads declare that they will ask the courts to forbid the enforcement of this order.

The Southern Railway has decided to extend voluntarily to all its passenger traffic in Tennessee the same rates which it expects shortly to establish in many of the Southern states as a result of the compromise agreements now being reached between the road and those states in which rate laws were passed last year. No rate laws have been passed in Tennessee. President Finley says that compromises are being reached in most of the states on the basis of $2\frac{1}{2}$ cents a mile for single tickets, $2\frac{1}{4}$ cents a mile for family mileage books, and 2 cents a mile for commercial mileage books. These rates are to be put on trial for a period of 12 months. In North Carolina a special session of the Legislature has been called to pass an act validating the understanding regarding rates which has been reached between the Governor, the Railroad Commission and the Southern Railway. In South Carolina it is expected legislation along the lines of the compromise will be enacted. In Georgia the Railroad Commission is supreme, and an understanding has been reached with the commission. In Alabama the situation is about the same, and in Mississippi it is expected the necessary legislation will be passed.

Government Statement of Monthly Railroad Earnings.

The Interstate Commerce Commission last week made public for the first time as provided by the law passed by the last Congress, figures showing the monthly earnings of the separate railroads. A typical example is given below in order to show the method of reporting railroad income results according to the revised accounting standards now in force. The showing of the Pennsylvania Railroad for November, 1907, is as follows:

Pennsylvania Railroad

Freight revenue	$9,958,743
Passenger revenue	2,606,391
All other revenue from transportation	1,137,551
Revenue from other operation	122,849
Total operating revenue	$13,825,534
Maintenance of way and structures	$1,402,679
Maintenance of equipment	2,688,946
Traffic expenses	172,072
Transportation expenses	5,241,408
General expenses	289,454
Total operating expenses	$9,840,974
Net operating revenue	3,984,560
One twelfth of annual taxes	174,339
Operating income	3,810,220

Opening of the Guatemala Railway.

The Guatemala Railway, which is controlled by the United Fruit Company, has finished its through line from Puerto Barrios, on the Atlantic coast, to Guatemala City, the capital of the republic, about 200 miles, where it will connect with the Guatemala Central, which runs to San Jose, on the Pacific coast, 70 miles. The United Fruit Company has announced a new fortnightly steamship service between New York and Puerto Barrios. The new line is to be put in operation on February 1.

Exports of Grain, Beef and Cotton in 1907.

During the calendar year 1907 the recorded exports of wheat from the United States were 89,897,600 bushels, valued at $84,859,379, an increase of 47 per cent., as compared with 1906, when 61,347,789 bushels, valued at $47,716,891, were exported. There were 15,191,351 barrels of wheat flour exported as compared with 14,259,252 barrels in 1906. Exports of canned beef fell from 35,028,912 lbs. to 21,948,354 lbs., while other cured beef decreased from 73,638,734 lbs. to 50,351,-835 lbs. Exports of fresh beef decreased very slightly. The year's exports of cotton, other than Sea Island, were 4,404,992,246 lbs., valued at 10.7 cents a pound, which compares with 3,471,931,550 lbs. at 11 cents in 1906.

Effect of Eight-Hour Telegraphers' Law in Wisconsin.

The last Wisconsin legislature passed an eight-hour telegraphers' law and a number of complaints have now been filed with the State Railroad Commission to the effect that the railroads, in order to supply the necessary shifts of telegraphers at the large stations, have closed the telegraph offices at the smaller stations. The companies point out that they cannot afford to maintain three shifts at small way stations.

Net Weight Packages for Paints and Colors.

Leading paint, color and white lead manufacturers have changed all packages of their products sold by the pound from gross weight to net weight. This change went into effect January 1. Heretofore it has been the custom of the trade to put up non-liquid goods in gross weight packages, although liquid goods have been sold by all reputable manufacturers for some years full United States standard measure. This is a step in the right direction because it fixes a definite standard regardless of the shape or weight of the package in which the goods are sold, and enables the consumer to know how much material he is buying. A number of paints and colors are already on the market bearing the net weight on the labels. All reputable gums of our character will be affected as soon as the various makers can make the necessary changes.

Annual Report of New York State Public Service Commission for the First District.

The New York State Public Service Commission, First district (New York City), has sent its report to the Senate. It recommends the passage of four amendments to the public service law:

1. A constitutional amendment exempting from the 10 per cent. debt limit bonds for the construction of rapid transit lines when, so far, and so long as such rapid transit lines shall be self-supporting.

2. An amendment to the rapid transit laws providing that leases of extensions of rapid transit lines may be made to terminate at the same time as the original lease, this commission having the power, in conjunction with the Board of Estimate and Apportionment, to fix the terms, conditions and compensation and to readjust the same each twenty or twenty-five years thereafter.

3. An amendment to the rapid transit law which shall give the local authorities and this commission the power to allow the construction and operation of rapid transit lines by private companies upon the payment of part of the earnings to the city or other proper terms and with a reservation to the city of the privilege to purchase at any time after a certain period of not more than twenty or twenty-five years and without any payment for the franchise itself; and

4. An amendment to the rapid transit law authorizing contracts for operation for a longer period than twenty years or else to make the lease terminable at any time after a certain period of not more than twenty years, with a provision that the equipment shall be purchased at a fair price by the city on the termination of the lease.

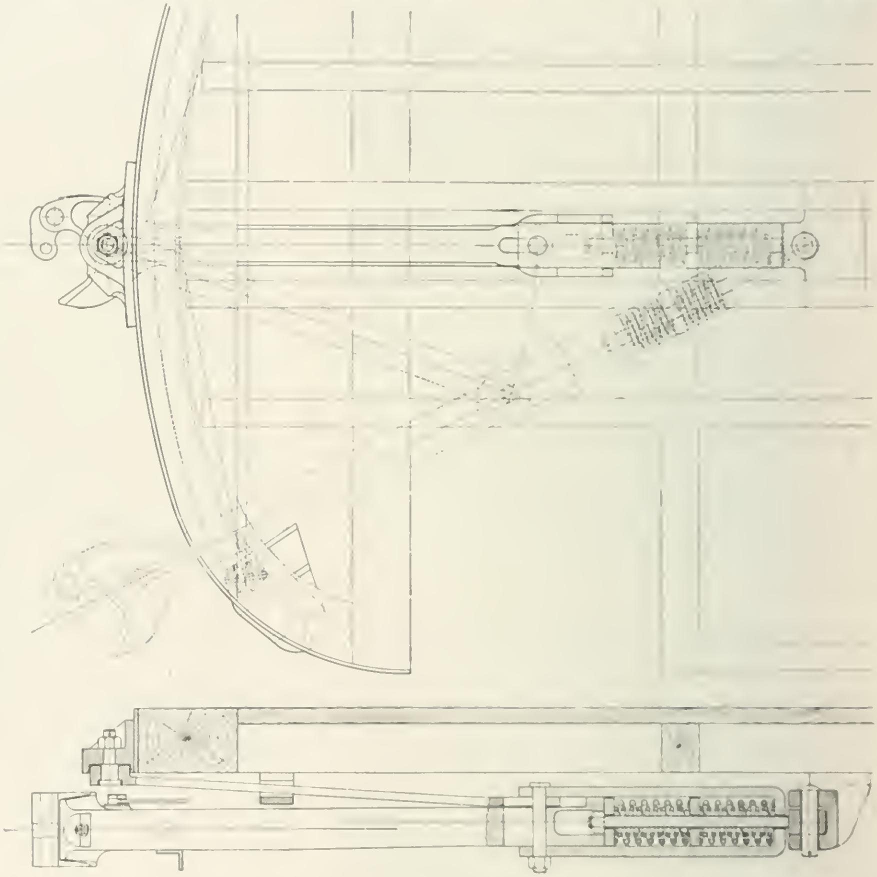
The commissioners have been unable to accomplish anything definite to bring about the removal of surface tracks of the New York Central on Eleventh avenue and West street. For the six months it has been in office the board has held 179 public hearings, and as a result of these hearings the commission has issued 186 orders which have called for increases of from 20 to 25 per cent. in the local railroad services. A conservative estimate of the increases required of all the operating companies indicates that over 15,000,000 additional seats yearly have been added to the service in New York City under orders of the commission. This was accomplished largely through improvements in facilities already at hand. At the same time comprehensive plans for extension of subway construction and important modifications in plans already accepted have been made. Much attention has been given to the extension of subway construction, not only in Manhattan and the Bronx, but in Brooklyn as well. Plans for a Broadway-Lexington avenue subway line, with two branches running into the Bronx, will be submitted to the Board of Estimate this month.

Commenting on the number of accidents in the six months the commission describes the total as "appalling." In the six months ended December 31 last there were 24,209 accidents, the number of deaths being 288. A committee has been directed to make a thorough investigation to ascertain whether it will be possible to adopt any method that will result in fewer persons being killed.

The commissioners report that they have not been able to enforce the present gas order because of the injunctions which have been obtained by the companies, but it is presumed that an appeal will be taken to the United States Supreme Court.

Janney Radial Coupler for Electric Cars.

The accompanying drawing shows a plan and longitudinal section of the Janney coupler with radial movement, designed especially for electric and interurban service, like those shown on model cars at the street railway convention at Atlantic City last fall. It is an adaptation of the Janney M. C. B. type passenger coupler, but has a wide range of lateral movement to accommodate itself to sharp curves. The auxiliary bar connected at its front end to the platform and at its rear end to the coupler yoke and to the stem of the coupler prevents lateral buckling of the stem under the impact shock of coupling. The draft spring, acting through



Janney Radial Coupler.

this bar, returns the coupler to the approximate center line of the car when the side strains are removed. It has been found desirable to have, on the heavier types of electric and interurban cars, a stronger type of coupler than that previously in service on the lighter cars on city streets; it is also desirable that these cars be equipped to couple with cars of steam roads, which are sometimes hauled over interurban lines or interchanged with them. This coupler fulfills these requirements. It is made by the McConway & Torley Co., Pittsburgh, Pa.

Andrew Carnegie Research Scholarship.

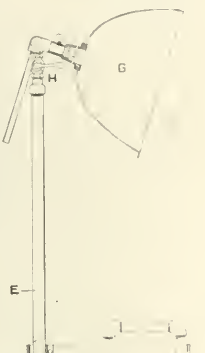
Andrew Carnegie has given the Iron and Steel Institute $89,000 in 5 per cent. debenture bonds. The council of the institute is to use this fund to endow one or more research scholarships annually. Candidates, men or women of any nationality, but under 35 years of age, must apply on a special form before the end of February to the secretary of the institute, 28 Victoria street, London, Eng.

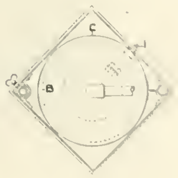
The object of the scholarship is not to facilitate ordinary collegiate studies, but to enable students who have passed through a college curriculum or have been trained in industrial establishments to conduct researches in the metallurgy of iron and steel and allied subjects, with the view to aiding its advance or its application to industry. There is no restriction as to the place of research, provided it be properly equipped for such work. The appointment to a scholarship shall be for one year, but the Council may renew it for a further period instead of appointing a successor. The results of the research shall be reported to the institute in the form of a paper at the annual meeting, and, if of sufficient merit, the Andrew Carnegie gold medal shall be awarded to its author.

The Milburn Acetylene Light.

The Milburn acetylene light for construction and maintenance of way work is shown in the accompanying illustrations. The apparatus consists of an outer tank, generally square, a vertical burner standard, and an interior cylinder. The carbide trays, A, are half filled with carbide and nested in the cylinder, B; the cover, C, telescopes over cylinder B and locks itself. The whole is then put in the tank, which is filled up with water. On turning the cock, as soon as the air is expelled from the pipe, which takes not more than a minute, the gas is ready to use.

The water rises under the cover, C, as the air or gas pressure is relieved, and enters the inner chamber through minute holes at the side, thus reaching the carbide. The reflector and burner is attached by a swing joint, and, since the burner pipe is free to turn around the inner pipe, the light can be turned to any angle required. There is a small double





Parts and Sectional Views of the Milburn Light.

chamber at the base of the tank through which the gas passes before going into the burner standard, so that back firing cannot take place; any condensation is drained into the chamber to prevent the pipes becoming stopped up.

Carbide of calcium generally costs from $3\frac{1}{2}$ cents a pound, by the ton, and $3\frac{3}{4}$ cents a pound, in 100-lb. lots, upwards. Each pound of carbide gives 5 cu. ft. of gas. In the Milburn light burner it is mixed with an unusually large percentage of air, so that the light is inexpensive. The United States Life Saving Service, after tests, reported that with the No. 2 Milburn light fine printed matter could be read at a distance of 360 ft. and objects 600 ft. away were plainly visible.

It can be piped by flexible or permanent tubing to any part of a wrecking car and either a reflector or large open burners can be used. It has been successfully adapted to dredges, cranes and steam shovels. A unique use of the light is for tunnel and sewer work. In one case two lights have been coupled together and a pipe run from these down a 60-ft. shaft and along about 250 ft. of tunneling each way, where a series of burners are used at intervals of about 50 ft. At the ends where the work of excavating is carried on, flexible tubing is used and connected with a tripod bearing several burners; these brightly illuminate the work and can be quickly removed when blasting is necessary.

The No. 3-Z size, giving 5,000 candle power for 16 or 17 hours with an extra cylinder, measures 12 in. square x 36 in. high and weighs only 80 lbs., as outside of the charge of from 12 to 18 lbs. of carbide only water is used, the handling of the light is an easy matter. The Milburn hand lights cost in use less than a cent an hour.

The light is made by the Alexander Milburn Co., 507 W. Lombard street, Baltimore, Md., and among the company's agents are, Manning, Maxwell & Moore, New York, and the Handlan-Buck Manufacturing Co., St. Louis, Mo.

Performance of Large Gas Engines and Electric Generators Under Adverse Conditions.

The Allis-Chalmers Co., Milwaukee, Wis., sends the following: The reliability of large gas engine-driven electrical units under unusual and severe conditions of service was shown during the recent heavy snow and wind storm in the Northwest. Interurban lines centering at Milwaukee, as well as a large part of the street railway system of that city, were completely at a standstill for 24 to 36 hours, with the exception of the Milwaukee-Northern Railway. This line, with power house at Port Washington, on Lake Michigan, 20 miles north of Milwaukee, is supplied with current from one of two Allis-Chalmers alternating current generators direct coupled to four-cycle, double-acting, twin-tandem gas engines made by the same company, each unit being rated at 1,000 k.w. Most of the right-of-way is through a flat, open country, where there was full exposure to the storm. Accordingly precautions had been taken against snow interfering with traffic by putting up snow fences along the worst places, but the storm, very early in the day, destroyed these fences and the tracks were soon covered with snow to the depth of several feet in places.

At this time three large interurban cars, a large snow plow, a large sweeper and four city cars were running. The interurban cars, when going through heavy snow, would take as much as 550 h.p., and the snow plows considerably more. This, together with the city cars, gave the gas engine at Port Washington a swinging load of from 280 to 2,400 h.p. The engine acted extremely well under these trying conditions, picking up the heavy load with apparent ease, and running so quietly that if it had not been for the wattmeter it would have been hard to detect an overload by the action of the engine. Although the cars did not run on schedule time during the day, they were kept going and by nightfall were back to the regular schedule.

Tie and Post Contract

Joseph Meloney, of Bloomer, Wis., and J. H. Meloney, of Williams, Minn., report that they have entered into a contract with the Grand Trunk Pacific for 125,000 ties and 150,000 posts. This material is to be used for the construction work in Canada. The ties and posts are being cut in the state of Wisconsin, north of Chippewa Falls.

Date Growing in California.

Investigations by the Southern Pacific company have gone far enough to show that the date palm can be grown successfully in California soil. At the Government's experimental farm near Mecca, in the California Desert, several acres have been set out and the trees are thriving. They have not reached the full bearing stage, but several branches have produced as high as 20 lbs. each already. Mr. Fee, Passenger Traffic Manager of the Southern Pacific, has received samples of both the soft and dried dates produced at these farms, and pronounces them of excellent quality.

Kansas, Mississippi, New York and Texas.

The legislature of Kansas is now in session. The Governor in his message told the members that they would be expected to pass a two-cent fare law. In the Mississippi legislature, which is now in session, a bill has been introduced making $2\frac{1}{2}$ cents a mile the maximum fare on the railroads of the state and requiring the railroads to sell 1,000-mile tickets at two cents a mile. A press despatch from Austin says that the railroad commission of Texas has abandoned its proposed reduction of passenger fares in that state, this action being taken, it is said, after the receipt from 16 railroads of notice that they would abandon their attempt to secure an injunction against freight rate reductions ordered by the commission. The New York State Public Service Commission, Second District, has issued a decision prepared by Commissioner Decker holding that low rates for the use of children attending school, a long existing custom, is desirable, proper and legal. The practice, confined within reasonable limits, is not discriminatory. The two-cent fare law of Pennsylvania has been declared unconstitutional by the Supreme Court of that state.

Steel Ties.

It was mentioned in these columns, December 27, that L. P. Friestedt, of Chicago, had bought the United States patents for the York cross-rolling process. We are now told: "The negotiations which were supposed to have been closed between Mr. York and Mr. Friestedt have been terminated, owing to present unsettled financial conditions; and, as soon as things appear again to be all right, the original intention may be carried out."

INTERSTATE COMMERCE COMMISSION RULINGS.

Export Rate on Walnut Lumber Reduced.

In the case of the Miller Walnut Co. v. Atchison, Topeka & Santa Fe and Gulf, Colorado & Santa Fe, the Commission (opinion by Commissioner Prouty) has decided that the rate of 26¼ cents per 100 lbs. for transportation of walnut lumber from Oklahoma City, Okla., to Galveston, Tex., for export, is unjust and unreasonable, and should not for the future exceed 21¾ cents per 100 lbs.

Reparation on Two Cars of Snapped Corn.

In the case of the Ocheltree Grain Co. v. St. Louis & San Francisco (opinion by Commissioner Prouty) it appeared that previous to December 12, 1906, the rate on snapped corn from Laverty, Okla., to Millican, Tex., and from Laverty, Okla., to Navasota, Tex., had been for a long time 29 cents per 100 lbs., but by tariff effective on that date the rate was advanced to 36¼ cents per 100 lbs. This advanced rate was continued in effect until February 17, 1907, when it was reduced to the former rate, where it stands to-day. On that statement, the Commission declared that it must hold that the rate charged complainant was excessive. The fact that the defendant had for some time maintained a rate of 29 cents and has since reduced its rate to the same figure is in the nature of an admission on its part that this rate is a fair one. Reparation of $58 was awarded complainant for unreasonable charge for the transportation of two carloads of snapped corn at an excess charge of 7¼ cents per 100 lbs.

Rate Fabric Upheld; Indirect Supervision Over Interstate Rates.

The Commission, in an opinion rendered by Commissioner Prouty, has announced decision in the case of Reliance Textile & Dye Works v. Southern Railway et al. The complainant alleged that rates on cotton piece goods from Cincinnati, Ohio, to Chicago, Ill., are so adjusted as to discriminate against Cincinnati in comparison with certain similar establishments at Clearwater, S. C., and Lanette, Ala. The rate on cotton piece goods from Clearwater and Lanette to nearby dye works and from the dye works to Chicago is less than the combination from the mill to the dye works of the complainant at Cincinnati and thence to Chicago. This is because the rates from Clearwater and from Lanette is competitive with rates from New England. The Commission decided that while the lower combination of rates in favor of the southern dye works may be a discrimination against the works of the complainant, it is not, under all the circumstances, undue and therefore unlawful. The complaint was therefore dismissed.

In connection with this decision, the Commission declared that where a discrimination results from the combination of a state and an interstate rate, both established by the same carrier, the matter is not withdrawn from its jurisdiction by the fact that the discrimination is produced by an improper state rate—certainly not when the state rate is voluntarily made by the carrier.

Grain Rates from Buffalo to New York and to New England Reduced.

The Commission, through Commissioner Prouty, has decided several cases covering grain rates from Buffalo to New York City and to New England points. In the case of the Banner Milling Company v. New York Central & Hudson River it appeared that the complainant is engaged in grinding spring wheat flour at Buffalo in competition with mills at Minneapolis, had its rate on flour from Buffalo to New York advanced on May 1, 1907, from 10 cents to 11 cents per 100 lbs., while no similar advance was made from Minneapolis. The Commission held that the 11-cent rate and the rate of 13 cents to New England points were unjust, and should not exceed 10 cents to New York and 12 cents to New England points. The Commission decided, however, to make no order in the case pending leave granted to the defendant to establish a proportionate rate on ex-lake grain, which would correct the discrimination.

In the case of the Thornton & Chester Milling Co. v. Delaware, Lackawanna & Western et al., the rate of 13 cents per 100 lbs. from Buffalo to Providence was condemned, but no order was made, the action being similar to that in the Banner Milling Company case.

Similar action was taken by the Commission in the case of the Washburn-Crosby Co., of Buffalo, v. the Erie et al. and in the case of the Washburn-Crosby Co. v. the Lehigh Valley, on complaints of excessive and discriminatory charges on wheat products from Buffalo to New England points.

The case of the Washburn-Crosby Co. v. the Pennsylvania Railroad, attacking the rates on grain and grain products from Buffalo to Philadelphia and Baltimore, was dismissed. It was shown that the failure of Buffalo to obtain differentials given to Philadelphia and Baltimore was due to its location, a disadvantage which the railroad never has attempted to equalize and which the Commission does not believe it ought to be required to equalize.

Philosophy of the Long and Short Haul Law.

The Commission, in an opinion by Commissioner Clark, has announced its decision in the case of the Bovaird Supply Company v. Atchison, Topeka & Santa Fe et al. On rope cables from San Francisco to Independence, Kan., complainant is charged 75 cents per 100 lbs., whereas the rate on such rope from San Francisco to Missouri river points, Chicago, etc., is 60 cents; but the Commission decided that the rate is not shown to be unreasonable.

The Commission views with disfavor the maintenance of a lower rate for a longer haul than for a shorter one included within the longer, and the circumstances and conditions obtaining at the more distant point which are relied upon to justify it must not only be clearly shown to be substantially dissimilar from those prevailing at the nearer point, but also to clearly exercise a potent or controlling influence in making the lower rate.

If the influence of competition, between points of production, in commodities, between carriers, and in rates prevailing at the farther distant point but not at the nearer one controls the establishment of a lower rate to the former, it will constitute such dissimilarity of circumstances as will justify the lower rate for the longer haul.

Competition in commodities alone, at the nearer point, will not make the circumstances there substantially similar to those at the farther point where the other competitive influences and conditions also prevail.

Dissimilar circumstances which justify under Section 4 a greater charge for a shorter haul than for a longer haul will also prevent such rate from constituting an illegal preference or advantage under Section 3.

Upon discovery that shipments have through mistake been moved at an unlawful rate the carrier should forthwith demand and the shipper forthwith pay the difference between such unlawful rate and the legal rate applicable thereto.

TRADE CATALOGUES.

Pipe Coverings.—The revised catalogue of the Philip-Carey Company, Cincinnati, Ohio, is devoted to the many types of Carey coverings, including 85 per cent., 50 per cent. and 35 per cent magnesia pipe coverings; asbestos and air cell pipe coverings; Argentum air chamber and cork pipe coverings. Other products include: 85 per cent. magnesia sectional blocks and locomotive lagging; asbestos block covering; air cell fire board; magnesia and asbestos cement, Carey cold water paints, and other magnesia and asbestos specialties. Prices are given.

Machine Tools.—Catalogue No. 45 issued by the Newton Machine Tool Works, Philadelphia, Pa., is a new general catalogue. It is 6½ in. x 9¼ in., has 303 pages and is bound in cloth. The press work throughout is excellent. The tools illustrated and described include boring machines, cold saw cutting-off machines, drilling and milling machines, crank and rotary planers, shapers, etc.

Compressed Air.—The December issue of *Compressed Air* includes "The Caisson Work for the Paris Subway"; "Life and Work of the Sand-hog"; "Compressed Air on the Belmont Tunnel Work"; "Steam Consumption in Air Compressors," and the usual departments.

Traction Draft Rigging.—The Edwin C. Washburn traction couplers and draft rigging are fully illustrated in a pamphlet recently published by the Washburn Steel Castings & Coupler Co., Minneapolis, Minn. These devices are particularly adapted for use on curves as sharp as 45 ft. radius. The illustrations consist of photographs and working drawings. The pamphlet also describes steam freight and passenger couplers, engine couplers and spring buffers and cast-steel bolsters for electric cars.

Roller Bearings.—Bulletin No. 103 of the Hyatt Roller Bearing Co., Newark, N. J., is a circular giving some data showing the friction load of shafting in an electrically-driven machine shop when equipped with roller bearings made by this company. The data is the result of tests made at the Dubois, Pa., shops of the Buffalo, Rochester & Pittsburgh.

MANUFACTURING AND BUSINESS.

J. B. Cox, formerly Chief Engineer of the Chicago Junction Ry., has opened an office as Consulting Engineer at 1741 Railway Exchange building, Chicago.

The Hayes Track Appliance Co., Geneva, N. Y., has made the Railway Specialty & Supply Co., Great Northern building, Chicago, agent for the Hayes derail in the Chicago district.

At the recent annual meeting of the American Civic Association at Providence, R. I., Mrs. A. E. McCrea, Landscape Architect of the Chicago, Milwaukee & St. Paul, was re-elected Vice-President and Chairman of the Railroad Department.

The Pittsburgh Lamp, Brass & Glass Co., Pittsburgh, Pa., has made the Railway Specialty & Supply Co., Great Northern building, Chicago, agent in Chicago for the sale of Kopp signal glass. The latter company is prepared to furnish promptly all styles of lenses, roundels and lantern globes.

The Maryland Railway Supply Co. of Baltimore City, 510 Continental building, Baltimore, Md., has been organized to handle steam railroad, electric railway and automobile supplies, working under exclusive territorial contracts in eastern and southern states. Several agencies have already been secured. A general office for New England is to be established at once; traveling salesmen will for the present cover the southern states and other offices will be opened in the north, east and south as soon as the amount of business justifies them. The officers are: President, Nelson E. Perin; Vice-President and General Manager, Charles Elliott; Secretary and Treasurer, Thomas W. Boykin. As Sales Manager of the West Virginia corporation of similar name and as a former railroad officer, Mr. Elliott already has many friends among railroad officers in the South and the personnel of the new company makes its prospects for success of the brightest.

The following reorganization plan for the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has been approved by the receivers, the directors and the creditors' committee. Its consummation is subject to subscription by stockholders to $7,000,000 new capital, unless otherwise determined by the committee. The plan provides for $35,000,000 first mortgage and collateral trust 5 per cent. 25-year bonds secured by mortgage on the various plants and by pledge of most of the heretofore unpledged securities of subsidiary and other companies. Part of the bonds are convertible into stock after January 1, 1910. The $18,500,000 convertible sinking fund 5 per cent. bonds and the $1,969,000 5 per cent. debenture certificates outstanding, are to be exchanged, dollar for dollar, for these convertible bonds. The remainder of the first mortgage issue is to take care of the $14,531,000 (about) floating debt. The $6,000,000 three-year 6 per cent. collateral notes maturing August 1, 1910, and the 14,000,000 francs ($2,800,000) ten-year 5 per cent. collateral notes maturing October 1, 1917, are to be exchanged (optional in the case of the ten-year notes) for similar notes with modified collateral and rights to participate in case of deficiency *pro rata* with the new bonds. The personnel of the board of directors is to be approved by the committee. Provision for the election of future boards satisfactory to the committee is to be made by voting trust or otherwise.

Iron and Steel.

The new Grey universal structural steel mill of the Bethlehem Steel Co., South Bethlehem, Pa., is now in operation. The company expects to work up by degrees to the mill's capacity; at present only 12-in. 70-lb. girder beams are being made.

OBITUARY NOTICES.

W. E. Estes, General Freight Agent of the Central of Georgia, died at his home in Savannah last week.

T. L. Courtney, formerly and for many years Superintendent of the Richmond, Fredericksburg & Potomac, died at his home in Richmond, Va., on the ninth of this month at the age of 83.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Franklin Institute.

At the section meeting held January 23 there was an address on Semi-Liquid Steel Ingots by N. Lilienberg.

At the meeting to be held February 28, there will be an address on Electric Power Transmission by Paul A. Spencer.

Western Society of Engineers.

The officers for 1908 are: President, C. F. Loweth (C., M. & St. P. Ry.); First Vice-President, J. W. Alvord (Chicago); Second Vice-President, P. Junkersfeld (Chicago); Third Vice-President, D. W. Mead (Univ. of Wisconsin); Treasurer, A. Reichman (Chicago), re-elected; Trustee for three years, L. E. Ritter (Chicago).

Canadian Society of Civil Engineers.

The twenty-second annual meeting at Montreal will fill three days, Jan. 28, 29 and 30. The first day, Tuesday, will conclude the general business, and there will be an exhibition of lantern views illustrating the Quebec bridge by Henry Holgate. On Wednesday the members will visit the works of the Lakefield Portland Cement Company at Pointe aux Trembles, the new power house of the Montreal Street Railway, and the foundry of Warden King at Maisonneuve, these to be followed by the annual dinner in the Windsor Hotel. The reports will be presented on Thursday.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Acme, Red River & Northern.—T. K. Hawkins has been appointed Secretary, Auditor and Treasurer, with headquarters at Dallas, Texas.

Delaware & Eastern.—Jacob L. Greatsinger has been elected First Vice-President, succeeding E. C. Fairchild.

Maine Central.—Morris McDonald has been elected Vice-President and General Manager in place of George F. Evans, deceased. Mr. McDonald has for 10 years been General Superintendent. George S. Hobbs, Controller, has been elected Second Vice-President.

Susquehanna & New York.—P. M. Newman, hitherto General Manager, has been elected President in place of C. S. Horton, deceased; office at Williamsport, Pa.

Washington County.—Morris McDonald has been elected Vice-President, in place of George F. Evans, deceased.

Operating Officers.

Canadian Northern Ontario.—See Canadian Northern Quebec.

Canadian Northern Quebec.—F. M. Spaidal, hitherto General Superintendent of the Canadian Northern Ontario at Toronto, has been appointed General Superintendent of the C. N. Q., with headquarters at Montreal. A. J. Hill succeeds Mr. Spaidal.

International & Great Northern.—Henry Martin has been appointed Superintendent at Palestine, Texas.

Louisiana Western.—See Southern Pacific.

Missouri, Kansas & Texas of Texas.—W. G. Koch has been appointed Superintendent of the Dallas, the Fort Worth, the Denton and the Henrietta divisions in place of C. H. Scott, resigned.

Morgan's Louisiana & Texas.—See Southern Pacific.

Northern Pacific.—Newman Kline, Assistant General Superintendent, has been transferred to the office of Superintendent at Minneapolis, Minn., in place of M. M. Fowler, who is now Trainmaster.

San Antonio & Aransas Pass.—See Southern Pacific.

Southern.—On account of the resignation of M. M. Richey, E. H. Coapman, Manager, now has authority over the Middle and Western districts, with office at Washington, D. C.

T. C. Laughlin has been appointed Trainmaster at Princeton, Ind., in place of Niles Shaw, who has been appointed Chief Train Despatcher.

Southern Pacific.—William M. Hobbs, hitherto Vice-President and General Manager of the San Antonio & Aransas Pass, has been appointed Manager of the Louisiana Lines of the Southern Pacific, succeeding to the duties of E. B. Cushing, General Superintendent.

H. W. Sheridan, heretofore Trainmaster on the Union Pacific at Green River, has been appointed Assistant Superintendent of the Sacramento division of the S. P.

Traffic Officers.

Chicago, Burlington & Quincy.—H. H. Holcomb has been appointed Assistant General Freight Agent, with office at Chicago.

Engineering and Rolling Stock Officers.

Central Vermont.—W. Kennedy has been appointed Superintendent of Motive Power and Cars, with office at St. Albans, Vt., in place of James Coleman, resigned.

Chicago, Burlington & Quincy.—J. G. Crawford has been appointed Fuel Engineer, with headquarters at Chicago. He will have charge of the inspection of coal.

Great Northern.—M. Flannagan has been appointed Master Mechanic of the Montana division in place of K. M. Froburg.

Kansas City Belt.—W. E. New, heretofore foreman of shops on the A., T. & S. F. at Newton, Kan., has been appointed Superintendent of Motive Power of the K. C. B.; office at Kansas City, Mo.

LOCOMOTIVE BUILDING.

The Orleans Railroad, 8 Rue de Londres, Paris, France, is asking American builders for bids on 10 passenger locomotives.

The New York, Chicago & St. Louis, which was reported as being in the market in the *Railroad Gazette* of December 27, has ordered 10 simple ten-wheel (4-6-0) locomotives, five simple consolidation (2-8-0) locomotives, and five simple six-wheel switching (0-6-0) locomotives from the American Locomotive Co., for February delivery. The specifications are as follows:

General Dimensions.

Types of locomotives	10-wheel.	Consolidation.	Switching
Weight, total	136,500 lbs.	160,000 lbs.	103,450 lbs.
Weight on drivers	105,600 lbs.	142,000 lbs.	103,450 lbs.
Diameter of drivers	62 in.	62 in.	50 in.
Cylinders	19 in. x 24 in.	19 in. x 28 in.	18 in. x 24 in.
Boiler type	Radial stay; ext. w. top.	Radial stay; wagon top.	Radial stay; straight top
" wrkg. steam pressure	180 lbs.	200 lbs.	170 lbs.
" number of tubes	244	306	172
" material of tubes	Iron.	Iron.	Iron
" length of tubes	13 ft. 3/8 in.	14 ft. 10 3/8 in.	11 ft. 1 1/16 in.
Firebox, length	102 3/8 in.	96 in.	96 in.
" width	40 1/4 in.	63 in.	33 in.
" material	......	Otis steel.	Otis steel.
" grate area	28.51 sq. ft.	40.9 sq. ft.	21.31 sq. ft.
Heating surface, total	1,783.0 "	2,532.0 "	1,121.0 "
Tank capacity	5,500 gals.	5,500 gals.	3,000 gals.
Coal capacity	14 tons.	14 tons.	4.4 tons.

Special Equipment.

Air brakes	Westinghouse
Bell ringer	Gollmar
Boiler lagging	Keasbey & Mattison
Brake beams	Waycott
Brake-shoes	American Brake Shoe & Foundry Co.
Couplers	Climax
Headlights	United States
Injector	Monitor
Journal bearings	Magnus
Piston rod packings	United States
Valve rod packings	United States
Safety valve	Coale
Sanding devices	Leach
Sight feed lubricators	Nathan bull's-eye
Springs	Railway Steel Spring Co.
Steam gages	Crosby
Tires, driving wheel	Latrobe

RAILROAD STRUCTURES.

Allentown, Pa.—It is said that the Philadelphia & Reading and the Central of New Jersey are planning a more convenient interchange of traffic from the North Penn division. Plans are under way for putting up a three-track bridge over the Lehigh river at South Bethlehem, and building additional yards and probably new passenger and freight stations in Allentown. The improvements are to cost about $1,000,000. When completed, trains of the North Penn can run through to and from Allentown by using the Central tracks west of Bethlehem.

Beaver, Pa.—Bids, it is said, will soon be asked for by the Pittsburgh & Lake Erie for putting up the proposed steel bridge over the Ohio river, which is to have a total length of 1,787 ft. The cost of the improvement with the necessary changes in tracks and approaches will be about $2,000,000.

Bethlehem, Pa.—Bids are wanted January 25, by Engineer R. E. Neumeyer, for putting up three truss spans and one girder span steel bridge over the Philadelphia & Reading and the Bethlehem Steel Works tracks between William and Anthracite streets, Northampton Heights. The proposed bridge is to be 385 ft. long, and the cost is to be shared by the Philadelphia & Reading, the Bethlehem Steel Company, the Eastern & Pittsburgh Transit Company and the Borough of Northampton Heights.

Brooklyn, N. Y.—The Coney Island & Brooklyn is planning to build six sub-stations this year at a total cost of $250,000.

Fort William, Ont.—This town will raise $50,000 towards building a municipal railway system. Bridges are also to be built over the McKellar, Mission and Kaministiquia rivers.

Fort Worth, Tex.—The Texas & Pacific freight house here which cost $150,000, was recently destroyed by fire. About $100,000 worth of freight was in the station at the time of the fire and it was entirely destroyed.

Hornell, N. Y.—Announcement is made that the Erie is planning to make improvements to its shops here.

New Castle, Pa.—All objections to the Pittsburgh street bridge having been withdrawn, plans will be made at once to carry out the work. The bridge is to be used by the Mahoning & Shenango Valley Railway & Light Company.

Somerset, Ky.—Plans, it is said, are being made to rebuild the high bridge over the Kentucky river.

Superior, Wis.—Plans have been made by the Great Northern to put up a steel elevator to replace the one destroyed by fire. Schmidt Bros. & Hill, Superior, Wis., and the Minneapolis Steel Company, of Minneapolis, Minn., will have charge of the work. The cost of the improvement will be about $1,000,000.

Wilkesbarre, Pa.—The railroads entering this place are planning to abolish a number of grade crossings within the city limits and to put up a union passenger station near Market and Northampton streets.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Buffalo, Rochester & Pittsburgh.—An officer writes in regard to the reported improvements to be made on this road that the only large improvement under way or contemplated at the present time is on a ten-mile section from Carman, Pa., south to Brockwayville, where the line is to be revised and a double-track tunnel pierced, about 1,000 ft. long. Contracts for grading let to Eyre-Shoemaker & Co., of Philadelphia.

Canadian Northern.—Surveys are reported being made for an extension from Regina, Sask., west toward Lethbridge, Alberta, on about 200 miles. (Dec. 6, p. 701.)

Cincinnati, Bluffton & Chicago.—This company now operates 52 miles of main line, having finished last year the extension from Bluffton, Ind., to Huntington, 15 miles, where the company has shops, roundhouses and terminals. It is expected that contracts for work on the southern extension from Portland south to Versailles, Ohio, 35 miles, will be let shortly.

Danville & Bloomsburg Street Railway.—This company, it is said, is planning to build an extension from Danville, Pa., west to Milton, 16 miles.

Dayton, Lebanon & Cincinnati Railroad & Terminal Co.—This company will begin work early this year on an extension of its Dayton branch from Lambeth, Ohio, west to Union Station in Dayton, 1.9 miles.

Hudson & Manhattan Railroad.—The "uptown" tunnels extending from Hoboken to Sixth avenue, New York, have been finished. Experimental trains are now in operation. Forty all-steel cars have been delivered and equipped and are now in the tunnels for preliminary operation. They will shortly be opened to the public for traffic between the station in Hoboken at the Lackawanna Terminal and the station at Fourteenth street and Sixth avenue, New York. A few weeks later the runs of the trains will be extended to Nineteenth street and shortly after to Twenty-third street and Sixth avenue, New York.

Work on the "downtown" tunnels, terminating between Cortlandt and Fulton streets in Manhattan, has actively progressed, the work being pushed by driving shields both from the New Jersey side and from the New York side.

The terminal station building at Cortlandt, Fulton and Church streets, in which is the loop terminal of the downtown tunnels, is nearing completion. The building is to be ready for tenants by April 15 of this year, and the station will be finished by the time the railroad is ready for operation.

The station at the present western terminus of this tunnel, at the Pennsylvania terminal in Jersey City, is about finished and work is progressing on the approach to the river tunnels on Railroad avenue and on the north and south tunnels along the line of Washington street in Jersey City.

The electrical power house at Washington street, Jersey City, is finished and boilers and machinery are being put in. All work is being done for the Hudson Companies. Charles M. Jacobs, Chief Engineer, and J. Vipond Davies, Deputy Chief Engineer. The electrical installation, power and rolling stock equipment are under the charge of L. B. Stillwell, Consulting Electrical Engineer, and Hugh Hazelton, Electrical Engineer.

Hudson Companies.—See Hudson & Manhattan Railroad.

Kansas City, Mexico & Orient.—On the Kansas-Oklahoma division of this road all the track has been laid and train service is now in operation from Wichita, Kan., south to the Red river, 272 miles. The next section to be finished is from Sweetwater, Tex., north on which track is now laid to a point two miles north of Benjamin, 90 miles, leaving about 69 miles to finish the line to the Oklahoma line at the Red river, where a 3,000-ft. bridge is to be built. On the completion of this work the company will have 431 miles of continuous track laid south of Wichita. Plans are also made to build south from Sweetwater to finish the line to San Angelo, 77 miles. On this section track has been laid for 11 miles from San Angelo north. All the roadbed is graded and all ties and bridge material are on the ground, but the rails are coming slowly.

MASSILLON, WOOSTER & MANSFIELD TRACTION.—An officer writes that this company has given contracts to the Northern Engineering & Construction Company, of Cleveland, Ohio, to build an electric line from Massillon, Ohio, west via Dalton, Orrville, Smithville, Madisonburg, Wooster, Reedsburg, Jeromeville and Hayesville to Mansfield, 50 miles. Grading finished for about four miles between Smithville and Madisonburg. G. A. Bartholomew, Chief Engineer, 1423 Williamson building, Cleveland, Ohio.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—This company, it is said, has plans under consideration for building an extension from Thief River Falls, Minn., northeast to Roosevelt, on the Canadian border, about 82 miles.

NEVADA NORTHERN.—It is reported that this company is planning to build an extension from its southern terminus at Ely, Nev., southwest to Goldfield, about 170 miles.

NEW YORK & NORTH SHORE TRACTION.—A franchise has been granted this company to extend its line from Foleys Corners, Roslyn, Long Island, east via Manhasset, Great Neck and Thomaston, to Little Neck, about five miles.

NEW YORK SUBWAYS.—The New York Public Service Commission, First district, expects to ask for bids early in February to build six sections of the projected subway from the Manhattan bridge, in the Borough of Brooklyn, toward Coney Island as follows:

From the Manhattan bridge to Willoughby street under Flatbush avenue extension.

Willoughby street to the beginning of Ashland place.

Ashland place to Sackett street.

Sackett street to Ninth street.

Ninth street to a point between 26th and 27th streets.

From the point between 26th and 27th streets to 41st street.

When these contracts are let the Commission will immediately take up the other divisions continuing the line to Fort Hamilton and the spur to Coney Island under New Utrecht avenue, 86th street and Stillwell avenue. (Oct. 18, p. 473.)

PAN-AMERICAN.—This company, which is building a line from the National Tehuantepec Railroad at San Geronimo southeast to the Guatemalan border, 250 miles, expects to have the line finished to Tapachula, 10 miles from the Guatemalan border, next month. The company has money on hand to finish the line, which is already in operation for about 200 miles.

PENNSYLVANIA.—Work on the tunnels under way for the past three years, under 32d and 33d streets, New York, from the terminal station at Seventh avenue to the East river, are about finished. The final blast was fired recently 60 ft. under Sixth avenue and 32d street. It cleaned the last obstacle in the 32d street tube. The 33d street tube was entirely blasted through some weeks ago. Much work yet remains to be done in the tunnels under the East river, in the Long Island City yards and approaches, and on the Jersey approaches to the Hudson tubes.

WILMINGTON & WESTCHESTER (ELECTRIC).—T. E. O'Connell, Wilmington, the principal promoter of this company, is quoted as saying that work will soon be begun on an electric line from Wilmington, Del., north to West Chester, Pa., 17 miles. A power-house is to be put up at Brandywine Summit.

RAILROAD CORPORATION NEWS.

BALTIMORE & OHIO.—Gross earnings of this system for December decreased over $1,000,000, or 16 per cent.; operating expenses increased $165,000, leaving a decrease of $1,200,000, or 53 per cent., in net earnings. President Murray is quoted as saying that the increase in expenses was more than accounted for by higher rates of pay and the larger charges for depreciation. Over 85 per cent. of the decrease in gross earnings was in connection with the steel industry, particularly in coke, ore and pig iron traffic. In the McConnellsville region alone all lines together in December moved only 23,000 loads of coke as compared with 61,000 in December, 1906. The movement of bituminous coal, which comprises about 50 per cent. of the company's tonnage, showed an increase of over 100,000 tons. This movement was, however, eastbound and therefore less profitable than the usual ordinary westbound tonnage. For the six months ended December 31 1907, gross earnings were $42,900,000, an increase of $1,100,000, and net earnings $13,000,000, a decrease of $2,000,000.

BOSTON & MAINE.—President Tuttle has filed a petition and bill with the Massachusetts House of Representatives, claiming that the law covering the issue of new railroad stocks and bonds should be changed so that securities may be issued "on such terms and such price as would warrant stockholders in subscribing" for them. The bill submitted with the petition provides that railroad corporations be authorized to issue preferred stock on such terms of preference as the railroad commissioners may approve, and also to issue convertible bonds subject to the same approval.

See New York, New Haven & Hartford.

BUFFALO, ROCHESTER & PITTSBURGH.—Gross earnings for the first two weeks of January, 1908, were 21 per cent. less than for the corresponding period in 1907. In the second week the decrease was 14 per cent.

CHICAGO & ALTON.—A stockholder owning 500 shares of the common stock of the old Chicago & Alton Railroad, which was consolidated in March, 1906, with the Chicago & Alton Railway into the present Chicago & Alton Railroad, has brought suit in the United States Circuit Court at Chicago asking that separate accounts be kept for the old Railroad company and that an accounting of profits wrongfully diverted from it be ordered. The contention is that the old Railroad company was much more prosperous than the Railway company which was consolidated with it in 1906, and that the outstanding stock of the old Railroad company should receive returns in proportion to the profits which are being earned by its individual properties. If the claims of this stockholder are upheld, the economies which were to have been brought about by the consolidation of the two companies in 1906 will be done away with, for it will be necessary to keep separate accounts for the old Railroad company and for the new Railroad (consolidated) company.

CHICAGO GREAT WESTERN.—Since the appointment of receivers the income results for the month of November have been made public. Gross earnings were $715,000, a decrease of 10 per cent.; and net earnings $110,000, a decrease of 50 per cent. For the five months ended November 30, 1907, net earnings were $74,400, a decrease of $592,000, or 44 per cent. Both the showing for November and for the five months are the most unsatisfactory for years.

CHICAGO, ROCK ISLAND & PACIFIC.—The Peoria & Bureau Valley, which is leased to the Chicago, Rock Island & Pacific Railway, has declared a regular semi-annual dividend of 4 per cent. and an extra dividend of 1 per cent. on its $1,500,000 stock.

Speyer & Company are offering $6,000,000 first and refunding mortgage 4 per cent. bonds of 1934 of the Chicago, Rock Island & Pacific Railway at 85½, a yield of 5 per cent. There were already $66,851,000 of these bonds outstanding. The Railway company, which is controlled by the Rock Island Company through the Chicago, Rock Island & Pacific Railroad, has paid dividends of not less than 5 per cent. each year since 1898. These are the first straight long term railroad bonds offered at public sale for some time.

DENVER, NORTH-WESTERN & PACIFIC.—The Denver Steamboat Construction Company was on January 10 incorporated in Colorado with $1,500,000 capital stock to extend the Denver, North-Western & Pacific from its present terminus at Yarmony, Colo., west through the coal fields of the Oak Hills district of Routt county to Steamboat Springs, 68 miles. Contract for this work has already been given by the railroad to the construction company, whose directors are: Col. D. C. Dodge, Henry M. Porter, Lawrence C. Phipps, Thomas F. Walsh, John F. Campion, Charles Boettcher, Charles J. Hughes, Jr., William Byrd Page and Samuel M. Perry, representing mining, cattle, beet-sugar, coal and other interests at Denver and outside interests. Much of the stock of the construction company had been subscribed for before its incorporation.

ERIE TRACTION.—This company, whose road runs from Erie, Pa., to Cambridge Springs, 27 miles, which is on the Erie, is reported to have been bought by the Wells-Fargo Express Company, presumably to prevent the Adams and American Express companies from shipping over it, thus cutting into Wells-Fargo territory. This attempted action of these two companies follows the success of the Wells-Fargo in getting into Pittsburgh over an electric railroad.

GREEN BAY & WESTERN.—Besides the regular annual dividends of 5 per cent. on the A debentures and 5 per cent. on the stock an initial dividend of one-half of 1 per cent has been declared on the B debentures. The A debentures are entitled to 2½ per cent. if earned, then the stock to 2½ per cent.; thereafter the two share equally. The B debentures are entitled to all surplus earnings after 5 per cent. has been paid on the A debentures and on the stock.

INTERNATIONAL & GREAT NORTHERN.—Estimated gross earnings for the week ended January 14, 1908, were $135,000, against $182,000 in the corresponding week of 1907, a decrease of $47,000, or 26 per cent. This sharp falling off in net earnings is typical of the experience of most other railroads in the Southwest during the last six weeks.

INTERNATIONAL TRACTION.—See Mohawk Valley Company.

KANSAS CITY SOUTHERN.—Gross earnings for December decreased $92,000, or 12 per cent.; operating expenses increased $64,000, leaving a decrease of $156,000, or 46 per cent. in net earnings. Net earnings, taxes deducted, were $166,000. After deducting one-twelfth of the other fixed charges for the fiscal year ended June 30, 1907, from this sum, there would be left $67,000 for the preferred stock, which is at the rate of 3.8 per cent. a year. It is, of course, not fair to judge of the year's results by any one month, as the results for the six months ended December 21, 1907, show. In this half year gross earnings were $5,000,000, an increase of $700,000, and net earnings $1,700,000, a small increase. The company intimates, but does not say, that a considerable amount was charged to operating expenses during this period, which ordinarily would be chargeable to betterments.

LOUISVILLE & NASHVILLE.—An extra dividend of 1 per cent., in addition to the regular semi-annual cash dividend of 3 per cent. declared December 19, 1907, was declared after the close of business on January 18, 1908. This extra dividend is payable in stock of the Louisville Property Company, fractional parts of shares to be represented by non-interest bearing scrip. The Louisville Property Company is a holding company which owns various lands in Louisville & Nashville territory, including coal lands. Its capital stock on June 30, 1907, was $50,000, but this has since been increased to at least $600,000, which amount exactly covers the recently declared dividend. Milton H. Smith, President of the Louisville & Nashville, is President of the Louisville Property Company. The regular dividend of the Louisville & Nashville was declared on December 19 in the usual way, but no announcement of the extra dividend was made until after the close of business on Saturday, January 18. On January 20 the books closed for payment of the dividends.

MISSISSIPPI VALLEY.—This company has been incorporated in Arkansas with $100,000 stock to lease the Portland & Southeastern, which operates 14 miles of railroad in Ashley and Chicot counties. The incorporators are: J. H. Bird and M. G. Price, of St. Louis; H. L. Pitman, C. C. Curl and C. Sawyer, of Ashley county.

MISSOURI, KANSAS & TEXAS.—Net earnings for the month of November were $512,000, against $1,007,000 in 1906, a decrease of 52 per cent. Fixed charges were $553,000, leaving a deficit of $41,000 for the month, against a surplus of $666,000 for the month of November, 1906. This decline came after a long period of great prosperity. Gross earnings for the month decreased $449,000, owing to the almost entire lack of cotton shipments, the reduction in traffic in coal and manufactures and legislative rate reductions, while operating expenses increased $139,000, owing to higher cost of materials and labor and legislative restrictions on operations.

MOHAWK VALLEY COMPANY.—It is reported that the International Traction Company, which operates 217 miles of line, including all the street railway mileage of and between Buffalo, Niagara Falls, Lockport, Tonawanda and North Tonawanda, N. Y., is to be acquired by the Mohawk Valley Company. This acquisition would greatly strengthen the Mohawk Valley Company, which already controls the street railway systems of Rochester, Syracuse and Utica and jointly with the Delaware & Hudson, of Schenectady. The D. & H. owns the street railways in Troy and Albany. The Mohawk Valley Company also controls several interurban lines, including a line from Utica to Syracuse. The New York Central owns 60 per cent. of its stock.

NEVADA CENTRAL.—An interest payment of $2\frac{1}{2}$ per cent. is being made on the $750,000 first mortgage 5 per cent. non-cumulative income bonds. The last previous payment on these bonds was 4 per cent. in July, 1906. The road is narrow gage and runs from Battle Mountain, Nev., to Austin, 93 miles.

NEW YORK CENTRAL LINES.—Nearly all of the $30,000,000 5 per cent. equipment trust certificates recently offered have already been sold. Of these, $20,389,000 were issued against the following equipment which has been or is about to be delivered to the following companies:

New York Central & Hudson River—165 locomotives, 76 passenger cars, 1,000 gondola cars, 1,000 flat cars and 2,000 box cars.

Lake Shore & Michigan Southern—125 locomotives, 25 passenger cars, 200 ballast cars, 1,000 hopper cars, and 2,000 gondola cars.

Boston & Albany—79 locomotives, 12 passenger cars.

Michigan Central—[illegible] passenger cars, 200 ballast cars, [illegible] flat cars and 1,000 gondola cars.

Cleveland, Cincinnati, Chicago & St. Louis—107 locomotives, 51 cabooses, 100 ballast cars, 250 flat cars, 250 hopper cars and 500 gondola cars.

Chicago, Indiana & Southern—[illegible] passenger cars, 150 ballast cars, [illegible] flat cars and 100 hopper cars.

Peoria & Eastern—500 gondola cars.

NEW YORK CENTRAL & HUDSON RIVER.—See Mohawk Valley.

NEW YORK, NEW HAVEN & HARTFORD.—Butler Ames, Representative in Congress from Lowell, Mass., has issued a statement favoring the consolidation of the Boston & Maine with the New York, New Haven & Hartford in view of the following advantages to be gained: Better freight and passenger rates; transfer accommodations around Boston between the two roads, electrification of suburban lines about Boston; a large saving in equipment and reduction of about half of the cost of management. Mr. Ames says that control of the Boston & Maine was not sought for by the New Haven, but that a block of stock sufficient to give control of the property was seeking a market, offered to the New Haven and the offer accepted. He regrets that this stock was not bought by citizens of Massachusetts, but believes that since it was not, control by the New Haven is preferable to that of any other railroad in the United States or Canada. He also points out that the interests of New England are a unit as against the interests of the territory west of the Hudson river in the matter of rates and traffic. He also calls attention to the fact that less than carload lots shipped from any point on the Boston & Maine to any point on the New Haven and *vice versa* now are transferred from car to car at junction points. He urges that two members of the board of directors of the consolidated system should be named by the Governor of Massachusetts.

NORTHERN ELECTRIC.—The Northern Electric Railway, incorporated on September 19, 1907, in California, with $10,000,000 5 per cent. non-cumulative preferred stock, of which $5,000,000 is outstanding, and $15,000,000 authorized common stock, has acquired the properties of the Northern Electric Company, which include a line from Chico, via Oroville, Yuba City and Marysville to Sacramento; also the Shasta Southern (Electric) Railway operating between Chico and Hamilton. The Northern Electric Railway has made a first consolidated mortgage securing $25,000,000 5 per cent., 40-year gold bonds dated December 1, 1907, none of which are as yet outstanding. The company is now operating more than 100 miles of track and plans to build over 300 miles more.

PENNSYLVANIA LINES WEST.—The Pittsburgh, Cincinnati, Chicago & St. Louis reports for December, 1907, an estimated decrease of $500,000 in gross earnings and a decrease of $200,000 in operating expenses and taxes, leaving an increase of $300,000 in net earnings after taxes. This would seem to show that this company is able to reduce expenses to meet the decreased earnings.

For the year ended December 31, 1907, gross earnings increased $2,700,000 and operating expenses and taxes $2,500,000, leaving an increase in net earnings after taxes of about $200,000.

PEORIA & BUREAU VALLEY.—See Chicago, Rock Island & Pacific.

PITTSBURGH, SHAWMUT & NORTHERN.—Part of an issue of $592,000 5 per cent. car trust bonds issued by the receiver of this railroad, and of the Shawmut Mining Company and the Kersey Mining Company, dated November 1, 1907, and maturing from 1908 to 1914, have recently offered for sale at a price yielding $6\frac{1}{2}$ per cent. for the 1908 maturity and 7 per cent. for each of the other maturities. These bonds cover three locomotives and 500 steel underframe coal cars of 100,000 lbs. capacity, 10 per cent. of whose cost has been paid. Owing to the fact that they are issued by the receiver, they have, besides the usual advantages of an equipment trust, a lien prior to existing mortgages on the properties of the three companies.

PORTLAND & SOUTHEASTERN.—See Mississippi Valley.

TEXAS & PACIFIC.—Estimated gross earnings for the two weeks ended January 14, 1908, were 24 per cent. less than for the corresponding period in 1907.

THIRD AVENUE RAILROAD.—Former District Attorney J. Addison Young, of Westchester county, has been appointed temporary receiver of the Westchester Electric Railway, which operates the electric lines at Mt. Vernon, N. Y., and of the Tarrytown, White Plains & Mamaroneck, which operates electric lines between these three points. Former County Clerk Leslie Sutherland, of Westchester county, has been appointed receiver of the Yonkers Railroad, which operates electric lines in Yonkers and thereabouts. These companies are all controlled by the Union Railway, which stock is owned by the Third Avenue Railroad, which, previous to the recent appointment of a separate receiver for it, was leased to the Metropolitan Street Railway, which was leased to the New York City Railway.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

The short term notes issued so freely during the past two years are beginning to mature. But fortunately it is now possible to secure new railroad capital. The Delaware & Hudson, which has $6,000,000 one-year notes of the Quebec, Montreal & Southern falling due in February has borrowed $6,000,000 from the First National Bank and Kuhn, Loeb & Company, of New York, for six months at $4\frac{1}{2}$ per cent. This company evidently believes that by August conditions will be favorable for permanent financing. The rate of $4\frac{1}{2}$ per cent. on this loan is strong evidence of financial clearing. The Missouri Pacific has adopted a new expedient in order to get funds. Certain of its lines, including the connecting line running west to meet the Denver & Rio Grande at Pueblo, Col., which will on completion by 1909 of the Western Pacific, be part of the through line to the Coast, are the property of the Kansas & Colorado Pacific. A new "first refunding" mortgage has been created covering the lines of this company which, including refunding, is limited to $30,000 per mile on 1,450 miles, a total of $43,500,000. The prior liens are at the rate of $15,541 per mile. These bonds are 30-year 6 per cents., dated February 1, 1908, guaranteed by the Missouri Pacific. Of these bonds, $12,000,000 have been deposited as collateral for $6,000,000 Missouri Pacific two-year 6 per cent. notes dated February 10, 1908, convertible at par into the first refunding mortgage 6 per cent. bonds of the Kansas & Colorado Pacific by which they are secured. These notes are to refund a like amount of 5 per cent. notes originally issued in 1904 as two year notes, in 1906 extended for two years and maturing February 10, 1908, and they have been sold to bankers and offered to the public at 99. We are informed by the bankers that these are the first notes convertible into bonds ever issued. At the moment the railroad company could not sell the bonds themselves; it evidently hopes that the notes will all be converted within the next two years into the bonds and thus changed from a short term to a long term issue. Being secured by bonds, they are believed to be a legal investment for insurance companies in New York State.

TO GET TRACK-GANG EFFICIENCY.

There is in use in the track and bridge departments of the Illinois Central, and probably on other roads, a Time Roll and Distribution of Labor book which each foreman is compelled to keep marked up to date and turn over to his supervisor on the 27th of each month. Its effect is to make it easier to detect and generally prevent any attempt to pad the payroll or date back a new laborer or credit any laborer more time than he has made. Indirectly also it has a telling effect in preventing the men from paying the foreman a commission for their employment. The book is $8\frac{1}{2}$ in. wide by 9 in. high, but it folds to $4\frac{1}{2}$ in. by 9 in., and is inserted in an oilcloth cover and carried in the foreman's pocket with little danger of getting soaked and illegible.

Its peculiar feature is that each leaf consists of two pieces of white paper pasted together at the edges, and fastened immovable between those leaves is a carbon paper, so that when a pencil record is once made it cannot be erased because it is duplicated on the other sheet of this compound leaf. When a foreman makes a mistake in entering he cannot rub it out, but on another page provided for the purpose he can write an explanation of his mistake. Opposite each man's name there are two blank squares about a quarter of an inch wide for each day. Opposite each laborer's name the foreman puts a dot in the blank square showing when the man reports for work. At noon he puts the number of hours, 3 or 4 or 5; after dinner when each man begins, he puts a dot in the afternoon square, and in the evening puts in the number of hours, so that when a man works all day there are two dots and two figures entered. At night the foreman turns to another page of the book and enters up the totals for each man and the distribution of hours to the accounts chargeable.

To prevent the foreman dating a man back, and so giving him some extra days' pay in return for a commission or fee, the foreman is required to keep all blank spaces of a previous date cancelled by drawing lines across the spaces. The supervisor looks at the foreman's book frequently, and he must see to it that these cancellations of previous dates are kept up. More than this, the company employs a number of time checkers who have no other duties than the checking of the number of men employed in the gangs with the number of men shown on the time rolls. These checkers are shifted from time to time to various points and they appear on the work and check the time rolls of the foremen at any time. This might be called surprise checking.

The subsequent history of the books is interesting. On the 27th of each month the books are handed to the supervisor who holds them for a day or two for checking and correction and the making up of his own report. The foreman's book of original entry then goes with the supervisor's report to the auditor who compares the payrolls with the work shown in the books, signs each book and returns it to the supervisor. H. R. Safford, Chief Engineer of Maintenance of Way of the Illinois Central, tells us that in the beginning the foremen had to be educated in the use of these time books and although some little trouble was experienced when the book was adopted, it was overcome in a short time and they are now having no trouble in getting the foremen to put up the time in detail four times a day and to keep their books in a neat condition.

The use of the book has effected a reform and in this connection the following comment and reminiscences of an experienced supervisor are interesting: "The dishonesty among track employees is nearly always due to weakness—to a foreman's desire to put off the day of trouble; to be comfortable after finding that it costs something to be known as a good fellow, appertaining to which, as Bill Devery once said, 'A man ought to have I get ready to get it in the neck with an axe as soon as trying.'

"One of my foremen spent his evenings in the saloon to meet his friends and smoke a pipe. He did not drink in excess and went home early. He paid cash for his beer and tobacco at first, but once when he happened to be short, his friend, the proprietor, said 'never mind.' This habit grew and it grew a good deal until the proprietor casually mentioned that he knew a good man who wanted a job. After that Mike paid for no more beer and the proprietor furnished all the men, charging the men for their jobs and keeping them as customers. I soon detected this in the amount of work done and had to let the foreman go. He was a good fellow and a good trackman.

"I had another foreman who was all for the interests of the company. He got good men and he held them. In a broad-minded way he offered premiums for efficiency. If a valuable man was sick for a day or two he credited him full time if necessary, to coax a good man from somewhere else he dated him back a few days on the payroll. He had the best gang I ever saw. But the small irregularities leaked out and the foreman was blackmailed. He is still working, but he was transferred and is living down the past.

"Another valuable foreman was positively afraid to take a pen or pencil in his hand. He was always on his job, loyal and energetic, the first man out at the least sign of a storm. Work exhilarated him, but in making up his time book he would gasp for breath and at just the right time a handy man appeared who offered to keep his book and employ men for him. Of course, this handy man collected from the laborers and credited long hours and extra days and pretty soon I called in the foreman and showed him the results. The results were a reduction of 40 per cent. in efficiency."

TWO CENTS A MILE ON THE NEW HAVEN.

In the annual report of the New York, New Haven & Hartford Railroad Company for the year ending September 30, 1886, President George H. Watrous announced an important reduction of passenger fares by vote of the directors. Beginning with January 1, 1887, he said, the company would reduce to two cents a mile the regular fare on the main line from New York to Springfield, Mass., and at the same time would reduce to 2½ cents a mile the fare on the Shore Line and Air Line divisions of about 50 miles each. The actual reductions in each case appear to have been about half a cent a mile. The reduction was, in the main, voluntary. It was true that to some extent the menace of a "parallel" hung over the New Haven line that later materialized in a bitter and very corrupt battle in the Connecticut legislature when in the metaphor of the time "the ship of state floated in a sea of champagne shored by greenbacks." But at least there was no popular outcry for the reduction and no threat or danger that it would be enforced by legislation. It was a matter of broad rather than specific policy and to that today the New Haven ranks as a pioneer among American railroads. The charter rate of two cents a mile on the main line of the New York Central, it is true, antedates the New Haven's action, but it was the legislative price paid for the consolidation of its lines across New York State.

In his report announcing the reduction, President Watrous forecast, on the basis of existing passenger traffic, a loss for the next fiscal year ending September 30, 1887, of $500,000. The gap between prophecy and the event was striking. The year in question included nine months of the reduction. But instead of a half million decrease passenger receipts rose from $1,225,698 to $1,319,252, or a gain of $93,554. Passengers carried rose from 8,267,310 to 9,361,426, a gain of 1,094,116, or somewhat more than 13 per cent., and passenger mileage rose from 226,162,000 to 249,161,000, a gain of about 10 per cent. [illegible] further on the New Haven in the fiscal year 1888 [illegible] returns [illegible] important additional lines [illegible].

For some twenty years [illegible] no important change was made in the New Haven's regular passenger rate. But in the meantime [illegible] a mile rate for 1,000 miles [illegible] books at the same rate for [illegible] miles in the [illegible] of Massachusetts, Rhode Island and Connecticut [illegible]. Early in the year [illegible], President [illegible] reduction to two cents a mile for regular fares [illegible] to the whole system of 2,000 miles [illegible]. The change was to [illegible] March 1, [illegible] and to be completed November 1 [illegible] It was to begin on certain [illegible] at the [illegible] part of the system and work eastward until on November [illegible] the through New York-Boston rate, thus [illegible] the order of density of passenger traffic. It [illegible] that this reduction was voluntary, that it [illegible] a [illegible] degree on the Boston & Maine [illegible] for [illegible] the part of Boston and Massachusetts, has hardly been vivid. On the basis of existing passenger travel the reduced annual receipts were estimated by the company at $7[illegible]. What actually came to pass is set forth in the table annexed showing regular passenger and commutation earnings by months for three years beginning with the month (November) of the completed reduction.

	1904-1905	1905-1906	1906-1907
November	$1,644,601.77	$1,72[illegible]	$1,76[illegible]
December	1,502,737.2[illegible]	1,6[illegible]	1,74[illegible]
January	1,376,963.65	1,[illegible]	1,[illegible]
February	1,261,977.62	1,378,5[illegible]	1,4[illegible]
March	1,461,601.85	1,51[illegible]	1,6[illegible]
April	1,625,820.82	1,697,67[illegible]	1,782,[illegible]
May	1,690,828.66	1,750,870.10	1,8[illegible]
June	1,775,286.60	1,922,768.26	1,971,7[illegible]
July	1,962,653.30	2,042,011.49	2,16[illegible]
August	2,07[illegible]172.99	2,175,649.18	2,4[illegible]
September	2,07[illegible]676.91	2,181,416.26	2,[illegible]
October	1,8[illegible]	1,9[illegible]31.92	2,04[illegible]
Total	$2[illegible]	$21,560,49[illegible].01	$22,771,87[illegible]

The first column represents the complete year beginning [illegible] November before the reduction, the second column includes [illegible] months under the sliding scale of reduction, and the final column represents the first full year after the reduction went into force on the whole system. The impressive comparison is therefore between the first column and the last. It shows a gain in passenger receipts of $2,487,212.72, or somewhat more than 12 per cent., with no increase of track mileage worth mention, a fact which gives the comparative returns increased value. The great increment is emphasized also by the fact that it appears on a system where the mileage books were already very commonly used and, indeed, privately traded in by temporary transfers. On the other hand, it is to be noted that in the year 1905-1906 the company [illegible] developed its excursion business which, however, in the following year, was reduced by its inability to run its excursion trains to New York City owing to obstruction due to the terminal improvements above the Grand Central Station.

How much of this greatly increased passenger business was due to the two cent rate, how much to national growth of passenger traffic cannot even be guessed at, and obviously there will be no light upon the subject during the year to come with its industrial recession affecting passenger traffic as well as freight. It is manifest also that the New Haven system, with its volume of passenger business not only immense, but dense and producing operating revenue almost equal to that from freight, holds a unique position in the matter of passenger rate reduction. Still, with every allowance on the plus and minus side, the increased revenue from reduced and uniform fares is peculiarly impressive. One cannot reason from the New Haven to other railroad systems great or small with their passenger business, nor to whole states or other geographical divisions that contain varied railroad lines. But the New Haven example has at least two sharp suggestions. First, the occasional value of voluntary as contrasted with compulsory passenger rate reductions, and, secondly, the feasibility and success of the "postage stamp" idea as applied progressively in systems with high passenger density, at first in the form of the mileage book, next to the zone of densest travel and finally to the system as a whole. Along these lines, without the dictate of legislatures or commissions, the future of the American railroad promises some instructive results. Were it not for the fear of public clamor for further and unreasonable reduction the idea would probably be tried out sooner and more often.

GOVERNMENT ACTION AGAINST THE HARRIMAN ROADS.

The current week has brought out two interesting and highly contradictory pieces of news with regard to the attitude of our government towards the railroads. On January 25, Attorney-General Bonaparte directed that a bill in equity be filed to set aside the control by the Union Pacific Railroad Company and its subsidiary corporations of the Southern Pacific and the San Pedro, Los Angeles & Salt Lake; also to have declared illegal the ownership by the Union Pacific or the Oregon Short Line of stock in the Santa Fe, the Great Northern and the Northern Pacific, it being alleged that all these lines are competitors of the Union Pacific and that they have conceived and carried out a conspiracy in restraint of trade. E. H. Harriman, Jacob H. Schiff, Otto H. Kahn, James Stillman, Henry C. Frick, Henry H. Rogers and William A. Clark are cited as individual defendants. Mr. Bonaparte has issued an official statement in which he says that the extended investigation by the Interstate Commerce Commission into the relations existing between the various roads engaged in transcontinental traffic, supplemented by independent investigations by the Department of Justice, has caused the department to arrive at the conclusion that the stockholding of the Union Pacific and its subsidiary companies in the other corporations mentioned above is in direct violation of the Sherman act. The department regards the suit as of great importance, since it seeks by means of it to break up what it refers to as the substantial monopoly of the transportation business of the country between the Missouri river on the East, and the entire Pacific Coast south of Portland on the West.

This news came out on January 25, as stated. On January 27, a conference as requested by the President took place in Washington, and some nine highly experienced railroad men discussed with him the question of modifying the Sherman law so as to minimize the restrictions now placed upon railroad pooling and traffic agreements for securing uniformity of traffic regulations and rates, etc.

It has, of course, for a long time been obvious to all careful economic students in this country that our national law has definitely taken two positions which are absolutely irreconcilable with each other. Through the Sherman law it has required competition; through the rate law of 1906 it has made it impossible. The doctrine of enforced competition is a subject too big to discuss here. It is sufficient to say that it has been the historic theory of most governments which did not own their railroads that competition between the roads should be required by law, although experience has amply shown that the law has never yet been successful in its efforts to sow seeds of dissension that should raise fruit of benefit to the public. On the other hand, evidence has been accumulating year after year which shows with incontrovertible definiteness the fallacy of the whole proposition as outlined by government.

It is now 36 years since the famous committee on railroad amalgamations was appointed in Great Britain. Charles Francis Adams, Jr., told us 21 years ago how this committee had showed with grim precision that in the 40 years during which railroads in Great Britain had been doing business up to the time when the committee made its report, English railroad legislation had never accomplished anything which it sought to bring about nor prevented anything which it sought to hinder. The cost to the companies of the useless mass of enactments (3,300 of them) had amounted to some $400,000,000, yet the committee concluded that competition between railroads existed only to a limited extent and that it could not be maintained by legislation. The committee cited practical examples of the respective workings of amalgamation and of competition, and then stated that in view of such facts as these it was clear that amalgamation had not brought with it the evils that were anticipated, but that in any event long and varied experience had fully demonstrated the fact that while Parliament might hinder and thwart, it could not prevent it, and was powerless to lay down any general rule determining its limits or character.

Having thus quoted the British Parliamentary committee on the futility of attempting to enforce by law competition between railroads, Mr. Adams took occasion to comment that the whole theory under which the American railroad system was left to develop itself was founded on the same theoretical error which had prevailed in Great Britain; the supposition being then universally accepted as an axiom that in all matters of trade, competition, if allowed perfectly free play, could be relied upon to protect the community from abuses. Thus the efficacy of railroad competition, expressing itself in the form of general laws authorizing the freest possible railroad construction everywhere and by anyone, at an early day became almost a cardinal principle of American faith. Yet, said Mr. Adams, "it is found that wherever this characteristic (the natural monopoly of the railroads) exists, the effect of competition is not to regulate cost or to equalize production, but under a greater or less degree of friction to bring about combination and a closer monopoly. The law is invariable."

Well, it was 22 years ago when Mr. Adams wrote his book and it is now 36 years since the British committee reported, and materially longer since George Stephenson observed that where combination is possible competition is impossible. Yet to-day the government is attempting to tear apart a great and enormously useful railroad system because its form of organization is alleged to represent combination just as all great and useful railroad systems must represent combination, instead of competition which, in the days when rivalry had full swing in this country effectually prevented any railroad system from being either great or useful in the fullest sense of both of these words. In the face of this action, however, the government appears to doubt the divine inspiration of the law which requires competition in all things—else why the conference of January 27?

A bystander unlearned in the law cannot help thinking that these two pieces of news in Washington have come out in the wrong order. If the government really thinks that the Sherman law is probably a foolish one, why does it not settle the conference on this point before it undertakes great new prosecutions under that law? While the chemist is still investigating our drinking water to see whether it is going to poison us, is it not better to drink something else for the time being?

What a Technical Journal Ought To Do.

It is a curious and interesting commentary on modern scientific and industrial development that book making cannot keep pace with it. The surgeon can learn the groundwork of his profession from recognized text books, but to keep abreast of the best current practice he must either see that practice, or hear it described, or read of it in the technical publications devoted to that alone. The lawyer can pass his bar examinations on the basis of his theoretic instruction at the law school, but to win cases he must read cases, as fast as decisions are handed down. The same thing has always been true of the work of the civil and the mechanical engineer. Certain standard books on bridge design and on locomotive design have collected together a great group of cardinal principles derived from two generations of practical experience, but no text book has ever yet or will ever be able to contain a full record of progress as it is illustrated by the best current practice—a record corresponding to the cases which the lawyer studies and also to the cases of a different kind which the surgeon studies. As rule-of-thumb methods in engineering work have more and more given way to scientific methods it has been more and more necessary for the engineer to know just what was being done simultaneously in all parts of the world. Within the last decade progress greater than many people realize unless they look back and count the milestones, has been made in the application of [illegible] and well understood methods to the operating, financial and traffic departments of a railroad as well as to the engineering department, and here again the production of text books has utterly failed to meet the demand for information.

To fill this demand is one of the two great purposes for which a technical journal exists. Colonel Proat pointed this out with great clearness in a paper which he wrote for *Transport* (now incorporated in the British edition of the *Railroad Gazette*) in 1902. He cited the case of the costly and elaborate volume [illegible] Modern Locomotives, published at the end of 1900 which, in 1902 was valuable as history, but not as a description of current practice, while the greater branch of service, covering both traffic and transportation, was represented in no book at all that did it even the most meagre justice.

But important as that function of the technical journal is, its other function—the broadening of the individual for his own good and for the good of the whole machine—is far more important. There are many branches of railroad service just as there are many branches of every other kind of service that in their direct tendency are exceedingly narrowing. Thus, a division superintendent may be so anxious to get a record figure for the biggest trainload that he forgets that trainloading, like every other branch of railroad work, exists for the sake of moving traffic. Similarly, a very large and important collection of railroad accountants, last spring, forgot that their accounts were collected for the sake of use and not merely as a hot house collection of beautifully developed statistical plants. Narrowing down our discussion from technical journals in general to a particular class of technical journals, it is undeniably true that the great and fundamental value of a paper which tries earnestly and successively to make a comprehensive study and give a broad view of railroad practice lies in the incentive at once to individual development and to team play.

The *Railroad Gazette* has recently been enabled to support this kind of theorizing in a rather remarkable manner. Some time ago, we addressed to all our readers a circular letter asking them whether or not we were devoting too much space to the reviews which we printed of annual reports. Our own point of view was that a proper and understanding review of an annual report constituted an extremely valuable part of the joint business of furnishing facts and furnishing incentives to usefulness; that an abstract of a report made only with an editor's blue pencil was not useful along either of these lines, because the facts which it presented were only half truths, and the conclusions that could be drawn from these half truths were of no service to anybody. Therefore, we had been making a series of thorough, careful and painstaking reviews, in which the information given in the reports was interpreted, measured by rules and standards applicable to all companies, and expanded with comment based on real information about the physical and financial status of the property, including the efficiency or lack of efficiency of its management. But all this took a great deal of space, and we sent out our circular letter of inquiry to see what the real opinion of our readers was about this matter.

We confidently expected that railroad presidents, financial officers, and banking houses would approve heartily of these reviews, because we knew that the work was done well; but in our weekly audience there are a great many more master mechanics, and chief engineers, and signal engineers, and general superintendents, and engineers of maintenance of way, than there are bankers and railroad presidents; just as in a well constituted regiment there is only one colonel and one lieutenant colonel, but there are two majors, 10 captains, 20 lieutenants and some 60 sergeants.

Our theories about the real use of a technical journal in training men to think and to see their positions as parts of a whole instead of as separate entities, received a most gratifying confirmation in the replies to this letter of inquiry. The total number of replies received was 335; say, in round numbers, one reply for 20 subscribers among officers. Twenty-seven of these 335 were inclined to think that we gave too much space to the publication of annual report reviews, 26 of them cast ballots which may be described as defective because they answered some other question than the question asked, and 282 said very positively that we were not giving too much space to the reviews and that they found them helpful and valuable in their work.

Now let us see who these people were. Comparing for the moment railroad financial officers with officers in charge of the roadway (including chief engineers, maintenance of way engineers and their principal assistants) we found, to our great interest, that three financial officers answered our letter, all of whom spoke enthusiastically about the reports; and that 41 engineers of roadway answered our letter, 39 of whom were heartily in favor of the report reviews. Thus, a financial officer writes:

"I consider this one of the greatest improvements the *Railroad Gazette* has instituted in the seven or eight years I have been a constant reader. I do not think you are giving too much space to the publication of annual reports and I have read every word of them."

This is what we expected and hoped for, although we would never have believed that he had read every word of these reviews unless he himself had told us so. But now observe the following replies:

"The *Railroad Gazette* is our most important source of information in such matters, and we feel that the space which you give to the statement and analyses of railroad reports is of great value." —*Consulting Engineers.*

"You have not given too much space to the review of reports. The comparisons you make, as, for instance, that of the Chesapeake & Ohio and Norfolk & Western, bearing on their class of traffic, difficulties of operation, department expenditures, etc., are all very interesting and valuable to an engineer, and I find them especially so in connection with the theory of railroad economics, as given by Wellington, Webb and others."

—*Consulting Engineer.*

"I take great pleasure in reading these reports."

—*Engineer Maintenance of Way.*

"I read, clip, index and file nearly all of the information in the annual reports as published by you." —*Construction Engineer.*

"I read these reports with a great deal of interest."

—*Chief Engineer, Maintenance of Way.*

"Your articles are so admirably prepared and give the information desired in such convenient and systematic form that they must be extremely valuable to those whose interests lie in the department of operation, traffic and finance." —*Bridge Engineer.*

"I should be very much disappointed if you were to discontinue the report reviews or give them in any more restricted form than at present."

—*Right of Way Inspector.*

"I have had a great deal of pleasure and profit in reading the reviews you refer to. I think them especially valuable to any persons engaged in any way in the [illegible] business of [illegible] lest we forget the ultimate object for which railroads are built and operated."

—*Assistant Engineer of Bridges.*

"I take great interest in these articles. I consider them one of the most valuable features of your paper." —*Engineer of Roadway.*

"An analysis of these reports such as [illegible] is very important to every railroad officer." —*Engineer [illegible] and [illegible].*

"I believe that it is proper that your paper [illegible] a [illegible] such subjects rather than [illegible] along [illegible] technical matters only." —*Civil Engineer.*

This is support from the permanent way department, and besides the 39 permanent way officers who approved, 18 civil engineers, two or three of whose replies were quoted above, expressed their entire approval of the work we had done along lines which apparently lay to a considerable extent outside of things in which they were directly interested.

Now let us see how the mechanical people feel about the reviews. We found one master mechanic, one shop superintendent and three men in the car and locomotive department who thought we gave too much space to report reviews; also an assistant engineer of tests, whose work is doubtless primarily mechanical. But the mechanical people who did read our reviews last year and who approved of them come second on our entire list in order of precedence, to a total number of 28. Here are some of their letters:

"I do read these reviews with great interest. [I] have got much information of value from them." —*Superintendent of Machinery.*

"I consider them extremely valuable and have gone over them with a great deal of interest. They have enabled me to collect figures and data on the cost of operation that otherwise would not have been obtainable."

—*Superintendent of Motive Power.*

"I try to read them all." —*Mechanical Engineer.*

"I have been very much interested in these reports and hope that you will find it convenient to continue them. The treatment accorded has been such that the reader is enabled to get the proper understanding of the subject."

—*Assistant Superintendent of Machinery.*

"We do read these reports. We cannot offer any suggestions that would improve the manner in which the subject has been handled by the *Railroad Gazette*. The fact that these reports are not actuated by the desire of pleasing the companies whose reports are reviewed makes them valuable, and I think your readers are convinced that that is your intention and effort."

—*Superintendent of Motive Power.*

"I read the reviews with considerable interest as they certainly give in a nutshell a pretty complete resume of the items in which all railroad men are interested and enable one to compare the results obtained on his own road with the results obtained on others." —*Mechanical Engineer.*

"I feel that they have given me a better knowledge of the conditions on our road than I could have obtained in any other way."

—*Superintendent of Motive Power.*

Among men engaged specifically in railroad service, we got the largest affirmative vote, next to the permanent way and mechanical departments, from the superintendents, 16 of whom heartily endorsed the work we have been doing while three dissented. For example:

"I read everyone of them. I have been very much interested in the articles." —*Superintendent.*

"I read most of them. I am very much interested in the reports as compiled." —*General Superintendent.*

"I have read many of these with interest. The analyses of the subject have been so well handled that I cannot criticize them or make any suggestions of value." —*Assistant General Superintendent.*

"I have read them carefully." —*General Superintendent.*

Continuing up a step in the same operating line we found that general managers and assistant general managers approved by a unanimous vote of the 15 who replied. One of the especially interesting replies is from the General Manager of a large street railway system in Wisconsin, as follows:

"I have learned more and gotten more valuable information which is useful in the electric railway business from reading these reports than I have from reading all the street railway journals published in the country. These unbiased and critical analyses, absolutely independent of the feeling of the corporation which is being discussed, I have held up to my friends in the street railway publication field as shining examples." —*General Manager.*

From the steam railroad general managers we quote the following:

"I have read all but a few. These reports have always appealed to me as specially interesting as showing railroad people how a report of this kind can be analyzed and what deduction can be properly made from it."

—*Assistant General Manager.*

"I have been very much interested and have read practically all the reports you have made public through your magazine." —*General Manager.*

"I have not read one that I regarded too long." —*General Manager.*

"While I cannot say that I have read everyone of them, I have read the reviews of all the principal lines and I consider them the best that have been made public. I believe the work is the very best there is and that it ought to be continued." —*General Manager.*

The total affirmative vote in addition to the officers already given was made up of the replies from persons whom we have classified as follows: Railroad presidents, 12; vice-presidents in charge of operation, 11; miscellaneous manufacturers, 17; manufacturers of cars and car specialties, 10; manufacturers of locomotives and locomotive specialties, five; signal engineers, seven; librarians, one; bankers, six; lawyers, statisticians, state railroad commissions and trainmasters, each three; bridge engineers, bridge manufacturers, purchasing agents, ticket agents and officers of coal companies, each two; also one favorable reply from each of the following: Traffic man, economist, assistant to president, industrial agent, contractor, locomotive engineer, chemist, superintendent of telegraph, yardmaster, passenger department, car accountant, passenger conductor, architect, timber expert; also 41 favorable replies which we have not attempted to classify by vocations. We will quote only a few of the replies to show the general range of interest and the point of view of people occupying a great many different kinds of official positions.

"I have read many of the reviews with interest as I can gather what I desire to know with less difficulty than by studying the annual reports, and the reviews save me the trouble of calling for such of the reports as I wish to see if they do not otherwise find their way to my hands. Permit me to say in this connection that the practice of the *Railroad Gazette* in regard to these reviews seems to me not only quite in keeping with its character as *the* railway journal of this country, but especially beneficial to the class of railway men who habitually read the *Gazette* in that it leads their minds to an intelligent consideration of the three principal elements of the railway question; namely, operation, traffic and finance. As a rule I think operating men are your best readers, in which I include the engineering department. Traffic men probably come next and those having to do with finance last. The tendency with operating and traffic men is to dwell upon their own particular branch of the service to the exclusion of the other two. Once in a while there is one bright enough to understand relative values and this man moves up, but ten to one of the successful operating men fail of such advancement as their ability in that branch of the service would seem to entitle them to because their minds are not trained to take a larger grasp of things. The articles referred to in the *Railroad Gazette* are calculated to stimulate this lack of interest in and appreciation of elements with which their duties do not ordinarily bring them into immediate contact." —*President.*

"I have been a very great admirer of the manner in which this information has been presented through your paper." —*President.*

"We have looked over these analyses and we find them in every way splendid. We think that your claim that they are better than those published in any other paper is not exaggerated; it is almost impossible to find a brief and fearless analysis of a railroad report setting forth the bad points as well as the good, and we congratulate you upon the straightforward method in which you have done this." —*Bankers.*

"We appreciate very much the critical analyses of railroad reports contained in the *Railroad Gazette*, and the frank and full way in which you deal with the principal topics of such reports. We always read them with much attention." —*Bankers.*

"These reviews are more interesting to the average railroad man, I think, than nearly any other railroad news item which might be published." —*Vice-President and General Manager.*

"We read them every time, and we file them for reference, regarding them as of invaluable use to us." —*Vice-President and General Manager.*

"I have no suggestions to make. I may say, however, that in your treatment of these reports I have found much of interest and value." —*Purchasing Agent.*

"The articles constitute, in my judgment, the clearest and most complete and practical outlining of railroad doings that ever appeared in any railroad paper." —*Sales Department, Manufacturing Company.*

"The writer has made it his practice to read these reports." —*President Bridge Company.*

"The reviews are extremely valuable, and I read them with the greatest interest." —*Secretary, Rolling Stock Company.*

"I think I can say that I read all of them." —*Trainmaster.*

We have devoted a good deal of space to these replies because they show far better than could be shown by theorizing, what the actual helpful work of a carefully edited technical journal is, in broadening the outlook of the individual. We can safely assume that the trainmaster who read every one of these reviews got more out of them which will be of service to him in shaping his future career than any of the railroad presidents did.

The Railroads of India.

The railroads of British East India at the end of the year 1906 had an aggregate length of 29,098 miles, of which 802 miles had been opened in that year. A little more than half the mileage was of the 5-ft. 6-in. gage originally adopted for the Indian standard; but there were 12,254 miles of meter gage, and 1,419 miles of narrower gages (30-in. and 24-in.). The length of the railroads owned by the state was 21,719 miles out of these 15,614 miles were worked by corporations under contract with the state. The capital of these railroads was at the average rate of $42,555 per mile. For the year 1906 their average gross earnings per mile were $4,819, and their net earnings $2,116, the working expenses having been a trifle less than 50 per cent. of the earnings. The gross earnings per mile were nearly 3 per cent. greater than in 1905, the net 1 per cent. less.

The traffic of these railroads in 1906 was at the average rate of 367,948 passenger-miles and 376,807 ton-miles per mile of road, or equal to a daily movement each way over the entire system of 504 passengers and 516 tons of freight. On the railroads of the United States the corresponding figures were 135 passengers and 1,345 tons of freight each way daily. In India the passenger-miles and ton-miles are nearly equal, here the ton movement is nearly nine times as great as the passenger movement. That the passenger traffic per mile of railroad should be 3¾ times as great in India as here is sufficiently explained by the fact that there are more than 10,000 inhabitants per mile of railroad in India, and less than 390 here. The light earnings per mile of the Indian railroads is due to the very low rates on the large passenger traffic and the comparatively small amount of the freight traffic. In 1906 the average rates received were 0.4157 cent per passenger-mile and 0.808 cent per ton-mile. If we charge half of the mixed-train mileage (which is more than 30 per cent. of the whole) to each kind of traffic, the average train loads were 265 passengers and 191 tons of freight. No other country has so large an average passenger train load. The average earnings per train-mile (all kinds) were 124.9 cents gross and 62.5 cents net. There is probably no other country which has so low a cost per train-mile which is very largely due to the very low wages paid to natives of India. These formed 463,108 of the whole number of employees against 6,850 Europeans and 9,326 Eurasians—offspring of white fathers and Hindoo mothers. This is at the rate of 16.5 employees per mile of road.

Of the whole number of passengers 95 per cent. traveled third class, paying an average fare of 0.387 cent per mile. The first class passengers were but as 1 out of 367; but they paid a trifle more than 3 per cent. of the total passenger earnings, with an average rate of 2.224 cents per mile. The largest specified freight was coal—12,580,000 short tons. Next came 11,939,400 tons of grain and beans, 2,565,000 tons of flax seed and other oil seeds, 2,064,000 tons of salt, and not very much less weights of sugar and cotton.

In spite of their low rates, the Indian railroads are prosperous, partly because of their low capital cost, but chiefly because they are worked so cheaply. Their net earnings were 5.83 per cent. of their capital in 1906, and 5.92 in 1905. Additions of considerable extent are made yearly.

NEW PUBLICATIONS.

Economics of Railway Operation. By M. L. Byers, C. E., Chief Engineer Maintenance of Way, Missouri Pacific Railway. New York: *The Engineering News Publishing Co.*; London: Archibald, Constable & Co., Ltd. 1908. 672 pages; 6 x 9; cloth. Price, $5.

Mr. Byers has endeavored to produce a book which will be to the science of railroad operation what Wellington's Economic Theory of Railroad Location has been to railroad construction, and he has probably succeeded. At all events, he has produced a standard reference book entirely different from anything now in print; a book which ought to serve a very useful purpose for a good many years.

The author makes a point which has often been brought out in the *Railroad Gazette*, that with the extremely rapid development of railroad transportation along special lines it has become more and more difficult to obtain a true perspective. The department officer too often works for the advancement of the department alone, losing sight of the broader interest of the stockholder, while the young man entering upon a railroad career finds it difficult, if not impossible, to obtain any very clear view of the relation of his work to that of other departments. Therefore, Mr. Byers has tried to bring into view the general outline of the mechanism of railroad operation as it is carried on to-day and to develop the principles involved.

The first chapter deals with organization and gives some very useful rules. For example Rule 1 reads: "Provide a supreme authority at all points where action must be taken". Rule 2: "Carefully and fully outline the authority and responsibility of each position". Rule 4: "Avoid as far as possible making any person subordinate to two or more others, especially in regard to matters at all closely related." A full quotation showing the disadvantages of extreme centralization in matters of administration is taken from the report of the committee appointed by the British Secretary of State for War to consider the decentralization of the War Office business resulting from the breakdown of that department in the Boer war. In this same chapter on organization, the departmental and divisional types are clearly differentiated and the advantages and disadvantages inherent to each type are shown. A [illegible] set of by-laws giving details of organization for a large railroad is shown.

The employment, education and discipline of force receive full attention, with a good many helpful suggestions about appointment, promotion and education and the relations which brotherhood employees have to the total working force. Thus it is shown that in 1900 the Brotherhood of Locomotive Engineers had 35,910 members among a total of 42,837 engineers, whereas the telegraphers in 1900 enrolled only about a third of the entire force within their union. The third division of the first chapter relates to accounts and accounting and it is perhaps open to criticism on the ground that it is rather more theoretical than the case demands. The function and idea of the accounting system receive wide discussion, but we should suppose that the men directly engaged in this highly specialized branch of the business would want considerably more on the subject, while the men only casually interested would require considerably less.

The same criticism can be made of other parts of the book. Yet on the whole it must be admitted that the selection of concrete material to illuminate theory is quite good. Under the general head of reports, 60 pages are devoted to abstracts such as the following:

"Form M. W. 26 will be used by foreman water service for rendering monthly reports to superintendent of water service on or before the 10th of each month following that covered by the report, of cost of operating and maintaining all water stations in his territory."

The objection which the casual critic might make to the selection of this material is that it would be better either to show all the forms themselves or to refer to them in more general terms. However, we do not doubt that the 60 pages of definite examples like the above will have their use.

Under the general head of economic operation, which constitutes Part 5 of the book, and fills some 360 pages, each detail of the expense account is discussed at length with copious examples from the practice of specific railroads. Specific examples are shown at large of such documents as "Daily report of condition of boilers and fireboxes examined at X Station; Roundhouse No. —." The topic of transportation is then taken up, under 18 specific heads, from the standpoint of the division officer. Topic No. 1 is train rules; No. 4, foreign car-home-routing instructions; No. 15, yard service, etc. The standard code is given in full; specifications are shown for train order forms, etc., illustrated with cuts; preparation of the train schedule or time-table is fully discussed, and each of the detailed 18 topics receives careful and studious treatment. We have only the highest praise for this entire study of economic operation. It is admirably done and is by itself worth the cost of the book many times over.

Part 6 deals with analysis of operation and control of expenses, showing the difference between constant expenditures, which do not fluctuate with any ordinary changes in the amount of traffic; indirect variable expenditures, and direct variable expenditures. This analysis is well made, and is followed by discussion of the general balance sheet and general income account. The book then tells what an inspector of transportation ought to do, and gives a number of specific examples of such an inspector's work and of the kind of report which he ought to make. Control of expenditures is, of course, the underlying theme of this final section of the book, and the topic is handled in a thoroughly competent and satisfactory manner.

We should be very much surprised if there was an operating man to be found in the whole great group of highly trained American railroad officers who would not derive much profit and helpful suggestion from reading Mr. Byers' book, which seems likely to remain a standard work for a long time.

CONTRIBUTIONS

What Are We Going to Do About Railroad Accidents?

New York, Jan. 30, 1908.

AN OPEN LETTER TO NEWSPAPER EDITORS.

The appearance of the yearly accident bulletin is always occasion for expressions of horror in the great dailies, and too often with ill considered demands for drastic legislation. The *Evening Post*, sane and with fine traditions to live up to, asks a proper question which we prefer to think is addressed to the railroads, rather than to legislators. It says:

"If 5,000 persons had been killed and 76,286 injured in battle or in two or three accidents the country would be aflame at the news. Because these casualties occurred on our railroads in the course of 12 months nobody pays much attention to them. The Interstate Commerce Commission gives the ghastly figures in its recent annual report. They bring up the question anew, 'What are you going to do about it?'"

The answer by railroad managers might truthfully be: "We are doing more than ever before; are making progress, but cannot be successful until we are allowed to control our employees." In the employment and discharge of enginemen and train crews the trade unions have rather more authority than the employers and except perhaps on the Reading and the Chicago, Burlington & Quincy, which have paid dearly for the privilege, dangerous men cannot always be weeded out. Nevertheless, many railroad officers do less than their full duty in organization and vigilance, and are legally and morally guilty of criminal negligence. The force of public opinion, which the newspapers aim to express and often to influence, together with the enforcement of the present laws, is practically the only hope for a better condition.

TRAIN ACCIDENT KILLINGS.

While it is true that 5,000 passengers and employees have been killed on the railroads in the last year, nevertheless people generally accept this as meaning train accident killings and assume that all of it or nearly all of it can be stopped. This summary is misleading and does a lot of harm. An "injury" is a variable, from a bruised thumb to a lost leg, and the minuteness of reporting varies on different railroads and in different countries, so that fair comparison can only be had from the more accurate records of those killed. Let us separate the items and try to see how much of the killing is within control of railroad officers or of anyone. Only 1,421 people were killed in train accidents. Of these 776 lost their lives in collisions, and it is quite nearly true to say that every collision is due to disobedience of orders—a lack of discipline—so that at least this much is pure waste and can be stopped. Of the 515 lives lost in derailments this is nearly but not quite so true. A detailed examination shows that at least 22 of these lives could not have been saved by the railroad man's vigilance. Unusual disturbances by the forces of nature and malicious interference are beyond control. Also by no means all these derailments were due to a lack of discipline; a considerable proportion, fully one-fourth, were caused by defects in equipment, preventable, but not by the same methods. Equipment includes the roadway and its structures, as well as all rolling stock. One hundred and thirty lives were lost in unclassified train accidents, and these cannot be analyzed fully, except that we find the same causes, human errors, defects of equipment and uncontrollable elements.

The other killings which go to make up the total of 5,000 are 3,579 lives lost on the right-of-way, and a careful examination of these losses is most instructive. For example: Seven passengers lost their heads by sticking them out of windows and 147 passengers were killed while trying to save time in getting on and off trains. Due to the same foolishness, more than 2,000 passengers were wounded—self-inflicted injuries, beyond the control of others.

THE HUMANE EFFECT OF SAFETY DEVICES.

In coupling and uncoupling cars, 302 employees lost their lives last year. In the year 1890 a greater number, 396, were killed while doing that work, although the number of freight cars in service has considerably more than doubled during the period and the yard and terminal work has increased by a much larger proportion. This subject is worth a little further study. Railroad accident statistics show, uncertainly, that 15 are injured for each one killed; but in car coupling accidents the ratio is about 27 to 1. In 1890, 7,842 were injured while coupling less than half as many cars were coupled as last year, when only 3,948 were injured; that is to say, more than 75 per cent of these injuries have been eliminated. We may assume that this relative reduction in killing and wounding is entirely due to the use of the automatic car coupler.

In tending switches and other similar work about trains 310 were killed this year. This, too, is a proportionate reduction due to the increasing use in busy yards of a power movement of switches in connection with the interlocking machines.

In contacts with overhead bridges and structures 142 lives were lost last year. The method of classifying accidents has been changed so that we cannot in this case make exact comparisons, except that here there has been an enormous reduction, due entirely to the invention of the Westinghouse air brake, with the result that brakemen rarely need to ride on the freight car roofs.

KILLING TRACK LABORERS.

There remains unclassified the large number of 1,873 lives lost on the railroad right-of-way. Perhaps the largest single item is the killing of trackmen. The foreman of a track gang has a heavy responsibility. He knows the time table and watches his timepiece, but he needs to be alert and watchful for extra trains and light engines. Nevertheless, foremen vary in alertness and the killing goes on. These workmen, Italians and the like, are apt to be stupid, but with a low cunning. In night work it is difficult to keep track of them and protect them. They will skulk and be found dead on the track behind a passing train. Material improvements have been made in methods of watching out and warning, but we need not expect much reduction in this kind of killing.

WE CAN SAVE 1,000 LIVES.

It would seem, therefore, that only a small reduction can now be made in the above mentioned total of 3,599 lives lost outside of train accidents. It appears also that nearly all of the 1,421 lives lost in train accidents would be saved if there were strict obedience by employees and if the design and material of rolling stock and permanent way were perfect. Perfection is not attainable in this world, and therefore a somewhat careful examination has been made of the accidents which involved these 1,421 lives.

Without going into detail, it does seem possible to reduce that loss by two-thirds—that is to say, our problem is limited to the saving of 1,000 lives of passengers and employees a year in railroad operation.

THE GENERAL MANAGER'S RESPONSIBILITY.

The newspapers have taken as a text the remarkable exoneration of General Manager Smith from responsibility for the fatal derailment on the electrical division of the New York Central—remarkable because the Court decided, without allowing the jury to consider a verdict, that the evidence showed a full measure of energy and caution in the use of equipment and the choosing of men. This is all that the manager can do, but he will be held to higher standards than we have had heretofore. The stenographer's report of the Smith trial makes a ponderous volume, including most of the material for a text book on train operation, and is inspiring in suggested possibilities of inspection of materials and men. Inasmuch as this railroad has been under severe fire, some details of its methods of improving discipline are worth noting. Some of the same methods are used on other roads.

TRAINMASTERS.

This not quite descriptive title is given to the four or five men employed on each engine division to spend their entire time on the line, riding in freight-train cabooses and on passenger trains and being at signal cabins and stations—wherever train movement can be observed. They are field inspectors of operation, such as enginemen's obedience to the signal indications, and their compliance with the rules for giving whistle signals at crossings and for sending out front and rear flagmen. They watch for infractions of safety rules by conductors, brakemen, towermen and station men. To prevent their being regarded as simply spies or detectives, they are given a measure of authority to deal privately—warn without reporting—with first offenses and make recommendations in favor of efficient men. They make "surprise tests"—for example, go to an automatic signal post and hold the semaphore and light at the caution or stop position and see if the engineman is alert in obedience.

INSPECTION AND PUBLICITY.

The New York Central has also, within the past year, put in effect a plan which seems to be original. An expert investigator, whose ordinary work at headquarters is such that he can leave at a moment's notice, proceeds at once to the scene of an accident that is serious or involves a lesson, and joins the division engineer and superintendent in an investigation and report. Mr. Brown, Senior Vice-President, writes: "The expert investigator's duties are, primarily, to bring out any wrong practice that may exist and which, if it had not already done so, might lead to an accident. I hope that with experience these special investigators, of whom we have two east of Buffalo, will become such authorities that the cause of an accident will be quickly determined and full of accurate information given to the press."

The establishment of an inspection department, thoroughly organized, primarily to insure strict observance of rules, was probably original with Julius Kruttschnitt, now Director of Maintenance and Operation of the Harriman lines. He appointed an Inspector of Train Service, and he and his staff have done great things on the Southern Pacific. The work covers cleanliness, ventilation, heating and lighting of cars and stations; neatness and good manners everywhere; excessive speed, schedule failures, neglect to flag and running past signals. These latter dangerous practices have been nearly eliminated. Mr. Kruttschnitt in his plan recognized the fact that neatness and orderliness are closely allied to uniform obedience to orders. It is surprising that this departmental method of administering discipline has not found favor on more railroads.

On the Chicago & North Western and on the Rock Island—and probably on other roads—there is an interesting undertaking for the triple purpose of promoting discipline, establishing frank relations with the public and getting, or holding, business. There is a fixed, compulsory, monthly meeting of division superintendents, and at this conference all that pertains to these subjects is discussed. Each officer then goes slowly over his division, keeping his eyes open and examining each station agent. He stays long enough in each community to make calls on shippers and others who have complaints or are otherwise critical and disaffected. If a frank exchange of views and facts can accomplish a better understanding, as it generally does, his work is done, for, as President Winchell expresses it, "he has no time to call on our friends, he must see the men who paint us black."

DEFECTIVE EQUIPMENT.

During the present winter a succession of rail breakages prompted a thorough inspection of about 80 miles of track—cleaning the sides of the rails with steel brushes and looking closely for flaws. Twenty-six cracks were found, all ripe for breaking and disaster. And even now, after this inspection, they are breaking on this short piece of railroad an average of one rail a week. It is only by sleepless vigilance that these accidents are prevented. The bad rails forced on the railroads under conditions which have made them helpless for several years make a story too long to be told here. The cause is greed, and it is only because of united action by all the railroads, through the American Railway Association, that there is now hope of reforming this outrageous situation.

The freight car travels from Maine to Texas, and the Lord have mercy on it if the Texas State Commission should not find something assessable in it! They might levy on its grab irons for taxes. The quality of material in its sills, cast iron wheels, brake-beams and brake riggings, draft gear and coupler knuckles, varies with the grades, loads and speeds of the owning railroad, and also with the quality of its officers. Foreign cars form a large proportion and are mixed in long freight trains on any trunk line. On a descending grade the long-applied brake shoes heat a cheap cast iron wheel. It explodes and wrecks the train. Due to poor material, brake-beams fall, knuckles and flanges break and drawbars pull out with like results. There is no known means of preventing, under unfavorable circumstances, a passenger train from derailment by the debris from a wrecked freight train on an adjoining track.

THE 6,330 "OTHER PERSONS" KILLED.

Before studying out the ways in which the railroads can reduce the number (5,000) of passengers and employees killed, it is necessary to look at the much larger number of "other persons" killed by railroad trains and not included in the Interstate Commerce Commission Accident bulletin. In 1906 (these returns for 1907 are not yet available) 6,330 people other than passengers or employees were struck by trains and were killed. Concerning this greater killing we have never seen serious mention and consideration in any daily newspaper. Of those so killed, 5,381 were trespassers, mostly tramps, but including many women, children and other not alert persons walking for short distances on the tracks. The railroads spend large sums and try hard to persuade the community to enforce the laws of trespass and vagrancy—to get rid of tramps who steal and destroy railroad property, cause wrecks and get killed. Under Mr. Loree's administration of the Pennsylvania Lines West an orderly and measurably successful undertaking to this end was made among the communities along the lines. That region is said to be now one of the least infested. Their tramps have simply moved to other fields of harmfulness.

During the year, 926 presumably good citizens were killed at highway crossings of railroads; proportionately as real a loss to the country as the 1,421 lives lost in train accidents. The elimination of a grade crossing usually requires joint action by the community and the railroad. The state of Massachusetts stands alone in cordial co-operation with its railroads for this desirable end. New York and other states have good laws, based on the Massachusetts plan—the state to pay one-fourth, city or town one-fourth and the railroad one-half of the cost of eliminating grade crossings. It is the railroad's interest to effect these changes in order to avoid the cost of slow-downs and killing, but it is only by strenuous effort, pressure, argument and persuasion that some small progress is made in this humane and economic reform.

THE POSSIBLE REMEDIES.

The General Manager is responsible and has the power to stop most of the loss of 1,000 lives in collisions and derailments. It is hard, but he must. Perhaps his most difficult problem is getting obedience and weeding out inefficient men. The trade unions are arrayed against him, but his disciplinary work is essentially military and he cannot succeed until he gets a high quality of military discipline throughout the entire operating force on train and track. We have said that the General Manager will be held to higher standards than heretofore. We need no new statutes. The law of criminal negligence is good; it needs only to be enforced. Judge Kellogg showed plainly in his summing up of the evidence in the Smith trial that if he could find any lack of extreme caution in making an operating organization for the Electric Zone—in delegating authority to anyone without an unassailable record—in making a working schedule without excessive speed, in training and examining motormen—in having a high standard of maintenance of way and rolling stock—for any lack of a full measure of vigilance and caution the General Manager must go to jail. Criminal prosecutions do good, although it is an agonizing experience for a faithful officer.

The present rate of killing nearly 1,000 persons a year at grade crossings has been a necessary incident in our method of developing new country by cheaply built railroads and city and town streets. This pioneering method has made our country rich. But long ago the time came when the elimination of these grade crossings was both humane and profitable, and it is now the communities and not the railroads who are at fault. Right-minded editors of newspapers can do much for this reform.

The killing of 5,381 trespassers on railroad tracks is largely the fault of government whose primary duty is police protection of citizens. The amount of this killing is appalling, but it only touches the edge of the harm done every year by tramps. They ravage the country, wreck trains and get killed. The subject is so big, and its effects so wide, that its concern to the railroads becomes only incidental. Nevertheless, the railroads have a plain duty to spend money and work energetically with any community that tries for improvement.

W. H. BOARDMAN,
Editor of the *Railroad Gazette*.

A Compound Rail Section

[illegible]

To the Editor of the Railroad Gazette:

The general shape of the present American T-rail is not in harmony with the fundamental principles of rolling and prevents a natural conformation of the metal. Two factors are responsible for this condition: first, the established mechanical relations in the roll passes; second, the temperature maintained by certain parts of the rail during conformation. Higher temperature can be held in some parts by simply increasing their thickness, but the proper mechanical roll effects cannot be had without altering the form of the section.

Some parts of a standard rail are formed in a manner which if permitted to continue, would subsequently help improve the internal character of the material, while other parts of the rail are formed in an unnatural way which curtail the process of forming. In other words, if a difference of mechanical effect is present in separate parts of an integral section the final finishing of the whole is governed by the part of the rail which assumes refractory conditions first. This physical condition will prevail in rolling the thick or thin flanges, since no effective change can be made in the mechanical action of the passes. However, within prescribed proportions this physical disparity can be controlled by proper mechanical application of the different diameters, but while it has had the effect of getting out the section, it has never eliminated the use of auxiliary apparatus and artificial requisites.

Small T-rails are rolled and finished without artificial assistance, although, to a degree, they are unbalanced. Middle sized sections require subsidiary apparatus to overcome progressive irregularities in curvature (metal flow) and physical distortion, and large sections invariably require the aid both of artificial and of mechanical means. It can readily be seen that the development of the final form is, and always has been, at the expense of the structure, while independent means, other than the rolls themselves, must be applied to arrest excessive distortion.

With every enlargement of the standard rail section the necessity for independent mechanical assistance during and after the rolling has increased. This proves that the shape of the standard rail does not furnish the proper mechanical conditions in the roll passes and is at variance with the fundamental principles which would benefit the material while rolling. It also indicates that the present method of shaping rails pretends to be nothing more than a means to form them.

Since medium sized standard rails are not in harmony with natural and fundamental principles for conforming the metal, it follows that larger unbalanced sections must have a greater disadvantage in rolling. Experimenting with small thick flanged sections will not guarantee internal improvements in larger sections, because every section has an individual relation with the center line of rolling. If the general shape of a T-rail establishes the center of gravity near the flange in smaller types of rails, and the same shape is preserved in the larger sections, there is no denying that there will be greater curvature and longitudinal tension in the metal while it is being elongated.

Because the head of a standard rail is formed by co-acting vertical pressures, which are positive, progressive, and cause a free flowing of the metal, these pressures disagree with the mechanical conformation at the base of the rail. The flange is formed by lateral pressure of roll surfaces varying widely in diametrical speed from the center line of rolling. They are slow and retarding, and the metal compressed between them is operated upon irregularly and elongated unequally. Even if a higher temperature can be maintained in the flange part of a rail it will not obviate this mechanical condition in the roll passes nor will it remove the cause which sets up longitudinal tensions in the metal at the rail base. The thickening of the whole flange is only a temporary adjustment and will not suffice for the successful rolling of structurally good rail above certain sizes. The many troubles which are associated with the manufacture of the present large standard rail give evidence that the limit of an unnatural mechanical treatment has been reached.

If a change in the design must be made to gain a natural conformation of the metal, it should be one that is capable of fulfilling the mechanical requirements in rolling still larger rails. If the present design will not conform to a natural development of a rail shape, how are the larger sections going to be benefited by the same mechanical treatment?

A suitable metal distribution offering the proper mechanical applications in the roll passes should be made now, for the reason that a natural conformation will contribute to the betterment of the structure. Reliable results cannot be acquired in any other way without working injury to the material. The best internal characteristics are gained by treating the metal decently in the initial stages of rolling, and similarly throughout the whole process of forming, not relying on treatment after the final form of the rail has taken place.

A practical way to gain the mechanical roll effects which would elongate the metal in a natural way at the head and base of a section is to use a section which may be described as being a combination of the double-head and American types. In this form the section assumes a contour susceptible to mechanical influences which have benefited the character of the double-head rail. The good granular condition of the double-head rail is well known, but the principal reason for its superiority has never been thoroughly investigated. The ease with which a double-head rail can be rolled is due to its symmetry about the horizontal and vertical axes, so that an equal amount of reduction can be placed over all. Most of the reduction of metal is thus accomplished in the line of least resistance, which is fundamental.

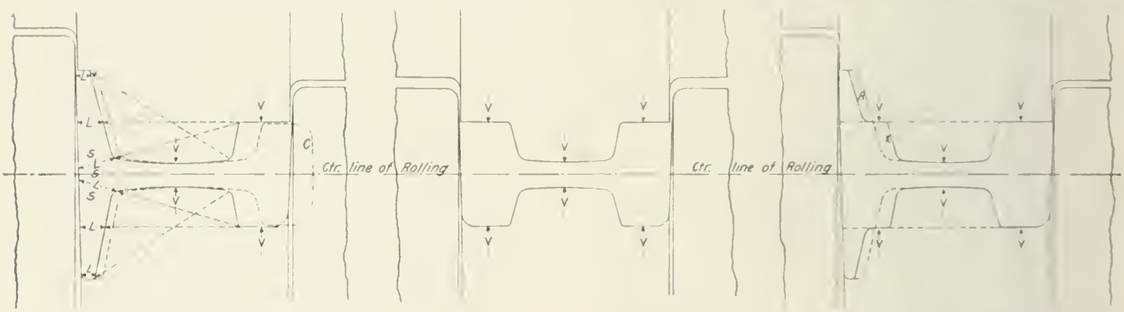


Fig. 1—Roll Groove for Standard Rail.

V—Vertical compression. S—Strained area.
L—Lateral compression. C—Deeper section.

Fig. 2—Roll Groove for Double-Head Rail.

V—Vertical compression.

Fig. 3—Roll Groove for Flat-Bottom Double-Head Rail.

V—Vertical compression.
R—Material removed to V.

An equal diametrical compression of co-acting roll surfaces on the head and base elongates the metal freely on both sides of the section, causing a true rolling motion. The elongation of all parts in line of least resistance eliminates internal straining and prevents any inclination on the part of the metal to flow laterally. In the standard rail the metal to form the flange is greatly reduced over that which is to form the head and naturally minute flaws move more readily toward the rail head. If the metal can be made to flow uniformly in one direction only, a far better opportunity to refine the metal is presented.

During and after the conformation, similar parts of the double-head rail cool evenly and more or less separately; therefore the chill does not travel toward either head, and a coarse crystalline structure is avoided.

As said before, a uniform elongation of material by co-acting roll surfaces equidistant from the center line of rolling eliminates longitudinal tensions, hence internal straining is not set up, and rolling can be continued to lower degrees of temperature without fear of distortion. To finish rolling a rail at the critical point in temperature is desirable and has its benefits, but the character of the material can be enhanced by approaching that degree in heat with a more gradual reducing of the metal. It is not generally known that heavy reduction per pass is out of all proportion to internal concentration and the natural contraction of the crystals. The harder the material, the more destructive is the process, and the greater the necessity for a gradual natural conformation.

If a symmetrical figure is primarily responsible for good structural results, the principal factors involved should be embodied in a flat-bottom, double-head rail. The effective mechanical action in the roll passes which will assist in a natural treatment of the metal can then be gained. A vertical compression of roll surfaces is positively necessary on the base of the rail to advance the metal at an even rate with the head. If applied at the proper place on the flange it will be the means of equalizing the elongation or flow of the metal. The cooling of the separated heads in the double-head section is more or less independent, with an alternating radiation of heat from similar shaped parts through the web, the effect of which subsequently anneals the whole section.

By assuming a similarity of parts, approximately those of the double-head rail, a combination section can be designed in which a uniform heat radiation is possible in all parts of the rail. This factor, together with the proper metal distribution, would undoubtedly extend the workable state of the metal. The continual working of the metal to form the combination section with light reductions per pass, accompanied uniformly with an equal contraction of the metal, will give a dease, homogeneous structure.

The metal in a thicker flange section can be distributed to better advantage by removing it from the flange points and placing it within vertical lines corresponding with the width of the rail head. This transfer of the metal from the flange points to the base of the web is the point where the mechanical influences of the roll passes are gained, and it will make the rolling of extremely large rails possible.

By placing the metal in the base of the rail in a form corresponding to the general shape of the head, a vertical roll pressure is applied midway between the flange points and the foot of the web. By so doing there is gained an active mechanical advantage of 50 per cent. over the established conditions for forming the standard flange. The delivery of the base is then as positive as shorter flanges beginning at the web. If the only true rolling action, which drags the metal through the passes, is exerted at the converging of the flange and web, the presentation of a like influence higher up on the flange will make the forming of still longer flanges possible. The true mechanical advantages the flat-bottom double-head rail will permit of, together with its ability to equally distribute the heat throughout all the parts, and principally the base, enables the whole section to go through any number of roll passes consistent with the workable state of the metal. The number of roll passes to be used would then depend on the comparative reduction per pass and the diminishing of the heat. By this arrangement the speed of the rolls could be increased, reduction per pass reduced, and more roll grooves added, or, less reduction per pass at the present speed of the rolls with enough additional grooves to reach the proper finishing degree in temperature without ceasing to work the metal. Actual practice will prove the usefulness of not less than 28 or 30 passes, according to the size of the section. However, all these advantages will depend on the specific shape of the rail and its successful passage through the rolls. The physical improvement which can be gained in rolling cannot be created in the laboratory as some are prone to believe. Rails cannot be made good regardless of the mechanical treatment, any more than [illegible] without the proper amount of [illegible].

Considering all the conditions in rail making up to the [illegible] there is no factor as important as the mechanical treatment [illegible] what gave enduring quality to the "John Brown" rail. It is what will give character to any piece of metal. It is one of the principal factors which will prolong the use of the Bessemer process, since analytical conditions of the material tending toward [illegible] can be overcome and benefited by a natural conformation, more roll passes, less reduction per pass and a final cooling which is at the same time uniform and more or less self annealing.

A. W. HEIN[illegible]
Consulting R[illegible]

New Compartment Sleeping Cars for the New York, New Haven & Hartford

The accompanying photographs show interior views of one of the two compartment cars recently built for the New York, New Haven & Hartford by the Barney & Smith Car Co., Dayton, Ohio. They were delivered on December 19 and 20, 1907, and immediately put in service between New York and Boston. They are 71 ft. 6 in. long, over sills, and 78 ft. 5 in., over platforms. Each has 10 staterooms with upper and lower berths and toilet facilities. The passageway runs along the outside of the staterooms. One of the photographs gives the impression that there is a corridor running through the staterooms. This is because the doors between them are all opened. With these doors it is possible to arrange the rooms in suites. The rooms are 6 ft. 3 in. long and 6 ft. 9 in. wide, the passageway taking up 2 ft. of the width of the car. There are lockers at each end of the car and at one end is a general toilet room. The lighting is by both electricity—generated on an axle-light system—and gas, with a combination chandelier in each section and a berth light at each seat. The corridor has deck electric lights and bracket gas fixtures. Each room is fitted with an electric fan. The windows, each 2 ft. 4 in. wide, are in pairs, with upper semi-elliptical panes of art glass. A particularly interesting feature of the interior finish is the variety of woods used.

Interior View; N. Y., N. H. & H. Compartment Car.

Stateroom; N. Y., N. H. & H. Compartment Car.

Stateroom A is finished in [illegible]. The trade name in the United States is Blanchet wood, so called from the name of the importer, who says that this special importation came from the island of Martinique shortly before the last volcanic eruption. The same wood is known in the West Indies as [illegible], in Panama as algarrola, in Brazil as [illegible] and in Guiana as [illegible]. The tree grows to enormous size and [illegible] in most parts of tropical America. Immense buttresses form at the trunk [illegible] a[illegible] to make the diameter 10 f[illegible]

Stateroom B is finished in [illegible] mahogany, so [illegible] by Barney & Smith. It was first introduced into this country [illegible] three years ago. The native name is [illegible]. It is used [illegible]

[illegible] present [illegible] interior finish and [illegible] to foreign.

Stateroom C is finished in [illegible] and is known as true or Spanish mahogany to distinguish it from other varieties. Real Spanish mahogany grows in Cuba and San Domingo but in the latter country it cannot now be obtained in practicable sizes. The wood used in this stateroom is from the mountains directly back of Guantanamo and Santiago, Cuba. It is said that it often takes 12 oxen from three to four weeks to haul a single log from stump to shipping point.

Stateroom D is done in jiqui, the name being native Cuban. It is somewhat like mahogany. This particular variety is seldom imported into this country.

Stateroom E is in tigerwood, so called from its mottled appearance. It comes from Africa and British Guiana, where it is known as itaka or itiki wood.

Stateroom F is finished in East Indian walnut, otherwise called koko, from Rangoon, India.

Stateroom G has the distinction of being finished in a wood of whose origin nothing definite is known. The Bureau of Forestry is investigating. It is called Moro wood and is supposed to be from the East Indies.

Stateroom H is in Circassian walnut, sometimes known as French walnut. This importation is from the Caucasus mountains.

Stateroom I is in padouk, from the Andaman Islands, south of India. It is also known as vermilion, East Indian mahogany and Burmese rosewood.

Stateroom J is in English oak.

The corridor and other public parts of the car are finished in mahogany. The design of the seats is simple and the upholstery is in keeping with the elaborate wood finish.

New Law Affecting Foreign Patents in Great Britain.

BY JOHN P. O'DONNELL.*

The Patents and Designs Act of 1907, which finally came into force on Jan. 1, 1908, in addition to various alterations in the previous acts and in the practice thereunder, introduced some striking innovations. The principal points in the act may be set forth briefly as follows:

Working.—At any time not less than four years from the date of a patent, and not less than one year after the passing of this act (i.e., Aug. 28, 1907), any person may apply to the Comptroller for the revocation of a patent on the ground that the article or process covered by the patent is manufactured or carried on entirely or mainly abroad. This is practically on all fours with the working clauses in the patent laws of most of the European countries, which compel patentees in those countries to actually manufacture the patented articles in the countries within varying periods (generally three years) from the date of the patent.

This working clause practically amounts to a protective clause, which renders a patent liable to be declared void if articles made under the patent are manufactured abroad and imported into this country.

The Comptroller may either order immediate revocation of the patent, if he is satisfied that there are no good grounds for the non-manufacture, or he may allow a reasonable time within which manufacture on a commercial scale sufficient to supply the demand in this country must take place, and if manufacture is not commenced within that time, he may then order the patent to be revoked.

An order of the Comptroller revoking a patent under this section of the act is subject to an appeal to the court.

Patents of Addition.—Patents of addition may be obtained for improvements or modifications of inventions covered by a specification on which an application for a patent has been filed, or on which a patent has been granted. Such patents of addition are limited in duration to that of the original patent and expire therewith. No renewal fees are payable on patents of addition.

Provisional Specifications.—An applicant for a patent having filed two or more provisional specifications for kindred inventions or inventions that are mere improvements on or modifications of those covered by the preceding specification or specifications may file a single complete specification including the subject matter covered by each of the provisional specifications and if the Comptroller is satisfied that the combined subject matter of all the provisional specifications constitute a single invention, he may grant a single patent thereon, and such patent shall be dated as of the date of the first provisional specification. In relation to questions of validity and for the purposes of oppositions to the grant of patents, however, the dates of the respective provisional specifications will be taken into consideration.

Opposition to Patents.—Three important changes have been made in regard to oppositions to the grant of patents, namely, (1) the second ground of opposition under the old act has been amended so as to permit of opposition on the ground of *any* complete specification or an application for a patent of prior date. This will include [illegible] complete specification whether or not such complete specification has been accepted and published before the date of the patent the grant of which is opposed, and also [illegible] specifications filed under the international convention; (2) a further ground of opposition has been added under which the grant of a patent may be opposed on the ground that the invention or the manner in which it is to be carried out is not fairly or fully described in the complete specification, and (3) the Comptroller may award costs in respect of oppositions.

Further, the Comptroller may require oral evidence instead of or in addition to any declarations filed in an opposition.

Revocation of Patents.—The Comptroller may, on an application made within two years of the date of a patent by any person who would have been entitled to oppose the grant of the patent, revoke the patent on the same ground or grounds on which the grant might have been opposed. This practically means that the period of opposition to the grant of a patent is extended to two years.

The Comptroller's decision is subject to appeal to the court.

Search as to Novelty.—In relation to the 50 years search in the records of British patents made by the Patent Office examiners under the Act of 1902, in respect of all complete specifications filed, the Comptroller has, under the new act, the power to refuse the grant of a patent if he considers the invention claimed to have been completely claimed in any prior patent within the 50 years. Under the 1902 act the most the Comptroller could do was to insert a specific reference by number and date to such an anticipating patent.

An appeal may be made to the law officer from the Comptroller's decision refusing the grant of a patent under this section.

Further, the new act provides, by a special section, that the search shall extend to specifications published *after the date* of the application in respect of which the search is made. This brings in specifications on applications filed under the provisions of the International convention and which may be actually deposited or filed at the British patent Office subsequently to, but on which the patent when granted would bear an earlier date than that of the application in respect of which the search is to be made.

Restoration of Patents.—The Comptroller has power to restore any patent which has lapsed owing to the failure of the patentee to pay the renewal fees at the proper time or times. Any application for restoration of a patent is, however, subject to opposition by the public, and the Comptroller's decision is subject to an appeal to the court.

This procedure is much cheaper and simpler than under the old acts, which necessitated all the trouble and heavy cost of obtaining a special act of Parliament to restore a patent.

Compulsory Licenses.—Any interested party may petition the Board of Trade for the grant of a compulsory license under a patent or for the revocation of a patent on the ground that the reasonable requirements of the public in regard to the supply of the patented articles have not been complied with, and if the Board of Trade is satisfied that a case has been made out, the petition shall be referred to the court, the court shall decide either to dismiss the petition, to grant a compulsory license, or to revoke the patent, according to the circumstances of the case.

Contracts for Sale or Licenses of Patented Inventions.—All agreements or contracts for the sale or license of patented inventions containing (a) any condition prohibiting or restricting the purchaser or licensee from using any article supplied or owned by any person other than the seller or licensor, or (b) containing any condition requiring the purchaser, or licensee, to purchase any articles from the seller, or licensor, or his nominees, and not covered by the patent, shall be null and void in respect of such conditions.

Further, any contract containing conditions as above set forth and made before the passing of this Act may be canceled by either party giving three months' notice in writing to the other, the party giving notice, however, being liable to pay compensation either to be agreed upon by the parties or, failing an agreement, to be settled by arbitration, the arbitrator to be appointed by the Board of Trade.

Further, any contracts relating to the leasing or licensing of a patented article or process, whether made before or after the passing of the act, may, providing the patent or patents has or have become void, be canceled by either party by three months' notice in writing, but where such notice is given in respect of a contract made before the passing of the act, the party giving notice is liable to pay compensation to be agreed upon by the parties or to be settled by arbitration.

Marking of Patented Articles.—All patented articles must be marked with the number and year of the patent in addition to the word "patent" or "patented", otherwise a patentee may be unable to recover damages in respect of infringement.

Designs.—The new provisions relating to designs are briefly as follows:

If an application for registration of a design is not completed within 14 days after the expiration of 12 months from the date

*Consulting Engineer and Chartered Patent Expert, Palace Chambers, Westminster, London.

of application, the application will be deemed to be abandoned. The Comptroller may give a further extension of 14 days in exceptional cases.

The duration of a design may be extended under the new act to 10 or 15 years, instead of, as under the old act, being limited to five years.

If a design is worked mainly abroad, the Comptroller may, on an application by an interested party, cancel the registration.

A design registered in one or more classes of goods may be registered by the proprietor of the design in some other class or classes.

Generally speaking, all articles covered by registration must be marked.

I have given above the most important provisions of the Patents and Designs Act, 1907, but there are other modifications of and additions to the old acts, which are, however, mainly in the nature of details relating to procedure. For instance, the act provides that models and samples of inventions may be called for. Further, the Board of Trade has power to increase the amounts of renewal fees payable for the maintenance of patents, but I am glad to say that, according to the new rules of practice recently issued and consequent upon the new act, the renewal fees remain, at all events for the present, the same as before.

Act Retrospective.—The act is retrospective, and will therefore apply to patents and designs granted, and also to those pending, before the commencement of the act.

The Alberton Cut-Off of the Baltimore & Ohio.

The Baltimore & Ohio has recently finished a revision, known as the Alberton cut-off, of its main line between Hollofield, Md., and Davis, on the old main line between Relay, Md., and Washington Junction. This is part of the work which has been going on for the past seven years making a low-grade freight line between these two points. Relay is the junction point for Washington coming from the east, and Washington Junction the junction point coming from the west. The through passenger trains run via Washington. The old main line between these two points is being made into a low-grade freight line.

The eastern part of this line from Relay to Mt. Airy follows the Patapsco river, the valley of which is narrow and crooked, with hills rising from the water's edge and spurs from these hills projecting across the bends of the river. The original main line, which had heavy grades and curves, followed closely the windings of the stream. In the reconstruction the line has been straightened and a number of tunnels and bridges have been built. The accompanying plan and profile of the territory between a point west of Hollofield and Davis shows the old and the new lines.

Work was begun on this section in September, 1905, and completed in October, 1907, during which time 400,000 cu. yds. of material were excavated. Seventy per cent. of this was granite; the rest sand, loam and clay. There were 10,000 cu. yds. of Pennsylvania sand stone bridge masonry built and 5,000 cu. yds. of concrete in foundations. Two tunnels, together 1,523 ft. long, and three undergrade crossings were built. Two changes of the river channel were made and a highway nearly a mile long was reconstructed.

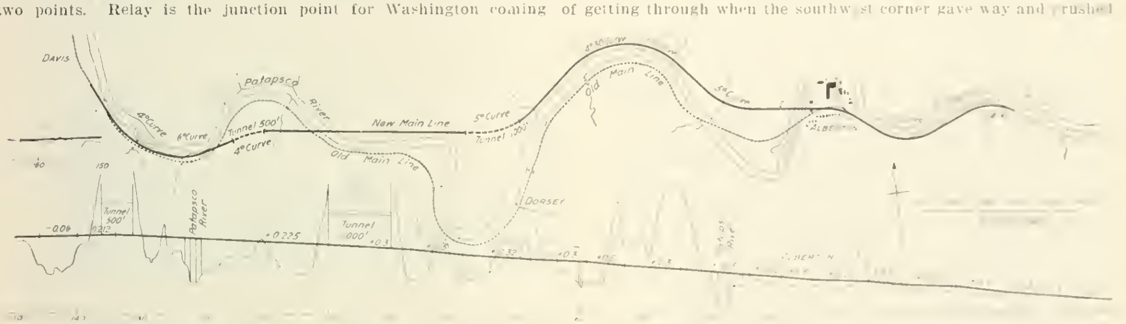
The grading averaged 100,000 cu. yds. to the mile. In the cut west of Alberton, which is 2,000 ft. long and 75 ft. high, there were 187,000 cu. yds. of grading. Nearly all the earth on the entire contract was in this cut between the original surface and a point about 25 ft. above subgrade. All the material in this cut was removed with a 70-ton Bucyrus shovel working in lifts from surface to subgrade, bringing it down full width and wasting the top material on tracks running around the contours of the hill on the same grade as the shovel.

The material in the east end of the south side of this cut was made up of pockets of mica sand, red clay and ledges of limestone alternating. This formation caused the south slope to break and pockets of this material to slide out at the seams. These slips were removed with the shovel. The rest of the excavation was all [illegible] land granite and was removed with steam drills and shovels.

Dorsey tunnel, one mile west of Alberton and on the [illegible] side of the river from the old line, is 1,025 ft. long from face to face of portals. This was bored through solid granite. Only [illegible] ft. of the west end had to be timbered—this on account of seams in the roof. A top heading 7 ft. x 10 ft. was first driven from both ends; the rest of the material was taken out in two benches. The amount of excavation in this tunnel was 36,500 cu. yds.

Davis tunnel is one-half mile east of Davis on the same side of the river as the old line. The material here to be excavated was a mixture of mica sand, soft granite which disintegrated when exposed to the air, and a hard rock which followed the subgrade closely, at times reaching as high as the wall plate grade 14 ft. above subgrade. This tunnel was 498 ft. long and had to be timbered for its whole length. Seven segments 12 x 12 were used for the centers and a plum post 3 ft. center to center. Where hard rock was encountered at wall plate grade, the segments rested on wall plates on the rock bench. This tunnel was driven in a different way from the Dorsey tunnel. The first heading was excavated from the roof to the wall plate grade and was taken out full width, the bottom bench being taken out later. The excavation in the Davis tunnel amounted to 17,000 cu. yds.

On October 22, 1906, while this tunnel was being lined, after 96 ft. of lining had been finished in the east end a fall [illegible] ft. in diameter occurred 140 ft. from the east end, almost on the center line and extending to the original surface of the ground, 92 ft. above subgrade. This fall was almost plumb and looked like a shaft. The north side overhung slightly and had a well defined rock seam. From that point south the material was soft granite and mica sand. The contractor then began to line the tunnel from the west end and finally got to within 104 ft. of the lining from the east end. It was then several times attempted to get under the fall by using crown bars. Four different times the men were within a few feet of getting through when the southwest corner gave way and crushed



Plan and Profile of Main Line Improvement Between Hollofield, Maryland, and Davis; Baltimore & Ohio.

the timber centers. This method was then given up. By June, 1907, the sides of the fall had been increased to 73 ft. at the roof of the tunnel and 140 ft. at the surface of the ground. A model A. Marion shovel was then put on the work and this removed the fall, which contained 36,000 cu. yds. and formed a natural [illegible] the original grade. The Davis tunnel was finished on September 25, 1907.

Both tunnels are standard double track section lined with [illegible] and vitrified brick and have sandstone portals. They were both driven by compressed air, the compressor plant being [illegible] between them and connected with them by 4-in. pipes. Payment for this work was not made per unit of excavation [illegible] a price per lineal foot of finished tunnel.

The bridge crossing the Patapsco river at Alberton has [illegible] spans. One 27½ ft. span, one 2[illegible] ft. 9 in. deck girder [illegible] undergrade crossing, two 90-ft. spans, one 100-ft. [illegible] 70-ft. span. The deck girders are 10½ ft. from base of rail to bridge seat and 32 ft. to the surface of the river. The bridge crossing the river east of Davis has three spans. One [illegible] span and two 90-ft. deck girder spans 12 ft. from base of rail to bridge seat and 36 ft. to the water in the river. The superstructure of these bridges was furnished by the Pennsylvania Steel Company and erected by the Youngstown Construction Company.

Except for one-half mile west of Hollofield, which was raised 5 ft. above the old grade, the old line was abandoned. East of Alberton the new line was built south of the old line through a rock cut. From Alberton to just east of Davis tunnel the new line is on the opposite side of the river from the old line. At the east end of Davis tunnel the new line crosses the river and the old line at a point 12 ft. above the old grade and at the west end of the [illegible] crosses the old line again at a point 8 ft. above the old grade. It continues on the north side of the old line to Davis where it connects with the old line.

The change of line does away with 542 deg. of central angle of [illegible] reduced the [illegible] from [illegible] to 7 deg. [illegible] grade from [illegible] and the [illegible] grade from 0.8 to [illegible] per [illegible]. On [illegible] are spiraled and all grades compensated. The new line is double track [illegible] with stone ballast and [illegible] with a [illegible] cuts and [illegible] on fill.

The cost of this [illegible] was $750,000. [illegible] Company, of Philadelphia, were the contractors and the work was done under the direction of D. D. Carothers, Chief Engineer, A. M. [illegible], Engineer of Construction, and J. [illegible] Wilson, Assistant Engineer of the Baltimore & Ohio.

Car Surpluses and Shortages Jan. 8.

Owing to the general car surplus Mr. Hale's committee feels that it is unnecessary at present to continue issuing bulletins giving the situation in detail, but will supply it for designated roads upon request. The following condensed bulletin is issued, as of January [illegible], with totals compared with Dec. 24, 1907:

[illegible]

The Fort Worth & Denver City is commanded as follows:

[illegible]

To construct adequate and suitable depot facilities at [illegible], Quanah and [illegible] [illegible]

Group.	Group No.	No. of roads.	Surpluses: Box.	Flat.	Coal, gondola and hoppers.	Other.	Total.	Shortages: Box.	Flat.	Coal, gondola and hoppers.	Other.	Total.
New England	1	9	1,859	2,427	450	117	[illegible]	[illegible]	0	6	1	[illegible]
N. Y., N. J., Del., Md. and Eastern Penn.	2	19	31,029	1,377	38,214	10,401	81,0[illegible]	279	[illegible]	[illegible]	14	[illegible]
Ohio, Ind., Mich., Western Penn.	3	21	28,287	5,305	57,720	8,186	[illegible]	[illegible]	0	0	12	[illegible]
Va., W. Va., N. C. and S. C.	4	11	6,443	1,605	5,527	1,896	15,471	[illegible]	0	0	[illegible]	[illegible]
Ky., Tenn., Miss., Ala., Ga. and Fla.	5	19	6,515	1,110	4,386	1,670	13,611	[illegible]	0	0	0	[illegible]
Iowa, Ill., Wis., Minn., N. Dak.	6	25	37,640	2,398	15,387	7,7[illegible]2	63,167	12	[illegible]	0	16	[illegible]
Mont., Wyo., Neb., S. Dak.	7	4	2,101	221	1,171	1,138	4,631	0	0	0	0	[illegible]
Mo., Ark., Kan., Colo., etc.	8	17	9,740	1,103	4,780	2,623	18,246	84	1	[illegible]	[illegible]	14[illegible]
Texas and Louisiana	9	8	1,957	150	86	106	2,299	[illegible]	[illegible]	[illegible]	20	[illegible]
Ore., Idaho, Cal., Nev. and Ari.	10	15	5,528	3,479	865	2,614	12,486	[illegible]	[illegible]	[illegible]	0	[illegible]
Canadian Group	.	6	8,395	1,885	171	1,734	12,185	0	[illegible]	[illegible]	17	[illegible]
Grand total	..	154	139,804	21,190	124,787	38,117	323,898	157	26	[illegible]	118	[illegible]
December 24th, 1907	.	153	87,714	14,740	62,150	42,276	206,880	187	81	[illegible]	265	72[illegible]

Improvements Ordered by Texas Railroad Commission.

The Railroad Commission of Texas, after inspection of the lines, has issued orders to the Texas & Pacific, the International & Great Northern, the Fort Worth & Denver City, and the Chicago, Rock Island & Gulf to make improvements. The orders to the first three of these roads fix minimum schedules for passenger trains over the lines which are to be improved. These schedules are to remain in effect until the improvements have been made and the schedule time can be shortened, subject to the Commission's approval.

The improvement orders to the Texas & Pacific do not cover the El Paso division, which had not yet been inspected when the orders were issued, but on which improvements are to be ordered later. The improvements required of the Texas & Pacific are as follows:

To relay with rails, not lighter than 75 lbs. per yard, all remaining 56-lb. rails in the Transcontinental division between Bagwells and Sherman, 82 miles. To be completed by December 31, 1908.

To renew all decayed and unserviceable ties now in the track over the entire mileage of the Eastern and Transcontinental division and the joint track between Whitesboro and Fort Worth, with an average equivalent to about 15 per cent. of all ties now in the track, or between 500 and 600 per mile. To begin at once and be completed by June 30, 1908.

To ballast with broken stone, or first-class gravel ballast, averaging from 2,500 to 3,000 cu. yds. per mile, the entire mileage of the Eastern and Transcontinental divisions and the joint track between Whitesboro and Fort Worth except those parts of those divisions which have been ballasted with stone and gravel during the past year. To begin at once and be completed at the rate of not less than 200 miles per year.

To construct new, suitable and adequate passenger depots at Marshall and Honey Grove and to rebuild and improve the present station buildings at Jefferson and Longview Junction. Plans and specifications for the Marshall and Honey Grove depots to be filed with the Commission by January 31, 1908, and the depots to be completed by December 31, 1908.

The following orders to the International & Great Northern do not include the Houston division of that road, which is still to be inspected:

To ballast with broken stone or heavy gravel ballast, using not less than from 2,500 to 3,000 cu. yds. per mile, all the main line from Longview Junction via Palestine to Laredo, except such parts of this line as have been ballasted with an equivalent amount of gravel ballast during the year 1907. To ballast one with sand or gravel the Mineola branch from Troupe to Mineola, the Henderson branch from Overton to Henderson, and the Georgetown branch from Round Rock to Georgetown. The work of ballasting to begin at once and to continue at the rate of not less than 200 miles per year until completed.

To renew ties on the main line and branches as follows: Between Longview Junction and Palestine, from 600 to 700 ties per mile; between Palestine and Valley Junction, from 800 to 900 ties per mile; between Valley and Austin, from 900 to 1,000 ties per mile; between Austin and San Antonio, from 1,000 to 1,200 [illegible]; between San Antonio and Laredo, from 700 to 800 ties per mile; between Overton and Henderson, from 600 to 700 ties per mile; between Troupe and Mineola, from 600 to 700 ties per mile; between Round Rock and Georgetown, from 900 to 1,000 ties per mile. These renewals at the designated rates to be placed in track within six months after the date of the order, and depots to be completed by December 31, 1908.

The Chicago, Rock Island & Gulf is ordered:

To construct adequate and suitable depot buildings at Amarillo. Plans for same to be submitted for approval within 30 days after the date of the order, and building to be completed by December 31, 1908.

To renew the ties in track between Amarillo and the Texas-Oklahoma State line near Texola within the next six months, at an average rate of not less than 700 to 800 per mile. All ties placed in the track since December 1, 1907, may be credited.

New Interlocking at Hoboken.

The Delaware, Lackawanna & Western has put in service at its enlarged passenger terminal at Hoboken, opposite New York City, a new electro-pneumatic interlocking plant, a general plan of which is shown in Figs. 8, 9, 10 and 11 herewith. This is a track circuit plan and it does not show the normal position of the switches. Fig. 1 is a general view of the yard, looking east from bridge No. 5. No detector bars are used in this plant, track circuit detector locking being used. A good view of a slip without detector bars is shown in the foreground at Fig. 1. As will be seen from the plan there are two long signal bridges as well as four short ones. The latter are not new, having been put in with the former plant several years ago.

Fig. 4 shows the cabin, which is of brick to the first story and of reinforced concrete above that. The top floor contains the interlocking machine. This is the standard electro-pneumatic machine made by the Union Switch & Signal Co. There are:

35 levers for 36 single switches.
23 double slip switches with movable point frogs.
1 single slip switch with movable point frog.
44 levers for 110 signals.
39 working levers.
11 spare switch levers.
21 spare signal levers.
131-lever frame.

Fig. 5 shows the machine. In this machine there are light indicators, showing whether or not a track is occupied, one under each switch lever. These consist of ground glass disks about 2 in. in diameter, but they do not show in the illustration. They are fixed in the ledge beneath the levers, each indicator directly under the switch for which it indicates. The number of the indicator is painted on its face. The machine was found to be too narrow to accommodate all the necessary contacts on the usual horizontal rollers. To overcome this difficulty vertical rollers were added at the back side.

The train director has before him a cabinet containing 14 miniature semaphore indicators to indicate whether or not the train shed tracks are occupied (Fig. 7). There is another cabinet containing 14 disk indicators controlled from push buttons fixed in the train shed at the east and the west ends on each track. These buttons are used to announce that the trains are ready to leave. The row of

Fig. 1—General View of Hoboken Yard Looking East from Signal Bridge No. 5.

Fig. 7—Train-Director's Desk in Cabin.

Fig. 2—Signal Bridge No. 5.

Fig. 4—[illegible]

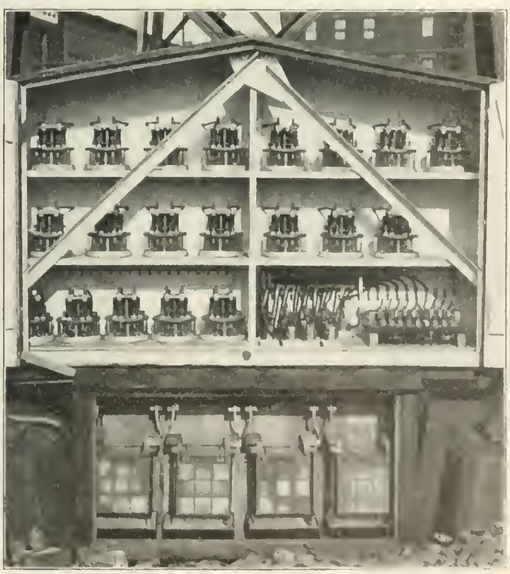
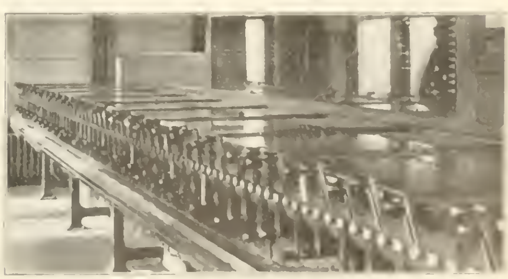


Fig. 3—Battery Cupboard at Signal Bridge No. 5.



[illegible]

Electro-Pneumatic Interlocking Switch and Signal Apparatus at Hoboken, N. J.—Delaware, Lackawanna, & Western.

Fig. 8.

Fig. 10.

Figs. 3, 9, 10 and 11—Plan of Tracks at Passenger Terminus of the Delaware, Lackawanna & Western, Hoboken, N. J.

Note.—[illegible]

push buttons shown in the illustration are for restoring the disk indicators to their normal position.

The middle floor of the cabin contains the relay room, supervisor's office, yardmaster's office and toilet. In the relay room are 122 repeating relays and 70 route-locking relays, making a total of 192 relays. They have six points each and are of 1,000 ohms resistance.

The lower floor is used for a repair shop and a generator and battery room. The generator room contains a G. E. 5 h.p. 110-volt, 3-phase, 60-cycle induction motor direct connected to a G. E. 60-volt, 3 k.w. d.c. generator and G. E. 1 h.p. induction motor, same characteristics as above, direct connected to a G. E. 20-volt, ½ k.w. d.c. generator. The large set is used to charge the storage batteries, and the small one to furnish current to the interlocking machine in case of emergency. The main switchboard is in this room.

In the storage battery room are two sets, eight cells each, 410 amp. hours, chloride accumulator to supply current to the machine, and two sets, two cells each, of same type to furnish current to the 11 track circuits in the train shed.

Fig. 5 shows a battery cupboard fixed in one of the legs of bridge No. 5. The cupboard contains 19 relays and the resistance used in connection with track circuits. The four storage battery cells in the lower cupboard are for track circuits near this bridge. These cells are 111 amp. hours each. They are General Storage Battery Co.'s 7 E type.

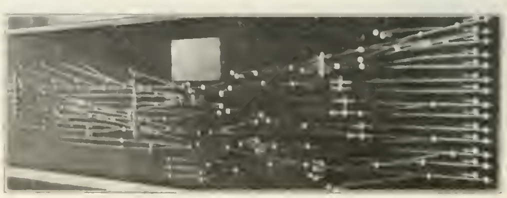


Fig. 6—Track Indicator.

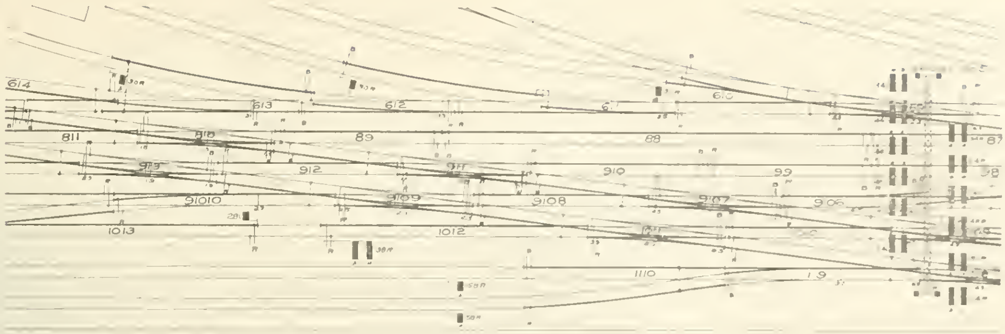


Fig. 9.

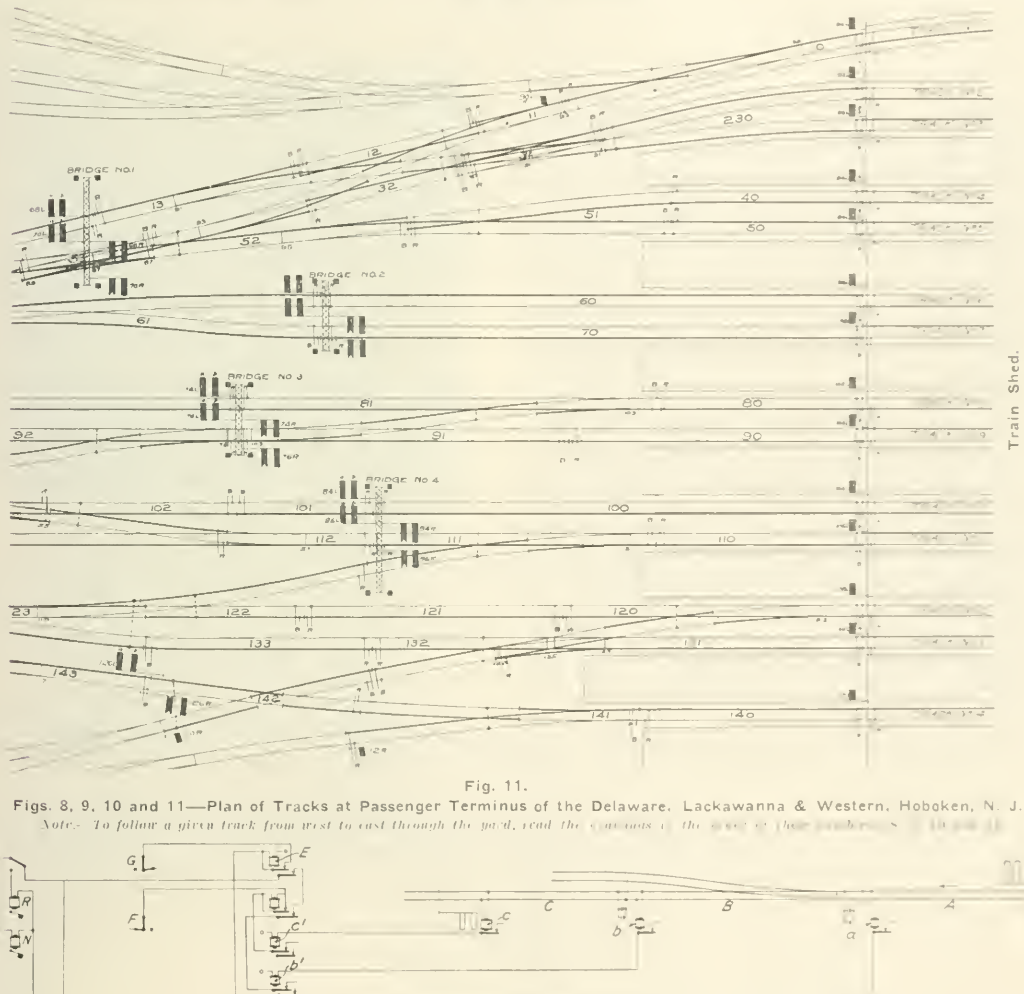


Fig. 11.

Figs. 8, 9, 10 and 11—Plan of Tracks at Passenger Terminus of the Delaware, Lackawanna & Western, Hoboken, N. J.

Note.- To follow a given track from west to east through the yard, read the

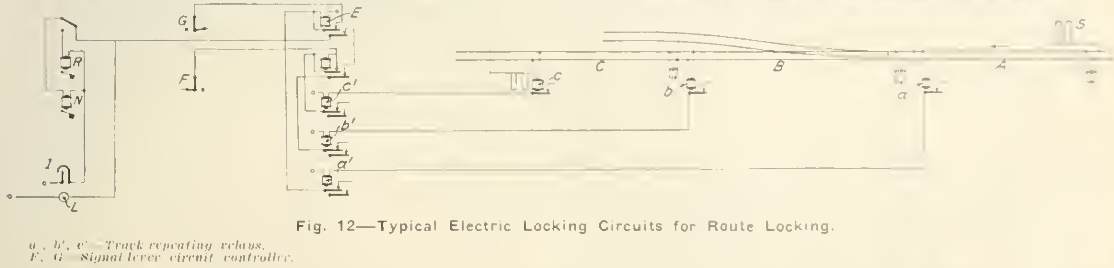


Fig. 12—Typical Electric Locking Circuits for Route Locking.

a′, b′, c′—Track repeating relays.
F, G—Signal lever circuit controller.

One hundred and twenty-two track circuits are fed from storage batteries. The batteries are contained at each signal bridge and in two special boxes opposite the cabin. The track circuits cover all switches, fouling points, and in many cases gaps between a signal and the first switch, and also between switches, to make route locking continuous.

Fig. 12 shows a typical electric locking circuit. The track is divided into convenient sections between signals so as to allow of maximum freedom of lever movement. a, b, c are track relays for circuits A, B, C, respectively. Each of these track relays controls a repeating relay, a′, b′, c′. These merely repeat the action of the track relays. Relays a′ and c′ control advance stick relays. The stick circuit is operative only when signal lever is reversed, so that for reverse train movements the circuit will be an ordinary locking circuit. When once this relay has opened owing to the presence of a train in the section with the signal lever reversed, it cannot pick up again until the train has left the track section, but with the lever normal the relay will be inoperative. This arrangement provides approach locking. Special magnets are provided on the indication quadrants in the machine to prevent the lever from being put full normal or reversed as the case may be when the magnet is deenergized. The circuit for these magnets is selected through a circuit controller on the lever and passes through the stick relays or repeating relays for the routes governed and to the battery, and to common, through a latch circuit controller normally open. In parallel with the circuit for these magnets is an electric light placed just below the lever handle, which burns when the switch is free but is extinguished when the switch is locked by the presence of a train.

Thus circuits are provided to lock all switches in the route when a train passes the governing signal at clear. The switches remain locked until the train has passed over them or has backed off the route. Each switch is released as soon as a train has cleared its points or cleared a fouling point. Thus a route cannot be changed ahead of a train, but may be behind one provided the home signal has been put normal.

All control wires are run in bituminous fiber conduit, made by the American Conduit Co. This conduit is laid in concrete with manholes at distributing or junction points about every 100 ft. Large main conduits run each way from the cabin.

The distant signals governing movements into the train shed are used to indicate whether or not the shed tracks are occupied. If a train is already on the shed track the distant cannot be cleared.

This plant was installed by the railroad company's men under the direction of M. E. Smith, Signal Engineer. The material, except as otherwise noted above, was furnished by the Union Switch & Signal Company. Mr. Smith informs us that the value of the light indicators (beneath the switch levers) as an aid to quick movement in case of dense fog, when the levermen can see but a short distance from the cabin, has already been tested, with highly satisfactory results.

Right to Discharge a Union Man Upheld by the United States Supreme Court.

The United States Supreme Court (opinion by Justice Harlan) on Jan. 27 decided that the most important section (10) of the arbitration act passed in 1898 is unconstitutional. Justice McKenna and Justice Holmes delivered dissenting opinions. The case was that of William Adair v. United States. Mr. Adair, who was and now is Master Mechanic of the Louisville & Nashville, at Covington, Ky., was tried in the United States District Court on the charge of threatening to discharge a locomotive engineer named Coppage, because he was a member of a labor union. Under the act of 1898, which was passed as one of the results of the great Chicago railroad strike, the District Court fined Adair $100. The decision of the Supreme Court overthrows this verdict.

In the course of his opinion Justice Harlan said:

"The right of a person to sell his labor upon such terms as he deems proper is in its essence the same as the right of the purchaser of labor to prescribe the conditions on which he will accept such labor from the persons offering to sell it. So the right of an employee to quit the service of the employer, for whatever reason, is the same as the right of the employer, for whatever reason, to dispense with the services of such employee. It was the legal right of the defendant, Adair, however unwise such a course might have been, to discharge Coppage because of his being a member of a labor organization, as it was the legal right of Coppage, if he saw fit to do so, however unwise such a course on his part might have been, to quit the service in which he was engaged because the defendant employed those who were not members of some labor organization. In all such particulars the employee and the employer have equality of right, and any legislation that disturbs that equality is an arbitrary interference with the liberty of contract which no government can legally justify in a free land."

To Provide for a Uniform Balance Sheet.

The Interstate Commerce Commission has sent out a circular asking the criticisms, suggestions and assistance of railroad officers in drawing up a uniform balance sheet. For purposes of the study the suggestion is made that the assets and liabilities of carriers should be divided into three general or primary accounts: (1) capital, (2) deferred and miscellaneous, (3) current or working. These general or primary accounts it is proposed to subdivide into such detail or subprimary accounts as may be found necessary to reflect sufficient data to enable clear and comprehensive analysis. The Commission asks the following questions and submits the following tentative balance sheet, with the request that replies to the circular should be made in duplicate, one copy to be sent to C. G. Phillips, Secretary Association of American Railway Accounting Officers, 113 Dearborn street, Chicago, and one copy to the Division of Statistics and Accounts, Interstate Commerce Commission, Washington, D. C. Replies should be sent prior to March 1.

1. To produce uniformity in compilations, subprimary accounts should be classified and a prescribed classification thereof agreed upon. You are therefore requested to submit for consideration a classification representing your views as to what items appearing on your general ledger should appear under the three general accounts suggested, and the order in which they should appear.

2. Generally speaking, "Cost of Road," "Cost of Equipment," and "Cost of Property" other than road and equipment, as reflected in the balance sheet, are those costs only which are capitalized, and do not include additions made to either of the classes mentioned from surplus or income, as a result, those accounts do not reflect true costs. If additions are made and charged to income, they disappear through the profit and loss account. To the end that the balance sheet may reflect the true costs of the property of a carrier, should not the costs of additions made and charged to income or to surplus be shown on the balance sheet as separate and distinct items?

3. Should the cost of equipment as stated on the balance sheet be affected by the introduction of the depreciation charge; that is, should that cost be the original cost, or the inventory value at a given date, or should it be the original cost or the inventory value as reduced periodically to the extent of the depreciation charge? You are requested to consider these three methods of procedure, and to state which of them approves itself to your judgment, giving your reasons therefor. In considering this question, due regard should be had to the possibility of introducing depreciation charges for other classes of railroad property than equipment.

4. The disposition through the balance sheet of premiums and discounts on securities sold, when securities are sold for the purpose of recouping a corporation for additions to its property or for the construction or acquisition of new property, should be carefully considered. Should premiums and discounts be disposed of through "income," "profit and loss," or "cost of property," or should they be set up in a permanent capital account on the balance sheet? You are requested to submit definite suggestions relative thereto, and your reasons therefor.

5. In stating capital liabilities, what distinction upon the balance sheet between "authorized issue," "outstanding," and "held in the treasury," should be made, it being understood that these terms are used in connection with an analytical statement of balance sheet liabilities?

6. Should material and supplies on hand be treated as a capital or a current asset and your reasons therefor? Many other questions will present themselves when the balance sheet is taken into final consideration. You are therefore requested to submit whatever observations and statements of facts in your opinion will be of assistance in working out the problem here submitted.

Previous year	Assets	Current year
	Capitalized	
	Cost of road	
	Cost of equipment	
	Cost of other property	
	Cost of securities	
	Total capitalized assets	
	Additions through income	
	Roadway	
	Equipment	
	Other property	
	Securities	
	Total additions through income	
	Leased properties	
	Total capital assets	
	Deferred and miscellaneous	
	Current or working	
	Profit and loss	
	Grand total	

Previous year	Liabilities	Current year
	Capital	
	Common stock	
	Preferred stock	
	[illegible] stock	
	Funded debt	
	Miscellaneous [illegible]	
	Capital liabilities of leased properties	
	Total capital liabilities	
	Deferred and miscellaneous	
	Current or working	
	Profit and loss	
	Grand total	

Tentative Balance Sheet.

The Shelling Out of Steel Wheels and Tires.*

BY GEO. L. FOWLER.

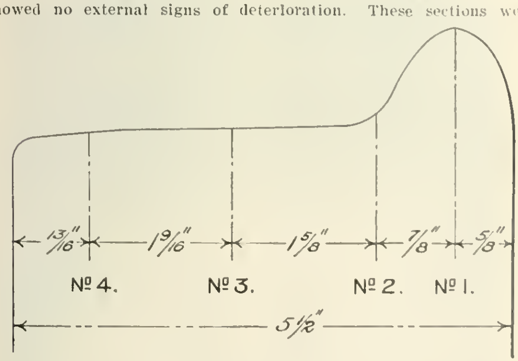
The service that can be expected from any wheel depends on the soundness and homogeneity of the metal of which it is composed. Irregularity of texture must necessarily result in irregular wear, while local defects are apt to result in an immediate failure. Of such failures, one that is the cause of much annoyance and trouble is that known as shelling out. It was for the purpose of ascertaining, if possible, the causes of this shelling out of wheels and tires that an examination with the microscope of a number of defective tires that had failed in service was undertaken.

The Rules of Interchange of the Master Car Builders' Association define a shelled-out wheel as one "with a defective tread on account of pieces shelling out." This is a poor definition; it may be supplemented by saying that the common understanding of a shelled-out wheel is one in which pieces from the tread have flaked off, due to inherent defects in the metal, such as the laminations so frequently found in wrought-iron boiler plates. It will be seen later that the analogy in the case of steel wheels is very close. The cause of shelling out of cast-iron wheels is outside of this investigation and will not be considered.

SHELLED-OUT STEEL TIRE AND WHEEL.

The samples of defective material investigated include one of each brand of wheel and tire previously referred to in these pages, and were obtained from several railroad companies. Each of these wheels and tires had one or more shelled-out spots on the tread, and there were also places on each where no signs of shelling out could be detected. The general appearance of two samples is shown in the accompanying photographs, and these may be considered as characteristic of all.

A section was taken at the spot where the worst shelling was found and another through a place on the tread where the metal showed no external signs of deterioration. These sections were then cut into strips whose centers lay along the lines 1, 2, 3 and 4 respectively. The strips were then polished, etched and photographed. The photographs were taken at the tread, and at intervals approximately 1/8 in., 1/4 in., 3/8 in. and 1/2 in. below. This was not strictly followed in all cases, since the examination was governed, to a certain extent, by the structure of the material examined, as it appeared under the microscope.

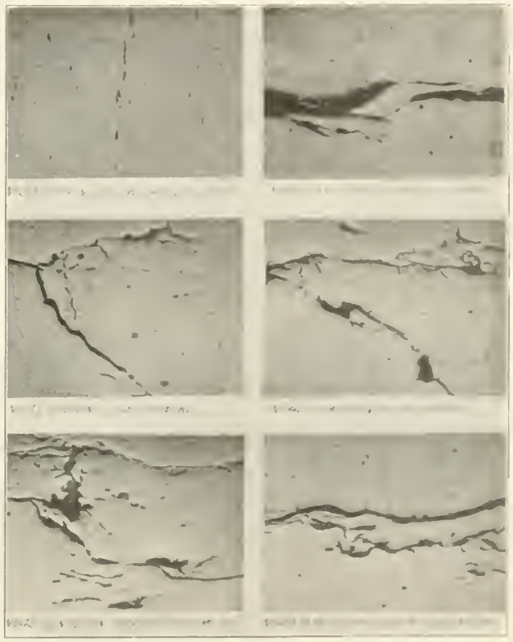


Section of Tire, Showing Location of Microphotographs.

Nos. 39 to 42 show the structure of the C tire at the point where the worst shelling out occurred. In strip No. 1, which ran down into the wheel from the flange, the metal shows a fairly good fine-grained structure at the edge and well down into the rim. In No. 39, which was taken at 1/4 in. below the edge, spots of manganese bisulphide are visible. The metal shows a good structure in all of the strips down to 1/2 in. in depth, wherever the photographs avoid the serious defects. In No. 40, however, which was taken from strip No. 3, there is a distinct flaw due to the presence of slag. The same kind of flaw appears, very pronounced, in the photographs Nos. 41 and 42, which were taken from strips Nos. 2 and 3 respectively, and through which a continuous line of slag extends. At other points adjacent to these defective places normal conditions and structure of metal was found.

Photographs Nos. 43 and 44 were taken from points on strip No. 3 at depths of 1/8 in. and 1/4 in., cut from an apparently solid piece of metal, and yet they show the presence of pronounced slag flaws. These flaws had not developed into shelled-out spots, but it is reasonable to suppose that it was only a matter of time when they would have done so.

Comparing this defective C tire with the sound new tire, the absence of a decarbonized surface on the defective tire is to be noticed, while it was very apparent in the new tire and can be clearly seen in photograph No. 7 (*Railroad Gazette*, Jan. 24). This is accounted for by the fact that the defective tire was in service and this soft outer shell had been worn away.



Microphotographs of Shelled-Out C Tire.

The balance of the material of the defective C tire is normal in structure, except that the manganese sulphide globules are large. Its failure is readily accounted for by the slag flaws found scattered through the whole body of the material as shown in Nos. 40 to 44.

The B tire failed from the same cause as the C tire. The structure of the metal is normal through a large part of the sections, but contains occasional slag cracks, and the characteristic markings of manganese bisulphide, as shown in No. 45. In the other parts of the tire precisely the same conditions exist as in C tire, namely, slag cracks, as shown in Nos. 46, 47 and 48, which were taken at various depths, and where no indication of shelling out had appeared at the time that the tire was removed from service. The presence of such large slag veins as those shown in Nos. 46 and 47 leaves no room for doubt as to the cause of failure. The presence of manganese bisulphide was also indicated in the new Tire B, but no slag veins are revealed.

Nos. 49 and 50 were taken from the defective A tire. If the metal of this tire is compared with that of the sound new tire, it will be seen that there is no variation in the normal structure

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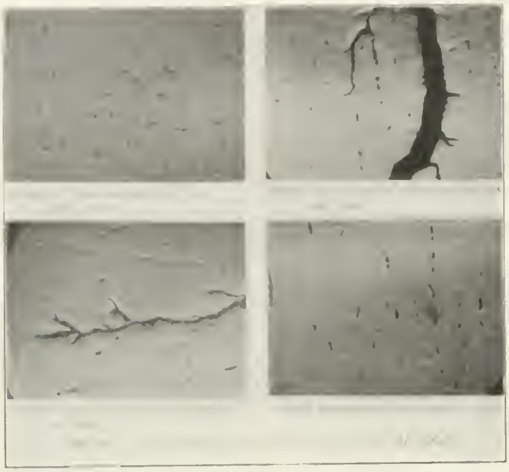
of the material to indicate a difference in the wearing quality, so that the failure of the shelled-out tire is undoubtedly due to the slag flaws clearly shown in the photographs.

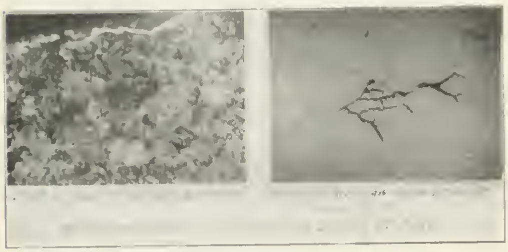
In the shelled-out D tire normal structure was found but interspersed with slag cracks as in the other defective tires. These are shown in Nos. 51 to 54, some of which were taken close to the edge of the tread. In some places there were spots of manganese bisulphide near the edges, but the cause for failure is the presence of the slag flaws that form planes of extreme weakness. In photograph No. 51 such a flaw is shown, which eventually must have caused shelling out. Another example of the same sort is shown in No. 52.

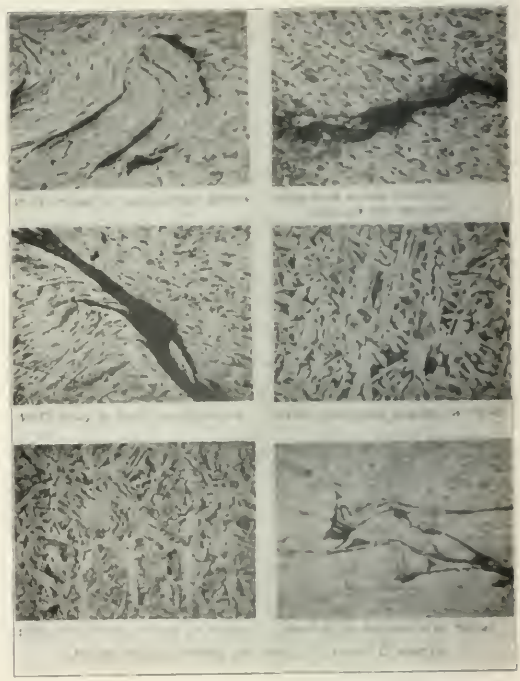
In the E wheel, the slag flaws can be seen in Nos. 55 and 56, which were taken from the shelled-out portion. In No. 55, there is a distortion of the slag defects due to the forging and in No. 57 there can be seen a slag crack which existed in the metal with no visible defect on the surface.

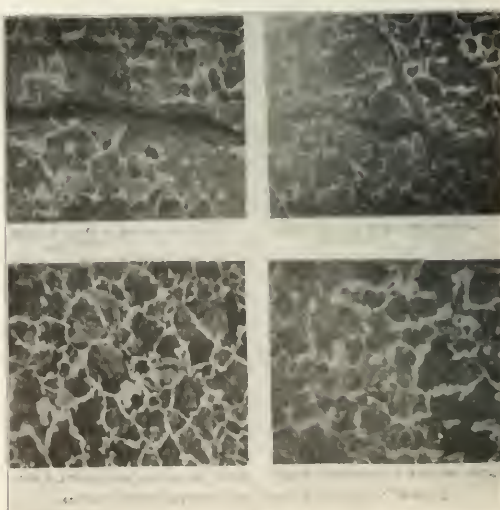
The material in this particular wheel is bad in every particular. The carbon content is low, apparently ranging from 0.35 to 0.40 per cent. The effect of both the work and heat treatment is practically nil and the structure looks like that of untreated cast steel or a metal that has been overheated. The surface shows the effect of cold rolling in the mixture of ferrite and slag, the whole having a schistose appearance. The presence of so much slag, as shown in Nos. 55, 56 and 57, renders the wheel totally unfit for service. The grain is coarse, as is seen in photos Nos. 58 and 59, and resembles that in the new wheel of the same brand that was examined. The carbon content of the new wheel, however, was apparently much higher.

In the shelled-out portion of the F wheel the slag flaws also appear well down in the metal, see Nos. 61 and 62. What was



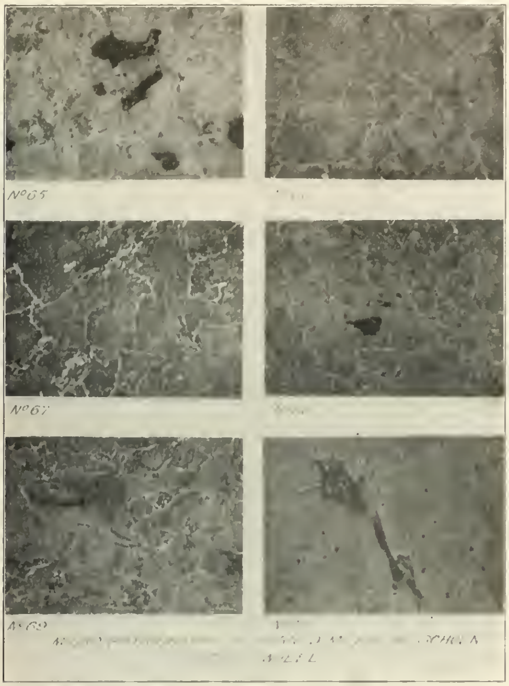






said of the defective E wheel applies to the F wheel. The carbon content seems to be low, while the presence of large quantities of slag, photograph No. 67, caused the many lines of weakness along which rupture occurred.

At the time this examination was being made, three specimens



of the Schoen solid forged and rolled steel wheel were obtained, two from shelled-out wheels and one from a section of a wheel

Burned Metal of Schoen Steel Wheel.

that had been purposely burned in heating during manufacture. An examination of the photographs of the two defective wheels, Nos. 67 to 70, shows that there are defects in the interior of the metal that were undoubtedly the cause of the shelling out but there is no evidence of slag. The same characteristics are to be noted in Nos. 65 and 66 of the specimen that had been purposely burned. The three specimens are examples of burned steel in which there is no evidence of slag.

From these photographs it is evident, therefore, that the cause of the failure of all of the wheels and tires, except the Schoen wheels, was due to the presence of slag flaws occurring near the surface of the tread.

It appears, therefore that there are at least two causes for the shelling out of steel tires and wheels, namely, slag flaws and overheating.

Western Canada and the Canadian Northern Railway.*

The commercial history of Western Canada begins in 1670, with the charter by which Charles the Second constituted Prince Rupert and seventeen of his friends—"The Governor and Company of Adventurers Trading into Hudson's Bay"—and permitted them to trade over an area of 2,500,000 square miles. For these tremendous privileges their only obligation to the monarch was to supply him annually with two elk and two black beaver from the country over which they assumed practically sovereign rights. The difference between the elk and beaver of the Governor and Company of Adventurers and the annual reports of the Canadian Pacific Railway and the Canadian Northern Railway is the difference between Western Canada without transportation and Western Canada with transportation.

One of the most remarkable characteristics of the race to which we belong is the pioneering instinct. It has made us what we are. Why do men carry implements and wives into the far country of the Peace river when a thousand miles nearer the best market for their produce, there are square miles of fertile land to be obtained for the asking? A gentleman, whom I will not name, was asked if he would sell, at a magnificent profit, his interests in a railroad system. His answer was, "No, I like building railroads." Now, the instinct of the Peace river agriculturist is vitally the same as that of the railroad projector. Each is the complement of the other, and each contributes to the newness of life that comes to the migrating millions of the race without which no empire can save itself alive. The impulse that brings my fellow-countrymen to Canada is not always the desire to acquire a little money. It is rather the reassertion of that elemental quality in virile mankind which has founded colonies and transplanted empires across the face of the planet. Abraham trekked out of Ur of the Chaldees under Divine direction. Thousands of settlers in the Canadian west were moved by the same influence, though they didn't recognize it, in the lantern lectures of the agents of the Dominion Government or the advertisements of steamship and railroad companies.

It is a profitable exercise occasionally to dip into the early literature of the prairie provinces of to-day. To glance over the prophecy of a living general in the British army, Sir William Butler, in "The Great Lone Land," written in 1871, as you cross Manitoba, Saskatchewan and Alberta in a luxurious train, is to make one fairly well satisfied with what has been done. Butler trailed from Fort Garry to Edmonton and Macleod, and returned over Saskatchewan ice. Reading his book you breathe an atmosphere of isolation, not to say desolation. But in the middle of it there is the prediction of settlement and abounding grain fields, a prediction fulfilled in his own time. Butler's journey was made just 200 years after the charter of the Company of Adventurers was granted. The intervening years had seen the company's work spread over a vast, immeasurable territory, and had produced Lord Selkirk's heroic efforts to found an agricultural community, imported via Hudson's bay to the Red river. But there was a majestic vacancy about the whole land. Even when a corner of the country had become sufficiently civilized to need an armed force to dissipate political rebellion the white population was pitifully sparse. The advance guard of ploughmen pioneers from the East soon afterward, however, began to break through the woods and waters of the Dawson route. But there could be no real advance so long as the Red river and the Dawson route governed the going out and coming in of the people. Men eagerly looked for railroads. They got the railroads, but they have never had enough of them, and never will have so long as there is a railroad builder in whom the pioneering instinct expresses itself in parallel lines of steel and in reduced passenger and freight rates.

The Canadian Pacific was the forerunner. The early promoters of that great corporation have never, I think, received all the credit due for their marvelous and successful effort to bind the East with the West. Remember the conditions under which that great enterprise was accomplished. Between settled Ontario and the prairies there was a wilderness of poverty. Between the prairies and the Pacific were ranges of mountains which many people thought no combination of engineer and capitalist could penetrate. The end-all of the scheme was foreseen by some excellent men to be unpaid bills for axle grease. Financially the times were unpropitious. In 1879 Sir Sanford Fleming felt compelled, in view of what he considerately called "the necessities of the situation," to advise the Minister of Public Works to "establish a great territorial road on the site of the main line of the Pacific Railway from Lake Nipissing to the north side of Lake Superior."

When, in 1881, the first Canadian Pacific rails were laid west of Winnipeg, the white population between the western boundary of Ontario and the Rocky mountains, and between the United States boundary and the Arctic Circle was 66,161. Manitoba contained 59,187 whites, of whom 8,000 were in Winnipeg, and several thou-

*From an address by D. B. Hanna, Third Vice-President of the Canadian Northern and President of the Canadian Northern Quebec and the Quebec & Lake St. John, before the Empire Club of Toronto.

ands were brought in by the railroad contractor. The true population indicator of that time is the fact that in the Northwest Territories there were only 6,971 whites, practically all living on the fur trade, and 19,500 Indians. It was only in 1876 that civil government was organized in the territories. Governor Laird, who took up his abode at the new founded Battleford and who still lives in Winnipeg, has described the perilous conditions under which he journeyed officially to Fort Macleod, which is now in the fall wheat section of southern Alberta. Eliminating British Columbia then, the Canadian Pacific in 1881 began to open up territory 900 miles long and 300 miles wide—taking the Saskatchewan valley as roughly the northern frontier—with a population of 66,000, or one-fourth of a civilized person to the square mile. But in the territories, or three-fourths of the prairie country, there was only one white person for every 35 square miles of cultivable land. It was not an inviting prospect for men of faint heart and little faith. The Canadian Pacific builders were of another sort. True, the company was given an unprecedented stake in the possibilities of the West, but its early history was one of hard times, and for years was a load of care to those who had riveted to it all of their own fortunes and as much of the fortunes of other people as they could attract to their cause. That it is to-day an enterprise of which all Canadians are proud is gratifying alike to the Dominion and to the company.

Beginning with 1881, the year in which the Canadian Pacific laid the first track west of Winnipeg, the growth of white population in 25 years was as follows:

	1881	1906	
Manitoba	59,187	365,688	
Saskatchewan and Alberta	6,971	257,763	Saskatchewan
	....	185,412	Alberta.
Total	66,161	808,863	

This is an increase of over 1,200 per cent. in 25 years. Quite as illuminating as the growth of population are the immigration returns, which show that during the year ended June, 1896, the total immigration to Canada was 16,835, and in the year ended June, 1907, it was 256,000. Yet the twentieth century had come in before the immigration reached 50,000 in a year. In 1901-2 it was 67,379, and in 1902-3, 128,364.

Equally illuminating is the growth in actual settlers located on free lands granted by the Dominion of Canada. Thirty years ago, or in 1877, 845 homestead entries were made, aggregating 135,200 acres (a homestead is 160 acres), but 54 per cent. of the entries were subsequently canceled, the duties required under the Homestead Act not having been complied with, and the land reverted to the Government. Five years later, in 1882, when the railroad reached Brandon, the homestead entries were 7,483, representing 1,197,280 acres, with cancellations of 47 per cent. Twenty years later, in 1902, the western country had passed the experimental stage, and the larger movement of settlers was in full swing. Then began what has often been called the American invasion, and that year, in addition to hundreds of thousands of acres of land sold by land companies to actual settlers, 22,215 homestead entries, representing 3,554,400 acres, were made. The figures are as follows:

	Homestead entries.	Average acreage.
1903	32,682	5,229,120
1904	26,513	4,242,080
1905	31,645	5,643,200
1906	42,012	6,721,920
1907 (10 months)	25,305	4,018,800

Up to the end of June, 1907, it may be conservatively estimated that over 30,000,000 acres of land have been granted by the Crown to legitimate settlers in Manitoba, Alberta and Saskatchewan. Add to this acreage sales made by railroad companies and land companies of approximately 20,000,000 acres, and it is not difficult to foresee that the Canadian West must soon become the bread basket for the world. The Surveyor-General of Canada estimates that in Saskatchewan and Alberta alone there is a total land area, after deducting 30,080,000 acres for water, of 324,125,140 acres, of which he says 106,240,000 acres are suitable for growing grain, the remainder being suitable for ranches and mixed farming. The influx of people and the occupation of the land have been coincident with railroad expansion.

The great expansion in immigration in 1902-3 was in a most remarkable degree coincident with the extension of the railroad with which I am associated. The Canadian Northern claims no special credit for the phenomenal increase in immigration; but it cannot dispute the fact that the rapid development of the enterprise opened up a wide and fertile territory and made it possible for the great influx of new settlers to locate on free or cheap lands near to markets and general supplies.

Besides enjoying the privilege, as I do, having been the officer in immediate charge of the operations of this company from the first day a wheel was turned, I am able to speak from a personal knowledge of what has been done. I shall refer exclusively to the lines west of Lake Superior. Ten years ago, in 1897, we operated 100 miles of railroad through a then unsettled country. Traffic was light and train service limited. Our equipment consisted of three locomotives and some 80 cars, all told, a working staff of less than 20 men altogether, and a payroll for the year of less than $17,000. The gross revenue for the first year was under $60,000, but it was more than sufficient to pay our debts. During that year we handled 25,700 tons of freight and carried 10,343 passengers. There is nothing particularly impressive in these figures.

To-day, or ten years afterward, we are operating 3,345 miles. We have an equipment of 237 locomotives, 219 passenger cars, including 35 sleeping and dining cars, and about 8,500 freight cars of all kinds. These figures do not include the large number of locomotives and cars ordered and now building. The 20 men of 1897 have become 10,700 in 1907, with a payroll of over $5,000,000 a year. And these figures do not include the large construction forces which at times run into thousands of men. The gross earnings now amount to over $10,000,000 a year; the freight handled for the past fiscal year was 1,822,220 tons, and we carried 703,988 passengers. We are accepting freight and passengers for 411 different points west of Port Arthur. If I were dealing with eastern as well as western lines I could tell you that the Canadian Northern has become the second largest railroad in Canada. Only a chastened humility prevents me from enlarging the fact that with 2,990 miles in the West actually in operation, 150 in Ontario, 531 in Quebec, and 431 in Nova Scotia, we have in all 4,059 miles in Canada, whereas the Grand Trunk Railway has in the Dominion 3,829 miles.

To me, however, the most fascinating result of the past ten years of western development is that the Canadian Northern system is responsible for the creation of over 150 town sites, of which at least 125 have been named by our officers and at least 70,000 persons (exclusive of Winnipeg and other large centers) have found homes tributary to this railroad. I think it is reasonable to estimate that at least one-third of the growth of Winnipeg in this century is directly due to the business opened up by the Canadian Northern. Let me repeat, we claim no special credit for that. But even railroad men are not devoid of the instincts of citizenship and may be allowed to reflect without boasting that they have inaugurated communities wherein the institutions of a free, strong and intelligent people may mature.

The railroads which connect Winnipeg with Eastern Canada are western lines, inasmuch as without them the West could not be served. They bind the East to the West and the West to the East as nothing else could. They are the abiding symbol of Canadian nationality, and, as they increase in number, they make the nationality the more abiding also. The lakes are the friend of the West in summer, but steel is its defense against the rigors of winter. The railroads are more vital to the national prosperity than water, for rails can do without the help of navigation, but navigation, of itself, would be helpless against the forces that tend to an identity of interest between the western United States and the western provinces.

The function of railroad transportation in the West, then, is to keep open communication with the East. On purely commercial grounds it is infinitely more important to the East than to the West that it should be so. May we not say that this is true, also, as a matter of sentiment? It is not necessary to argue that the present prosperity of Eastern Canada is the fruit of transportation in the West. It is conceded, on the one hand, that the rural population of Ontario has declined. On the other hand, the manufacturing population of Ontario has enlarged out of all proportion to the increase of Ontario's demand for Ontario-made goods, while the Winnipeg warehouses of eastern manufacturers tell an eloquent story of the origin of modern Canadian growth and pay tribute in the fullest sense to the wisdom of rail connection with the East. For Canadian solidarity there must be more and still more communication to and from the West.

Foreign Railroad Notes.

The railroad in German East Africa from Dar-es-Salaam westward to Mrogoro, 140 miles, was opened for traffic Dec. 16 last. It was begun Feb. 9, 1905. Dar-es-Salaam is in 7 deg. south latitude and just about 200 miles south of Mombasa, the ocean terminus of the British Uganda Railroad. The new railroad crosses the unhealthy lowlands near the coast and reaches the comparatively healthy high country. It is intended eventually to extend the railroad to the south end of Lake Victoria Nyanza, making a line nearly parallel to, but about 200 miles south of, the Uganda Railroad.

Last summer the Hungarian State Railroads conducted a series of tests of the Westinghouse quick-action brake, the results of which were recently published. The tests were made with a train of 71 covered freight cars, with three passenger cars interspersed among them for purposes of observation, and two testing cars equipped with all manner of recording instruments. Preliminary tests were made in which the brakes were applied 275 times, with no injurious shock and no parting of the train. The main tests were then made in the presence of a committee of the German Railroad Union, and of many other Austrian and German railroad officers. The train was hauled first by one and then by two locomotives, and all the applications of the brake were satisfactory.

sleeping and dining accommodation, or as inspection cars, wrecking cars, baggage cars, etc.

A run was recently made with the car over the tracks of the Delaware & Hudson from Schenectady, N. Y., to the junction with the Susquehanna division, thence to Albany, Cohoes, Mechanicsville and back to Schenectady, about 78 miles in all. The car carried its full complement of passengers and made 23 stops, the engine running continuously. The speed varied from 23 miles an hour on a 1.3 per cent. up grade to 56 miles an hour on a ¼ per cent. down grade, except where traffic conditions and road regulations required lower speeds. Where traffic conditions permitted, a speed of 50 miles an hour was recorded on level track, and from Albany to Mechanicsville 47 miles per hour was sustained on a steadily rising grade. The operation of the equipment was in every way satisfactory, neither vibration nor sound of the engine reaching the passengers. The car heated readily from the exhaust system although the day was cold and the air keen. The gas engine developed at times 150 h.p. and the two motors were under such control that the acceleration was noticeably smooth and free from jerks.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

IV.

*Line Traffic and Its Extension.**

The British Government, which had been the pioneer founder of steamship lines in 1822, did so because private citizens did not seem to be able to fill the need. By 1838 the government was able to hand some of the work over to private firms and the first regular transatlantic line, the result of the British mail contract, was really a subsidized line. Without such aid a transatlantic line in the period of 1840 to 1860 was in a precarious situation as witnessed by the speedy failure of most of those attempted during the period.

The Cunard, starting with a strong subsidy and backed by the support of the government, kept steadily on, as also did the Inman Line, which started 10 years after the Cunards, and after 1856 shared the mail contracts with them. By 1861 there had been 12 distinct attempts at steam connection between United States and England, and only these two had survived although the second Glasgow line had then been running five years.

Between 1840 and 1850 the old packet lines were as numerous and as fast as ever, and they occasionally beat the Cunard steamers, even when that line had been 15 years running, but these performances were unusual and far from the average. The Cunarders had their own way with mail, with the express freight which paid $36 per ton, and also with those passengers who could afford a costly journey, for the charges were much above the packet fares. During this decade the steamers carried only first and second class passengers, although the third class, then as now, made up the bulk of the travel and was very profitable. All of this class, from necessity, still traveled in the packets which were on the whole well able to compete with the steamer lines and were effectively doing so as was proved by the repeated failure of steamer lines during the period 1840-1860. Up to 1850 the steamer certainly could not have held its own, without the aid of the subsidy. The decade 1850-60 witnessed the real establishment of an economically self-sustaining ocean steamship line traffic on the Atlantic.

The full list of the failures in this transition period need not be enumerated here, but at least four American attempts of the period are worthy of attention.

The success of the Cunard steamers was a great blow to American pride. Our newspapers had for decades been rejoicing in no moderate terms over the triumphs upon the sea that had been won by our world-famed packets and clippers. Then the British line steamers sailed into our ports, and the speed records were held by the other side. In 1847 an attempt to win back these laurels was made by an American corporation, the Ocean Steam Navigation Company, which started the first of its two steamers, "Washington" and "Hermann," to Bremen via Southampton (Cowes) on June first. But it was counted a failure because the Cunard steamers made from two to four days better time. The American Government mail payment was $200,000 per year, but the British authorities discriminated against the American-borne mail. The city of Southampton gave the line no welcome and it was continued only a short time.

While this line was leading its cheerless existence, another of similar performance but longer life began operations. An American company, the New York & Havre Steam Navigation Company, organized in 1848, sent its first steamer, the "Franklin," in 1850; a second steamer was put on the next year and the company with difficulty managed to maintain a two-boat service until the outbreak of the Civil War. The gap was thereafter filled by the French Transatlantic Company, founded in 1860.

But this line to France did not even pretend to be in the Cunard record-breaking class. The failure of the one American attempt in this direction goaded the nation to more determined efforts. The idea of naval dependence was brought before the public mind by the carrying of all steamer mail by the British. The packets were recognized as useless for this race. The nation was stirred and a subsidy was granted to E. K. Collins, owner of a line of packets running from New York to Liverpool. He contracted for 20 voyages a year and was to receive $19,250 per voyage; later it was raised to $33,000, or $858,000 per year. No pains were spared in the effort to beat the British. The national spirit was shown by contractors who assisted in the enterprise by delivering to Mr. Collins at cost.

In 1850 the Americans were ready. Mr. Collins sold his packet ships and launched his fortune on the sea in his great new wooden paddlewheel steamers, having the unheard-of boiler pressure of 13 lbs. per sq. in. This race between Britain and America was a world event and Mr. Collins beat the Cunards. He beat them once and beat them regularly, the average difference in time of voyage for the two lines in 1851 being seven hours going east and 18 hours going west; the annual average time of the Collins steamers for that year being a fraction over 11 days and the Cunard slightly over 12 days. It is interesting to note that in the 96 trips made by these two lines between New York and Liverpool that year they carried only 8,268 passengers, an average of but 86 per trip. They were almost evenly divided, but the smallness of the number will help to explain the lamentable failure of the Collins Line a few years later.

This competition was in more than speed. It was an inroad upon the Cunard's monopoly. Upon the opening of the Collins service the steamship freight rate fell from £7, 10s. to £4—a rate which to-day would seem like the most Heavenly kind of manna to the owners of ocean greyhounds.

In December of 1850, the same year that the Collins Line began, the Inman Line (British) established a fortnightly service between Liverpool and Philadelphia, and made the innovation of giving full and complete competition with the clipper ships by providing for third class passengers. This was a popular move which was copied three years later by the Cunard Line. The Collins Line still represented the strictly express type of service built for speed, at which it succeeded. It thereby added great laurels to the American flag and name, but it netted only losses to the stockholders. In 1854 one of their steamers, the "Arctic," was lost in collision on the Grand Banks. Two years later, the "Pacific" disappeared at sea with Mr. Collins' wife and two children on board. Then, even worse for the fate of the line, the great subsidy upon which it had rested was withdrawn, due, some say, to the jealousies of Boston, Philadelphia and Baltimore, and to the business jealousies of the clipper ship owners who made a combination in Congress which killed the Collins subsidy, and this promptly killed the Collins Line. It made its last voyage in 1858. During the eight years of its brilliant, but unfortunate career, the passenger traffic had increased five fold.

The experience of this line with the subsidy shows how unstable the company is that depends upon the repeated votes of a legislature dominated by party politics. The government support of the Cunard Line was never violently withdrawn.

Upon the failure of the Collins Line, the Inman Line swung its Philadelphia service to New York and took the Collins dates and kept up the bi-monthly service. In 1860 it became weekly, 1863 three in two weeks, and in 1866 bi-weekly in summer.

Another sturdy American, Vanderbilt, tried to follow in the footsteps of Collins and get a subsidy for a route to the continent. He labored hard in this cause and failing to get a subsidy he determined to put on steamers anyhow. In 1855 he began service from New York to Havre and Southampton. The next year he extended it to Bremen and in 1858 he got the contract for carrying the mail and was paid the amount of the actual postage receipts. In 1861 he gave it up and sold most of his steamers to go to the Pacific, and retired from the Atlantic carrying trade.

The year 1856 witnessed the founding of a line, the second attempt, which was probably more nearly a freight line than any other of the period—the Anchor Line from Glasgow to New York. This service, with its greater dependence upon freight, marks another stage in the progress of the development of line traffic and of the replacing of sail by steam lines. From 1850 until 1870 this replacing continued steadily, and with increasing speed. The new lines were usually steam lines, and the old lines gradually changed their vessels from sail to steam. The Hamburg American Packet Company, incorporated in 1847, had sailing vessels only, for nine years, and then in 1856 a screw steamer was added. Others

*References: *Westminster Review*, 101:368; *Chambers' Journal*, 15:392; *Hunt's Merchants' Magazine*, 17:358; Lindsay's History of Merchant Shipping, 4:224; *Westminster Review*, 101:367; Fry's History of North Atlantic Steam Navigation; Wheelwright's Pacific Steam Navigation; *Hunt's Merchants' Magazine*, 29:116; Lindsay's History of Merchant Shipping, 4:151-6; *Chamber's Journal*, 22:189; *Journal of the Society of Arts*, 8:164; *Scribner's Magazine*, 70:156; *Living Age*, 165:784; *Scribner's Magazine*, 10:267.

followed and in 1860 the nine remaining sailing vessels on the line were replaced by four new steamers and fortnightly sailings to New York were inaugurated.

The old Black Ball Line, the pioneer between New York and Liverpool, the pioneer of all the Atlantic lines, had 25 fine sailing ships in 1850. But the competition of the new lines of steamers was such that they had to be merged shortly into the Guion Line, and this company in 1863 made an arrangement with the Cunard Line to carry some of its passengers in the Cunard steamers. In 1866 the Guions added their first steamer and in eight years more they had a steam fleet. The decade 1860-70 marked the practical disappearance of the old transatlantic packet-ship lines and their final replacement by lines of steamers. The last days of the packet lines found them carrying emigrants while the first and second cabin passengers were taken by the steamers. The White Star Line was an example of this transformation of an established line traffic from one type of vessel to another. The present service had its origin in the purchase of a sailing vessel fleet in 1870, their immediate transference to another service and their replacement by steam vessels.

The summer of 1856 saw the establishment of the subsidized Allan Line steamers from Montreal to Liverpool by an old firm of merchants and sailing ship owners who had been running their vessels in the Montreal-Glasgow trade for a quarter of a century. The first ocean steamer to reach Montreal came in 1853, and for two years there was a poor, irregular service, but it was so irregular that the government canceled its mail contract, and the next effort was the more liberally paid Allan Line, which succeeded and maintains itself to the present day.

In 1866, the North German Lloyd Line from New York to Bremen, which had been founded with steamers in 1858, increased its service to once a week. Between 1866-70 it succeeded in beating out three attempts of New York capitalists headed by Henry Ruger, who tried to establish competitive service to Bremen and to Scandinavian ports. In 1869 the Bremen company started a steam service to New Orleans. The next year the New Orleans cotton merchants, who had been depending on sail for their direct shipments to Europe, formed the Mississippi and Dominion Steamship Company, which ran steamers from New Orleans to Liverpool in winter when the cotton season was on and in summer when the St. Lawrence was open they went to Quebec and Montreal. This New Orleans service was not long lived. It was shifted to the New England and Canadian ports and there became known as the Dominion Line.

The period of 1840-60, that of the founding of steam line traffic on the North Atlantic, was also the period of its establishment in nearly all parts of the globe.

It is rather remarkable that the backward, warring and disturbed countries on the west coast of South America should have had upon the Pacific ocean one of the earliest of oceanic steamship lines, but there were peculiar reasons for this. The topography of the coast made land travel to any distance absolutely impracticable. The sea was the only highway and here the peculiarities of the winds were such that sailing vessel communication was exceedingly slow and tedious. William Wheelwright, an enterprising American, who had spent some years on those coasts as consul, appreciated the situation and went to Europe to raise money for a steamship line. His pamphlet stated that "by steam many voyages would be performed in 40 or 50 hours which now occupy 20 or 25 days." The explanation of these disparities he showed to be a combination of southeastern trades and prevailing westerly winds to the south of them which made it necessary for a sailing vessel bound on a mere coasting journey to go far out into the Pacific to get the requisite winds. Mr. Wheelwright secured his financial support and the first two steamers reached their station in 1840. In 1852, there was a bi-monthly service from Valparaiso to Panama, where it connected with the Atlantic navigation. In 1865 the service was extended around the southern end of the continent to the River Plate and the Falkland Islands, and two years later regular steam connection was had with England through the Straits of Magellan.

At first Wheelwright's English line, the Pacific Steam Navigation Company, had great difficulty to secure the necessary fuel which had to be brought around the Horn in sailing vessels. In this respect it was identical with the Pacific Mail Steamship Company, an American company giving service from Panama northward.

The acquisition of California gave the United States an exceedingly remote possession (there is no colony anywhere so really remote to-day). With this territory some kind of connection was imperative and the administration, which was so liberal in helping the Collins Line to beat the British, contracted with the Pacific Mail Steamship Company, formed in 1847, for a service from Panama to Astoria and from New York, Charleston and New Orleans to Havana, from which port the company already had a connecting line to Chagres (Colon), thus completing the connection between the coasts. The first steamer left New York October 6, 1848, and the company soon had six of the finest steamships afloat. The speed from Panama to San Francisco was more than 10 miles per hour. Thus the United States had line traffic of first class character connecting its remote coasts before it had a good American line to Europe. At Panama it connected with the Pacific Steam Navigation Company, giving service to Peru and Chile, so that before the middle of the century the Pacific had at least 5,000 miles continuous steam line traffic. The success of the United States government's line on the Pacific was far more enduring though somewhat less brilliant than that of the Collins Line. Its steamers had not reached the coast before the gold fever set rovers from all over the world flying toward California. Despite the troubles of 'round-the-Horn coal, the company, dropped by chance in the golden stream, reaped a golden harvest, and when railroad competition began shortly after 1870 it was by all means the largest American maritime organization. It had 33 fine steamships capable of holding 74,000 tons of cargo and many passengers. It served 47 Pacific and three Atlantic ports and had 35 agencies in the Orient, United States, Spanish-American and Europe. On January 1, 1867, it had begun a monthly service to the Orient terminating at Hong Kong. This was soon made a fortnightly service and a branch established at Yokohama to skirt the Japanese inland sea and go on to Shanghai. There was an express steamer from San Francisco every two weeks connecting with the New York steamer via the Panama Railway. There was also an accommodation steamer which attended to the local needs of the coasts of Mexico and Central America, and at Panama connection was had, not only with New York, but also with lines to Hamburg, Havre, Southampton and Liverpool.

England pushed out her steamer lines to her colonies about as quickly as she had to America. "In 16 years after the crossing of the North Atlantic, regular lines of steamships traverse both the North and South Atlantic, the Indian ocean, the Arabian sea, the Mediterranean sea," etc.

The same burst of confidence and mechanical enthusiasm that started companies to building steamers in 1836 for the North Atlantic, sent two steamers out to India in 1836 and 1837 to ply between Bombay and Suez. This line soon became a link in one of the largest and certainly the oldest steamship companies in the world. The present Peninsular & Oriental Company started as the London & Dublin Steam Navigation Company, running two steamboats about 1824. This enlarged in 1837 into a line running steamboats to the (Iberian) Peninsula, hence the name Peninsular. Before this innovation, the sailing vessel time from London to Lisbon had been three weeks. As the next step in the development of its service and its name, the Peninsular Company took a subsidy in 1842 to carry the mail in steamers between Alexandria and London. At Alexandria it connected first by camels and then by four-horse vans with the Suez Line to India, a service which has been maintained to the present day and extended to the east and southeast, taking in China and Australia. The Australian Line came in 1873 after the opening of the Suez Canal permitted the abandoning of the bothersome shifting at Suez and substitution for it of a continuous steamer voyage.

Australia appears to have first had line traffic connection with the mother country in 1850 when a lively sailing vessel traffic was deemed of enough importance to be reduced to a schedule. In 1852 the desire for greater regularity of mail brought about a contract for the carrying of the mail in steamers. The first steamer sailed June 5, 1852, and between that and 1854 several others were successfully added.

In the fifties, the South African traffic was carried in sailing vessels with the exception of such service as the first Australian steamers rendered. In 1857, the Union Steamship Company, which after 50 years, still dominates the South African situation, entered into a contract to carry the British mails. In 1872 the Castle Line was founded. In 1873 it participated in the mail contract, and in 1876 it shared equally and helped maintain the schedule.

The pioneer in the service from England to eastern South America was the Royal Mail Steam Packet Company, which started its first steamer from Falmouth in 1842 and has since built up a great service and met the rivalry of many companies.

It appears that the Atlantic ocean can scarcely be called the pioneer in the establishing of ocean steam line traffic although it certainly had been in the sailing traffic. Experiments were being made in all oceans at the same time, and the period 1840-1857 is the epoch of the establishment of steam line traffic to all important quarters of the globe. There were lines on the North Atlantic, fast, fine and competing. These were the backbone of the world's connection. At New York the American Pacific Mail Line gave connection through Panama with the Pacific coasts of both Americas. The Cunard Line had connecting lines here to Bermuda and West Indies.

On the other end of the Atlantic trunk, the English lines gave quick access to the Mediterranean and India, to South Africa and Australia. The world was connected. The rest is a story of improvement.

(To be continued.)

GENERAL NEWS SECTION

NOTES.

The Baltimore & Ohio has issued a notice that employees must abstain from the use of intoxicants both while on and while off duty.

The Baltimore & Ohio has reduced by 10 per cent. the pay of all officers and employees receiving $166 a month or more and reducing to $150 all now receiving between $150 and $166.

At Kansas City, Jan. 21, D. H. Kresky and W. A. McGowan, the former agent for a shipper and the latter for a railroad, were fined $1,000 each for violation of the freight rate law. They were indicted two years ago.

Acting on a complaint concerning the compression of cotton in Oklahoma, the Interstate Commerce Commission has decided to hold a general inquiry into the whole question of compression and the relations of the railroads to compressors, buyers and shippers everywhere.

A press despatch from Pottsville, Pa., says that some of the employees of the Pennsylvania Railroad at that place have been furloughed for nine months. By taking this course, instead of dismissing the men, the company reserves to them their rights and privileges as regards promotion.

At Denver, Colo., the United States District Court has issued a temporary injunction requiring ticket brokers to conform to the recent decision of the United States Supreme Court in the Bitterman case, outlawing all outside dealing in tickets which, according to their terms, are non-transferable.

The Philadelphia, Baltimore & Washington has conveyed to the government by deed the recently abandoned passenger terminal at Sixth and B streets, Washington. The railroad surrenders its right to use any portion of the mall; and the sum of $1,500,000, to be contributed by the government toward the cost of the new union station, now becomes payable.

The State Railroad Commission of Illinois has directed the Cleveland, Cincinnati, Chicago & St. Louis to run one passenger train each way daily over the Kankakee & Seneca branch regardless of the probability that the trains will earn less than it will cost to run them. Hitherto for many years the company has maintained only a freight service on this branch.

Those employees of the United Steel Corporation who subscribed for preferred stock in 1903 under the profit sharing plan and have since held their stock, are to receive an extra dividend of $65.40 in addition to the regular 7 per cent. dividend and the regular bonus of 5 per cent. a year. Next year, stock subscribed for in 1904 will be entitled to a similar extra payment.

The Railroad Commission of Wisconsin, which is investig the action of the railroads under the law of that state limiting telegraphers' work to eight hours a day, finds that the Chicago, Milwaukee & St. Paul has discontinued 63 telegraph offices; the Chicago & North-Western 41, and the Wisconsin Central 36. These all did commercial business, but the roads had to have the operators to put into more important stations to comply with the law. It is probable that the telephone will be extensively used by these railroads.

The Pennsylvania Railroad, in reporting monthly earnings to the Government, declines to make affidavit that the accounting rules issued by the Interstate Commerce Commission have been followed, and the New York Central, it is said, has made no monthly reports whatever. The Government proposes, therefore, to proceed against these roads for not complying with the law. Notice has also been given that henceforth all roads will be required to send their monthly statements within 10 days after the end of the month, as required by the rules issued by the Commission.

The railroads centering in Manhattan, Brooklyn, Long Island City and Jersey City have agreed on "track service charges" in addition to car service (demurrage) charges at congested stations, to be put in effect Feb. 20, amounting to $1 a day (total demurrage and track charge $2) for the third and fourth days; $1 additional for the fifth and sixth days and $1 more for the seventh, making the gross rate after the sixth day $4 per car per day. Coal, coke and hay are excepted from this regulation. It appears that the Long Island Railroad has decided not to abandon this "track charge" as was proposed a few weeks ago.

At Washington last Monday a number of prominent railroad officers called on the President and on the Interstate Commerce Commission to see what could be done towards securing the amendment of the law limiting the hours of telegraphers and signalmen, which comes into force in March, but it does not appear that the conference produced any tangible results, and the Washington reporters seem to think that Congress will be very slow to take action on any modification of the laws affecting railroads. The Chief of the Order of Railway Telegraphers says that there are plenty of competent telegraphers in the country.

At the conference called by Governor Patterson of Tennessee at Nashville last Tuesday to see if the railroads would reduce passenger fares, the Southern repeated its former announcement that rates would be reduced in Tennessee to the basis which is to be adopted in Georgia, and the Mobile & Ohio and the Cincinnati, New Orleans & Texas Pacific announced that they would follow the action of the Southern. The other roads represented said that they could not afford to make the desired reduction. President Smith of the Louisville & Nashville said, however, that if the surrounding states succeeded in securing a reduction of passenger fares on his road the company would adopt the same reduced rates in Tennessee. The Illinois Central made a similar promise. Meanwhile the order issued by the State Railroad Commission requiring all rates to be reduced on April 1 to the basis of 2½ cents a mile still stands.

In an opinion by Justice Peckham the Supreme Court of the United States has decided the case of the Penn Refining Company, of Oil City, against the Western New York & Pennsylvania and the Lehigh Valley in favor of the railroads. The independent refiners of Western Pennsylvania charged that the privilege of shipping in tank cars, permitted to the Standard Oil Company, was denied to the other companies. The Interstate Commerce Commission ordered the railroad companies to pay damages of $13,000, and the United States Circuit Court for the Western District of Pennsylvania upheld the order. That court, however, was reversed by the Circuit Court of Appeals, and the independent refiners took the case to the Supreme Court, which now has affirmed the decision of the Court of Appeals. In his opinion Justice Peckham said:

The whole theory of discrimination rests upon the alleged failure to furnish tank cars to shippers demanding them, while at the same time the defendants (the railroad companies) leased tank cars from their owners and used them to carry the oil of such owners exclusively; and yet in this case there has been no such failure because there has been no demand for such cars by the refiners, who had no use for them. . . . It is therefore apparent that the failure of the plaintiff to use tank cars was not owing to refusal or omission of the defendants to supply them, but because the plaintiffs did not demand and could not use them economically for the transportation of oil.

Detector Bars Abandoned.

The Pennsylvania is making great improvements in its interlocking towers. A new electro-pneumatic machine, with latest improvements in locking up fouling points electrically, has just been installed in the tower at Henderson street, Jersey City. This does away with the old-style detector bars used on switches as, until the route is perfectly clear, the track circuits keep the signal lever locked. The drawbridges across the Hackensack and Passaic rivers have been similarly equipped. (Approach track-circuit locking.) Five towers on the New York division are now equipped in this way and all others will be in due time.—*Newark (N. J.) Call.*

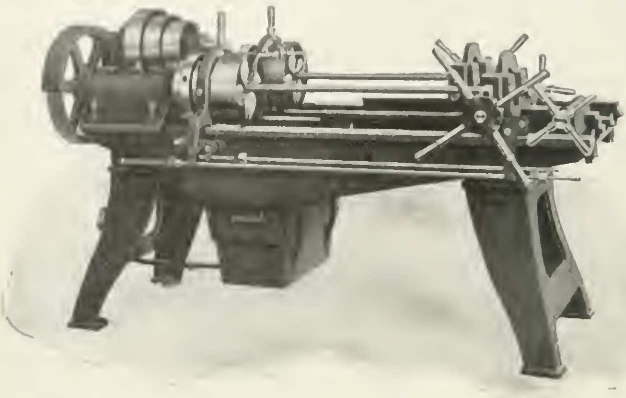
Cement Makers' Association.

The Association of Licensed Cement Manufacturers, 30 Broad street, New York, was organized on January 9 by the North American Portland Cement Co., the Atlas, Alpha, American, Lehigh, Lawrence and Vulcanite Portland cement companies, and various other companies in the East and West, including the Dexter, Edison, Nazareth, Pennsylvania, Penn-Allen and Catskill companies, all of which have secured licenses under the Hurry and Seaman, Edison, Carpenter and other patents controlled by the North American company. The association already represents nearly 70 per cent of this country's Portland cement output, and other applications for membership have been presented and are under consideration. The officers of the association are: President, A. F. Gerstell, Vice-President and General Manager of the Alpha Portland Cement Co.; Vice-President, Conrad Miller, President of the Dexter Portland Cement Co.; Secretary and General Manager, Alfonso De Navarro, Vice-President of the Atlas Portland Cement Co.

The purposes of the association include the betterment of the mechanical and chemical processes used in making cement, the improvement of the quality of cement, matters of traffic and shipment and the establishing of an association laboratory for technical tests and experiment. It is understood that all existing and properly equipped cement plants will be granted licenses and admitted to membership. Infringers of the patents above referred to will be vigorously prosecuted.

Landis Staybolt Cutter.

The illustrations show the new Landis staybolt cutter, recently placed on the market. It is equipped with Landis patent dies. The chasers are each 4 in. long, with threads milled on the flat side and running the full length. These chasers are set tangent to the rod, being threaded to give the right cutting clearance. The rake can be ground to any angle desired to suit the kind of material that is being



Landis Staybolt Cutter.

cut, and a rolling chip is cut just as from a lathe tool, so that the thread can be cut at high speed. All chasers are interchangeable.

The die requires no lead screw to govern the pitch of the thread that is being cut. The chasers are not hobbed but milled, and they are held so that the front or working teeth do the cutting, while the back teeth do no cutting, but extend across the cutting line, so that the four chasers form a lead nut which bears on the threaded rod and draws it into the cutting teeth true to the pitch of the die. This lead is so positive that it is impossible to influence the pitch of the thread by retarding or forcing the rod into the die. Before such action could affect the pitch either the threads would be stripped off the rod or the teeth would be pulled off the die. This leading feature is permanent, as the die never needs to be ground in the throat; the ends only of the chasers are ground, which keeps their shape uniform. In machines using lead screws there are at least two hardenings and one screw, whose inaccuracy must be corrected to get the right pitch. The best lead screw made must be cut with some form of die or on an engine lathe where accuracy cannot be guaranteed. In the Landis die there is but one hardening—the hardening of the die. When lead screws and dies are not of exactly the same pitch a bad and distorted thread will be produced. The lead screw will work against the dies, and the lead screw nut being the most powerful of the two the die is bound to distort the thread, giving it a ragged appearance and frequently pulling off the tops of the threads, as all of the teeth can shave the thread in the hobbed die. The die in the Landis machine never needs to be annealed, hobbed or retempered. Its life is much longer and it has a much wider range on special diameters.

The carriage on the machine can be adjusted upward, downward and sidewise, and the cutting strain is central. The rack has recesses between the teeth, so that when chips or scale drop on the rack they will fall through and not interfere. The machine is built single and double head, in sizes up to $1\frac{1}{2}$ in. Each machine is provided with pump, countershaft, wrenches and automatic throw-out. The main spindles are so arranged that any oil which may be carried into the spindle will feed back into the oil tanks and not be carried out at the rear end of the spindle to run on the floor.

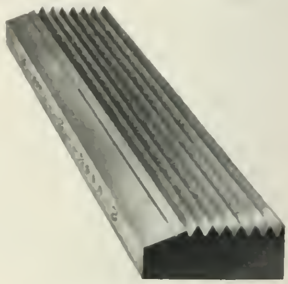
The machine is manufactured and sold by the Landis Machine Co., Inc., Waynesboro, Pa.

Passenger Fares on the Pennsylvania.

The Supreme Court of the state of Pennsylvania having decided that the act of the last Legislature fixing a maximum passenger fare of 2 cents a mile is inapplicable to the Pennsylvania Railroad, its branches and leased lines, the company announces that on Feb. 1 it will restore the schedule of fares which had prevailed from Nov. 1, 1906—when the maximum one-way rate was voluntarily reduced to $2\frac{1}{2}$ cents a mile—until Oct. 1, 1907. On the latter date, when the 2-cent fare act became effective, all one-way rates were reduced to conform to the law as it stood. The system of passenger fares which prevailed prior to Oct. 1 will, after Feb. 1, again apply to all portions of the Pennsylvania Railroad within the State of Pennsylvania, including the Buffalo & Allegheny Valley, the Philadelphia & Erie, and the United Railways of New Jersey grand divisions.

But as the act is held to apply to the Pennsylvania Railroad and its branches only, the 2-cent rate, until cases now pending before the courts are decided, will be retained on such portions of the Philadelphia, Baltimore & Washington and the Northern Central as are within the state of Pennsylvania and on the Bedford division and the Lancaster and Quarryville branch.

The company will also resume the sale of 180-trip three-month tickets, 100-ride tickets (good within a year) and all other commutation privileges which were withdrawn pending the decision of the courts. Although the 2-cent rate will still apply to the Philadelphia, Baltimore and Washington Railroad, the company will, after Feb. 1, restore all commutation privileges which were withdrawn Oct. 1, 1907. Pending the decision of the courts, the Pennsylvania Railroad and its affiliated lines East of Pittsburgh, Buffalo and Erie withdrew the issuance of orders for special rates to clergymen living along these lines. Beginning March 1 clerical orders will again be issued, the amount of work involved in preparing them making this delay unavoidable.



Chaser for Landis Die.

Portable Lathe Driven by Westinghouse Motor.

Electric motor drive has brought into use several convenient and labor-saving portable machines. An example is the portable bolt-turning lathe, for use in locomotive repair shops. The illustration shows a lathe made for this purpose by the Williams & Wilson Co., Montreal, Que., equipped with a Westinghouse motor. They form a compact unit, which is mounted on wheels. It can be

Portable Lathe, Driven by Westinghouse Motor.

lifted by a crane and placed beside an erecting pit and then shifted as desired by hand. When in working position the machine rests on the two rear wheels and the front legs. To move it, the legs are lifted from the floor and the load thrown on the front wheel by simply lowering the handle, which acts as a lever.

The motor is the induction type, 2 h.p., 1,700 r.p.m., connected through a friction clutch, providing for either 200 or 400 r.p.m. of the spindle. Direct current motor applications are equally successful. Current is carried by flexible cable connection to plugs located at convenient intervals. A simple and convenient connecting plug is made for the purpose. The advantages in the use of a machine of this type in work that requires turning each bolt to the proper size is readily apparent. It saves trips to and from the machine shop and enables the mechanic to do his work without interruption.

The Hendershot Shaft Coupling.

A new shaft coupling, to be known as the Hendershot coupling, is being put on the market by Manning, Maxwell & Moore, Inc., New York. The assembled coupling and the parts are shown in the accompanying illustrations. The advantages claimed for it are unusual strength, and quickness and ease of application. The shells A and B are first slipped on the shafting. The short taper compression sleeves, S, S, Fig. 2, are put in place and the shells are drawn over them and bolted together. The shells have cast lugs which engage each other so as to put the torsion strains directly on the shells themselves. This relieves the bolts of all shearing stresses.

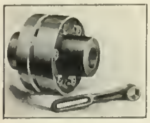


Fig. 1.

The internal surface, 3, on shell B, and the external surface, 4, on shell A, true up the coupling to approximate alinement which is made exact by keeping the faces 1 and 2 parallel while adjusting the coupling. This saves a good deal of time, particularly in a new factory where it is not convenient to start up to see how the line runs. The use of two sleeves makes it possible to put the

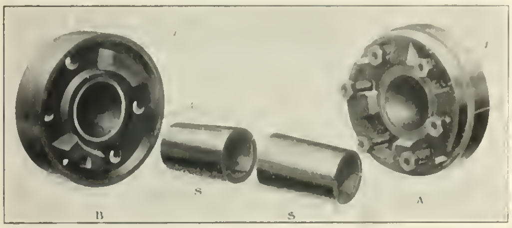


Fig. 2.

two halves of the coupling in place while the shafting is on the floor. It may then be hoisted into position and bolted together as easily as a plain flange coupling. In uncoupling, the shells can be drawn apart by screwing two bolts into holes tapped for this purpose. If the shafts to be coupled are of slightly different sizes or are a little out of line, or both, this coupling adjusts itself and the compression will be the same on the whole length of the sleeves. The strength of the coupling is increased, without increasing its outside diameter, by making the sleeves thinner and the hubs heavier. It is made of gray iron.

Trifles Make Perfection.

T. F. Whittelsey, General Manager of the Seaboard Air Line, has issued a general order, in which he says that "all officials and employees of the Seaboard Air Line Railway when answering telephone calls should do so with a rising inflection of the voice. The telephone is to a large extent the voice of the company, and we should assure our patrons that we are eager to communicate with them and in a cheerful and accommodating manner."

Third Class in China.

An Englishman who ventured his life in a third class car on the Shantung Railroad, where the trainmen are Chinese, found it disagreeable. These cars have three compartments, intended to hold 20 passengers each; but sometimes twice as many squeeze in. The rules say that a passenger may take into the car only so much baggage as he can carry in his hand; but it is common for one to have a pile of boxes, baskets and packages, sometimes making a respectable bale. Often the passenger piles the seat full of baggage and himself sits on the floor. Some bring bedding with them, and if they get into the car while there is room, they spread it on the floor and sleep, remaining undisturbed by the guard, however the car may be crowded afterwards. Meanwhile the air becomes thick with the smoke of Chinese tobacco, Japanese cigarettes and Manila cigars. The floor is littered with egg and peanut shells, sweet potato skins and melon seeds, and slippery with spilt soup and spittle. In the course of a few hours the car looks like a hogpen. The Chinese trainmen are obeyed by the Chinese passengers; but shrink before a European. A German tramp, without ticket, money or baggage, traveled on his face in a third class car nearly the whole length of the road. The trainmen would not venture to put him off.

John R. Walsh.

John R. Walsh, President of the Southern Indiana Railway, and late President of the Chicago National Bank, has been found guilty of violating the national banking laws in making loans irregular in form and without the knowledge and approval of the directors. That the acts were reckless and wrong, the evidence is convincing, but that they were with criminal intent there is no evidence, and, based on this, an appeal has been taken from the verdict. An acquittal was given in all the counts relating to the railroad company. This is a case of a great man and a good man, attaining great power, uniformly acting for the benefit of the community, and in this accomplishing great results and doing good in the world. With nearly uniform success from the time when he began as a Chicago newsboy, it was natural to get a confidence in his own judgment which made him impatient of control and perhaps arrogant in administering the affairs of a bank and the funds of depositors and stockholders. His fellow-directors were at fault and he was at fault, but for the purpose of estimating his character it is a fair plea in abatement to note that he became a banker late in life and in making loans without the knowledge of his directors he followed many precedents, and also that after the failure, by wonderful vigor and with sturdy integrity, he saved his depositors from loss.

Earnings of the United States Steel Corporation.

The United States Steel Corporation on January 28 reported its earnings for the three months ended December 31, 1907, by months. There has been no more striking testimony to the effect of the financial panic on business. The earnings, after deducting all operating expenses, including those for ordinary repairs and maintenance of plants, employees' bonus funds, and also bond interest and other fixed charges of subsidiary companies, were as follows:

October, 1907	$17,052,211
November, 1907	10,167,253
December, 1907	5,034,531

The earnings for October were the largest for any month in the company's history. As against the total of $32,500,000 for the quarter, the corresponding figure for 1906 was $41,700,000. In the quarter ended June 30, 1907, which was the largest on record, earnings were $45,500,000 and for the September, 1907, quarter $43,800,000. Unfilled orders on December 31, 1907, were reported as 4,624,553 tons, against 8,489,718 a year previous, 8,043,858 in March, 1907, 7,603,878 in June, 1907, and 6,425,008 in September, 1907.

Traffic Club of New York.

The January meeting of the Traffic Club of New York was held on January 28. James H. Gannon, Jr., Financial Editor of the New York *Times*, gave a clear review of the causes which brought about the banking panic of October and drew comparisons for the future from the year following the panic of 1893. C. H. Crosby, Vice-President of the United States Express Company, gave a general review of the express business, tracing its history from its beginning in 1839 and describing the various functions of the express companies. The difficulties of compliance on their part with the rules of the Interstate Commerce Commission may be judged from the fact that the filing of the rates to competitive points alone, including points at which there is competition by any possible combination of companies, required 39 volumes, which cost $45,000. It was announced that Governor Charles E. Hughes will attend the annual dinner, which is to be held on March 6.

Referred to the Committee on Standardization of Practice.

There is a station on the Chicago & North-Western Railroad at State Line, Wis., the depot being built on the boundary line between Wisconsin and Michigan, a white strip down the side of the building showing where one state ends and the other begins.

The station stood mostly on Badger soil and the town has been credited to Wisconsin. Since the passage of the Wisconsin eight hour law the company has moved the building into Michigan. The postoffice designated as State Line, Wis., is not in Wisconsin, and the agent-operator-baggageman-express agent-postmaster has to put in more than eight hours service.—*Press Despatch*

Final Decision in Axle-Light Suit.

Notice of the decision in the suit of the Consolidated Railway Electric Lighting & Equipment Co., New York, against the Adams & Westlake Co., Chicago, for infringement of its patent relating to car axle generating electric lighting equipment was given in our issue of March 29, 1907, page 462. That decision, which was rendered in the

Circuit Court of the United States for the Northern district of Illinois, Eastern division, held that with the exception of a single equipment which had been built by the defendant for a customer, the patent had never been infringed. Neither party was fully satisfied with this decision and both appealed, the complainant seeking to have the finding of infringement extended to cover all equipments of the defendant, and the latter asking to be relieved of the finding in the single instance referred to. On January 7, 1908, the United States Circuit Court of Appeals rendered a decision in favor of the defendant and ordered the suit dismissed.

Dinner to Mr. Vreeland.

Responding to numerous suggestions from the membership at large, the executive committee of the New York Railroad Club has arranged a reception and dinner to Herbert H. Vreeland, President of the club, to be given Feb. 7, the hour and place of meeting to be announced later. The announcement says: "Mr. Vreeland has for many years given most generously of his time and effort wherever possible to promote the welfare of the club. In unusual measure he has contributed to its continued success and present high standing. It seems peculiarly fitting that some evidence of our appreciation should be made manifest. Your committee has therefore decided that this testimonial dinner shall be by popular subscription at a cost of $5 per plate, that each member in attendance may feel he is present as a host and to personally attest his esteem for our president and guest." Members are asked to signify their acceptance by Feb. 1. The circular is signed by W. G. Besler, chairman; Frank Hedley, William B. Albright, Richard L. Thomas, Otis H. Cutler and Daniel M. Brady.

INTERSTATE COMMERCE COMMISSION RULINGS.

Coke Oven Basis of Car Supply Condemned.

The Commission, in an opinion rendered by Chairman Knapp, has announced decision in the case of the Powhatan Coal & Coke Co. v. Norfolk & Western and 56 coal operating companies in the Pocahontas district of West Virginia.

The complaint in this proceeding alleged that the method of car distribution known as the "coke-oven basis," enforced by the Norfolk & Western Railway Company in the Pocahontas-Flat Top coal district, unduly discriminates against the complainant, and asked that the so-called "capacity basis" of car distribution be adopted. The theory of the coke oven basis of distribution is that the available supply of coal cars shall be distributed to mine operators in proportion to the number of coke ovens erected by each operator. That is to say, the number of ovens erected by an individual operation divided by the total number of coke ovens in the district will give the percentage of the available car supply to which such operation is at any time entitled.

The Commission decided that the coke oven basis does not fairly measure the relative rights of the various operators, but unduly discriminates against complainant and operates to the unreasonable preference of other mining companies in the same field.

The Commission further declared that while the mine capacity of a given shipper may be greater than his allotment of cars, yet where this is also the case as to other shippers similarly situated in the same coal field, it is the duty of the carrier, when the supply of cars is inadequate, to fairly distribute the available number among all operators.

It requires only ordinary imagination, said the Commission, to see the illogical and artificial character of the coke oven basis. One company, with limited capital, uses its money in building coke ovens instead of extending its underground workings, while another company expends the same sum in enlarging its mining facilities, but without adding to the number of superfluous ovens. The necessary result would be that the former, with its mining capacity unchanged, would secure an increased car supply, while the latter, with largely augmented ability to produce coal, would have fewer cars for its shipment. A system which involves such absurd consequences is open to grave objection.

It appeared in the case that the Norfolk & Western some years ago became and still is the virtual owner of the coal lands on which the operations in question are located, the legal title thereto being in a land company whose stock is owned by the railroad company. The coke oven basis of car distribution seems to have been the outcome of the general policy of the railroad, in accordance with which the land company required each lessee of coal lands to construct a certain number of coke ovens per hundred acres of land leased. This policy was evidently adopted for the purpose of encouraging coke production and the manufacture in that district of articles which could be made by the use of coke. The railroad company preferred to discontinue the coke oven basis and apparently desired an order of the Commission as a justification for taking that course.

While the Commission is convinced by the facts and circumstances disclosed that the present basis is unjust and results in unlawful discriminations, it is not unmindful that the change which will be directed may occasion loss and injury to some of the operators whose expenditures for the construction of coke ovens, as required by their leases, may be materially and perhaps greatly diminished in value. Although not warranted in sanctioning a further continuance of the coke oven basis, which under existing conditions is found to be neither just nor suitable, the Commission does not desire or intend that the report and order herein shall affect the rights, responsibilities or liabilities of any of the interested parties under any contract or agreement which they might otherwise be able to enforce for their benefit. It is assumed that some form of capacity basis suited to the conditions and peculiarities of the district in question will be devised and put into effect, but the railroad should take the responsibility, at least in the first instance, of determining and applying the substituted basis.

The Norfolk & Western was ordered to cease and desist for a period of at least two years from enforcing the coke oven basis in said district. It was further ordered to establish for at least two years a regulation whereby coal cars shall be distributed fairly and equitably among the operators along its line in said district, without undue discrimination against or undue preference in favor of any of said operators.

TRADE CATALOGUES.

Bridges, Buildings and Foundations.—The Condron & Sinks Co., Civil Engineers, Chicago, have prepared a book of views of steel and reinforced concrete structures built after their designs and specifications. These structures include railroad and highway bridges, shops and mercantile buildings, foundations, reservoirs, tanks, roofs, etc. The illustrations, which are half-tone reproductions of photographs, are good and their arrangement is in good taste. Line engravings show two steel truss designs and a reinforced concrete arch. The book is 6 in. x 9 in. and has 31 pages.

Reinforced Concrete Culvert Pipe.—The American Concrete Co., Chicago, a new company, has prepared a pamphlet illustrating and describing its reinforced concrete culvert pipe. The characteristics, construction and advantages of this pipe are described in detail, and its economies compared with cast-iron pipe. The illustrations are full-page half-tones, mostly from photographs. The pipe has been used by the Chicago, Burlington & Quincy for over a year and was described in the *Railroad Gazette* of Oct. 12, 1906. The company also makes reinforced concrete piling and girders.

Testing Alternating Current Generators.—Bulletin No. 1,037 of the Allis-Chalmers Company, Milwaukee, Wis., describes the company's method of testing alternating current generators. It was perfected by B. A. Behrend, Chief Electrical Engineer, who makes it possible to get, comparatively easily, the most important data of the performance of alternating current generators while they are yet in the shop, the machines being subjected to full load conditions without actually putting them under full load.

Valves.—Catalogue No. 10 of the Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., illustrates and describes Anderson cushion non-return valves, emergency stop valves, pressure reducing valves. Clean Seat valves and blow-offs; check valves, balanced plug cocks and blow-offs and Golden steam tilting traps. Other specialties include: Anderson automatic standpipes and counterbalance valves, automatic float valves, controlling altitude valves and strainers and fish traps.

Flexible Conduits and Conductors.—Pamphlet No. 429 of the Sprague Electric Co., New York, describes Greenfield flexible steel conduits and flexible steel armored conductors and cords, together with tools and fittings in connection with them. The conduits are made of rolled concave strips of steel, galvanized inside and out, and rolled spirally on each other so as to interlock. The conductors are armored with sheathing made in a similar way.

Car Couplers and Kindred Devices.—The Washburn Steel Castings & Coupler Co., Minneapolis, Minn., has issued its 1908 catalogue. It illustrates and briefly describes the car couplers and kindred devices made. The latter include a new design of car replacer, shown in this catalogue for the first time. The form and method of working these frogs are fully illustrated. The book is 6 in. x 9 in. and has 94 pages.

Signaling on the Union Pacific.—The passenger department of the Union Pacific has prepared an interesting pamphlet on its interlocking and block signal systems. The principles of both systems are explained briefly, and colored half-tone views illustrate the various indications of the signals. These engravings are made from photographs and give an excellent idea of the character of Union Pacific signal equipment.

London & North-Western.—The passenger department of this road has published a pamphlet describing in full the "American special" train between Liverpool and London. This service began with the first sailing of the "Lusitania" last fall. The train consists of a baggage car, five corridor cars and a dining car. The pamphlet is illustrated with line drawings of each type of car.

Injectors.—A pamphlet issued by William Sellers & Co., Philadelphia, Pa., describes and illustrates with sectional and prospective views the latest types of Sellers' injectors, giving dimensions, capacities and prices. Other specialties of the company are also included, among them being valves, water strainers and boiler washers.

Bolsters.—Bulletin No. 4 of the Atha Steel Casting Co., Newark, N. J., shows a number of types of cast-steel body and truck bolsters used by various steam roads. Driving wheel centers, motor frames, electric railway truck frames and cast-steel gears made by the company are also shown.

Electric Drive in Cement Plants.—Bulletin No. 4,555 of the General Electric Company, Schenectady, N. Y., describes the application of electric drive to cement plants, and gives information regarding different processes and the apparatus used in making cement.

Springs.—A pamphlet issued by the Union Spring & Manufacturing Co., Pittsburgh, Pa., illustrates and describes a number of types of coil and elliptic springs for locomotives and cars. Several styles of pressed steel journal box lids are also shown.

MANUFACTURING AND BUSINESS.

W. P. Cosper, Chicago, dealer in railroad specialties, has been appointed Central Western Agent for the Lord Electric Co., Boston, Mass.

The Detroit Seamless Steel Tubes Co., Detroit, Mich., is installing machinery to make larger sizes of cold-drawn seamless steel tubes. This increases materially the capacity of the plant.

The St. Paul, Minn., office of the Northern Electrical Manufacturing Co., Madison, Wis., has been moved from 21 East Fifth street to 516 Endicott building. T. E. Drohan, formerly Superintendent of the company's shops at Madison, is in charge of the new office.

A meeting of department and district office managers of the Allis-Chalmers Co. was recently held at headquarters in Milwaukee, Wis. The prevailing note during the meeting was one of decided optimism. With the possible exception of a single district, which depends on one particular product for its prosperity, reports indicate that there is a general resumption of business activity, and the outlook for purchases of material of all kinds, particularly power and electrical machinery, is encouraging. Many district managers stated that during the past two weeks inquiries have been many, and customers are only waiting for a little more nearly complete restoration of normal conditions to place large orders for apparatus.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Engineers' Club of Philadelphia.

At the meeting of this club to be held February 1, there will be a paper on Engineering Problems in Road Construction, by Joseph W. Hunter, illustrated with lantern slides. The Secretary announces the election of the following officers: H. W. Spangler, President, Washington Devereux and William Easby, Jr., Vice-Presidents; Francis Head, Secretary, and George T. Gwilliam, Treasurer.

American Railway Engineering and Maintenance of Way Association.

The nominations for officers for this association to be voted on at the coming convention to be held in Chicago March 17, 18 and 19, are: President, Walter G. Berg (Lehigh Val.); Vice-President, L. C. Fritch (Ill. Cent.); two Directors, C. S. Churchill (Norf. & West.) and E. F. Wendt (P. & L. E.); Treasurer, W. S. Dawley (Mo. & North Ark); Secretary, E. H. Fritch, Chicago.

American Society of Mechanical Engineers.

The first meeting of the gas power section of this society is to be held February 11, in the Engineering Societies building at 29 West 39th street, New York. The subjects for discussion will be "Experimental Gas Turbines in France," illustrated with lantern slides; "A Simple Continuous Gas Calorimeter," "A Gas Engine and Producer Guarantee." Other subjects relating to the question of gas power will also be discussed.

Convention Plans for Supply and Machinery Associations.

A joint meeting of the committees appointed from the American Supply and Machinery Manufacturers' Association, the National Supply and Machinery Dealers' Association, and the Southern Supply and Machinery Dealers' Association, was held at Richmond, Va., last Friday to formulate a programme for the joint annual convention of these three associations to be held at the Jefferson Hotel, Richmond, May 13, 14 and 15, 1908. The complete programme will be ready for publication early in April and will be sent to all members of these associations fully a month before the convention.

The committees who met to arrange the programme were made up as follows:

American Supply and Machinery Manufacturers' Association.—M. W. Mix, Dodge Manufacturing Co., Mishawaka, Ind.; E. H. Hargrave, the Cincinnati Tool Co., Cincinnati, Ohio; C. F. Aaron, New York Leather Belting Co., New York; F. A. Hall, the Yale & Towne Manufacturing Co., New York; D. K. Swartwout, the Ohio Blower Co., Cleveland, Ohio; W. M. Hood, the Lunkenheimer Co., Cincinnati, Ohio; F. D. Mitchell, Secretary-Treasurer, New York.

National Supply and Machinery Dealers' Association.—George Puchta, Queen City Supply Co., Cincinnati, Ohio; A. T. Anderson, Secretary-Treasurer, Cleveland, Ohio.

Southern Supply and Machinery Dealers' Association.—J. C. Miller, Miller Supply Co., Huntington, W. Va.; Alvin M. Smith, Smith-Courtney Co., Richmond, Va.; Hunter B. Frischkorn, Hunter B. Frischkorn, Richmond, Va.; Levin Joynes, Southern Railway Supply Co., Richmond, Va.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Pere Marquette.—Henry B. Ledyard, Chairman of the Board of the Michigan Central, has been elected a Director of the Pere Marquette.

Operating Officers.

Baltimore & Ohio.—John G. Walber, hitherto Assistant General Manager of the Baltimore & Ohio Southwestern at Cincinnati, has been appointed Assistant to the Third Vice-President of the Baltimore & Ohio, with office at Baltimore, Md. Mr. Walber began his railroad career on the Ohio & Mississippi in 1885 and has been Secretary to various Managers and Vice-Presidents. He was made Assistant to the General Manager at Cincinnati four years ago.

Canadian Northern.—J. R. Cameron has been appointed General Superintendent, with office at Winnipeg, Man. A. Wilcox has been appointed Superintendent of the First division, with office at Port Arthur, Ont.

Canadian Pacific.—Grant Hall, who has been appointed Superintendent of Motive Power on the Western Lines of the Canadian Pacific, at Winnipeg, has been Assistant Superintendent of Motive Power for about three years past. Mr. Hall was born in Montreal and was educated at Bishops College School at Lennoxville, P. Q. He entered the service of the Canadian Pacific as a machinist in 1886 and was soon promoted to the position of locomotive foreman. In 1893 he went to the Intercolonial as general locomotive foreman, but in 1898 he returned to the Canadian Pacific and was rapidly promoted through the several grades until he became Assistant Superintendent of Motive Power of the Eastern Lines. In October, 1904, he went to the Western Lines, as before stated.

Grant Hall.

Chicago & Alton.—Patrick Henry Houlahan, who has been appointed General Superintendent of the Chicago & Alton, with office at Chicago, thus becoming the head of that department on both the Alton and the Toledo, St. Louis & Western, has held that office on the T., St. L. & W. for the past three years. Mr. Houlahan was born in 1855 at Ottawa, Ill., and began his railroad service in 1867 as a water boy with a track construction gang. By 1875 he had become a ticket agent and five years later conductor (on the Fox River branch of the Chicago, Burlington & Quincy). From 1881 to 1886 he was on the St. Louis division of the Burlington, rising from train despatcher to Assistant Trainmaster and then to the position of Trainmaster. In 1886 he went to the St. Louis, Arkansas & Texas, where he was Master of Transportation on the Missouri & Kansas division, but he soon returned to the Burlington, where he became Superintendent. From 1892 to 1905 he was Superintendent of the Hannibal & St. Joseph, a part of the Burlington System. From there he went to the Toledo, St. Louis & Western, of which road, as before stated, he has been General Superintendent for three years.

P. H. Houlahan.

Chicago, Burlington & Quincy.—Robert Rice, heretofore Superintendent of the Hannibal division, has been appointed Superintendent of the St. Joseph division, with office at St. Joseph, Mo. E. Welsie succeeds Mr. Rice at Hannibal.

Chicago Great Western.—Charles S. Weston, who has been appointed Division Superintendent of the Southwest division, with office at Des Moines, Iowa, has been for the past five years Superintendent at Red Wing, Minn. Mr. Weston was born in 1858 at Linden, Wis., and began his railroad service on the Burlington, Cedar Rapids & Northern as brakeman in 1879. He was rapidly promoted through the different grades until he became Trainmaster in 1901.

Missouri Pacific.—A. J. Abell has been appointed Superintendent of the Valley division of the St. Louis, Iron Mountain & Southern, with office at Monroe, La., in place of C. H. Bevington, resigned.

Northern Pacific.—George Arthur Goodell, who has been appointed General Superintendent of the Middle district of this road, with headquarters at Livingston, Mont., has for the past five years been General Superintendent of the Chicago Great Western. Mr. Goodell was born at Knoxville, Ill., on August 13, 1855, and began his railroad service on the Chicago, Burlington & Quincy in 1869 as a telegraph operator. He served for a short time on the Toledo, Peoria & Warsaw, and in 1877 went to the Burlington, Cedar Rapids & Northern, where he was promoted successively to the positions of train despatcher, Assistant Superintendent and Superintendent. In 1902 he left that road and went to the Chicago Great Western, as above noted.

G. A. Goodell.

Southern.—J. M. Bennett has been appointed Superintendent of the Winston-Salem division, in place of A. M. Smith; office at Winston-Salem, N. C.

Southern Pacific.—The report of the resignation of E. B. Cushing, General Superintendent at New Orleans, and the appointment of W. M. Hobbs in his place, is denied.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—A. Dinan, heretofore Master Mechanic of the Middle division, has been appointed Master Mechanic of the Missouri division, with office at Fort Madison, Iowa, in place of J. H. McGoff, promoted. G. W. Taylor, heretofore Master Mechanic of the Oklahoma division, has been appointed Master Mechanic of the Middle division at Newton, Kan., in place of A. Dinan. J. T. Lendrum has been appointed Master Mechanic of the Oklahoma division, with office at Arkansas City, Kan., in place of Mr. Taylor.

Colorado Southern, New Orleans & Pacific.—C. H. Fisk has been appointed Chief Engineer of Maintenance of Way, with office at Beaumont, Tex.

Missouri Pacific.—E. J. Correll has been appointed Division Engineer of the Valley division of the St. Louis, Iron Mountain & Southern at Monroe, La., in place of R. A. Gray, resigned.

Northern Pacific.—C. T. Hessmer has been appointed Master Mechanic of the Minnesota division, with office at Staples, Minn., in place of Williard Lincoln, resigned. Silas Zwight has been appointed Master Mechanic of the St. Paul division, with office at Minneapolis, Minn.

CAR BUILDING.

The Keweenaw Central has ordered 20 flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The Pittsburgh, Canonsburg & Washington, under construction, intends to ask bids on electric cars about April 1. F. Uhlenhaut, Pittsburgh, Pa., is Chief Engineer.

The Duluth & Iron Range, it is reported, is in the market for 200 or more freight cars. Up to the time of going to press we have not been able to confirm this item.

The Woodstock, Marengo, Genoa & Sycamore Electric, which is to build 38 miles of road in Illinois, intends to ask bids on rolling stock in April. Charles A. Spenny, Chicago, is Secretary.

The Brownsville, Masontown & Smithfield Street Railway, under construction from Brownsville, Pa., to Uniontown, 36 miles, will ask bids on rolling stock in March. W. J. Sheldon, McKeesport, Pa., is President.

The Morgantown Interstate Railroad, under construction from Morgantown, W. Va., to Star City, four miles, will ask bids on electric cars about April 1. W. W. Smith, Morgantown, W. Va., is Secretary and Treasurer.

The Northern Pacific, as reported in the *Railroad Gazette* of December 6, will, it is said, be in the market for new passenger equipment within a few days. Up to the time of going to press we have been unable to confirm this item.

The Massillon, Wooster & Mansfield Traction, under construction from Massillon, Ohio, to Mansfield, 50 miles, will ask bids on rolling stock in about three months. G. A. Bartholomew, Williamson building, Cleveland, Ohio, is Chief Engineer.

RAILROAD STRUCTURES.

Austin, Tex.—The State Railroad Commission has made public improvement orders which direct that the following work be carried out by the railroads: The Chicago, Rock Island & Pacific to build new stations at Amarillo or to jointly build with the Fort Worth & Denver City a union station at that place; the Texas & Pacific to build new passenger and freight stations at Longview Junction and at Jefferson; the Fort Worth & Denver City to build new stations at Decatur, Electra, Quanah and at Amarillo; the International & Great Northern is required to replace all wooden culverts and bridges with concrete and steel structures.

Brooklyn, N.Y.—The Delaware, Lackawanna & Western company's freight yard, at Kent avenue and Cross street, is to be enlarged about 17,500 sq. ft., which will permit the handling of 25 more cars. When the yard is enlarged it is understood that the tracks will be rearranged. The improvements will give the yard 175 ft. more frontage on Washington avenue.

St. Louis, Mo.—Bids are to be asked for at once by the Manufacturers' Railway Company, controlled by A. Busch and associates, for putting up a steel and reinforced concrete elevated structure at Second and Dorcas streets, St. Louis, at an estimated cost of about $100,000. The work will call for about 3,000 cubic yards of concrete and 575 tons of steel. Address Edward Flad, Consulting Engineer, Fullerton building.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Brownsville, Carmichaels & Waynesburg (Electric).—See Brownsville, Masontown & Smithfield.

Brownsville, Masontown & Smithfield (Electric).—Grading work is to be started early in February on this proposed electric line from Brownsville, Pa., south via Masontown to New Geneva, thence northeast via Smithfield to Uniontown, 36 miles. Surveys made for 20 miles and being continued on the rest of the line. The company has already graded about half a mile between Masontown and West Masontown. The work will include several viaducts. Contracts are to be let in February and March. E. C. McCullugh, Chief Engineer, Uniontown.

The Brownsville, Carmichaels & Waynesburg has been granted franchises and is shortly to be incorporated to build about 58 miles of electric lines from Waynesburg east to Carmichaels, thence north via Jefferson and Rice's Landing, in Green county, and Clarksville, Zollarsville and Bentleyville, in Washington county; also a line from a point on the Monongahela river opposite Rice's Landing northeast to Brownsville, in Fayette county. Work is expected to be started this spring from Rice's Landing to Waynesburg, 15 miles. When the organization of the company is finished it may be taken over by the Brownsville, Masontown & Smithfield. W. J. Sheldon, McKeesport, holds the franchises and is organizing the company.

Canadian Pacific.—William Whyte, Second Vice-President, is quoted as saying that in addition to the work already under way, the new work arranged for to be carried out during 1908 includes the completion of the following lines: Between Kirkella and Asquith, Sask., on the Edmonton branch, and a line to Hardisty, Alb.; also a line from Lanigan, Sask., to Sheho, 82 miles; between Woolsey, Sask., and Reston, Man., 23 miles; extension of the Winnipeg Beach line north to Icelandic river; and continuation of the line from Tuxford, Sask., 50 miles west. A large amount of bridge work is also to be carried out; in British Columbia many of the present wooden structures will be replaced by permanent structures.

Centralia Eastern.—Contract has been given by this company to W. F. Nelson, of Seattle, Wash., for building its proposed line from Centralia, Wash., northeast nine miles. Grading is expected to begin early next month. Contracts will probably soon be let for building five miles additional. B. A. Johnson, Chief Engineer, Centralia.

Chicago, Lake Shore & South Bend (Electric).—This company, building an electric line from South Bend, Ind., west to Chicago, Ill., 71 miles, has track laid on 48 miles. Grading will shortly be finished on 13 miles additional. It is expected to have the entire line in operation by July this year. A mortgage for $6,000,000 has been filed, of which $3,500,000 will be used for construction and the remaining $2,500,000 held for future extensions and improvements.

Cumberland Railroad.—Contracts let to S. P. Condon, of Knoxville, Tenn., for extending this road from Artemus, Knox county, Ky., south via Cumberland to Jellico, Tenn., 32½ miles. Track laid from Artemus to Cumberland, 8.2 miles. B. C. Milner, Chief Engineer, Warren, Ky.

East Carolina.—This road, which was recently extended from Farmville, N. C., south to Hookerton, 13 miles, is now open for freight service on this section, and the company expects to start passenger service next month.

Keweenaw Central.—This company is building a branch from Phoenix, Mich., to Eagle River, two miles.

Mexico, Santa Fe & Perry Traction.—An officer writes that this company began grading its proposed line from Mexico, Mo., northeast via Molino and Santa Fe to Perry, 27 miles, last November. J. M. Wolfe, Collinsville, Ill., has contracts for all the work, some of which has been sublet. About three miles of grading is finished and the company expects to have the entire line in operation about September of this year. The work includes a number of bridges for which contracts are soon to be let. An extension from Mexico to Columbia is also projected. S. L. Robison, President and General Manager, and C. O. Thon, Chief Engineer, Belleville, Ill.

Morgantown & Dunkard Valley (Electric).—Under the name of the Morgantown Interstate Railroad grading is now under way for an electric line from Morgantown, W. Va., to Star City, four miles. The work includes a bridge 600 ft. long. W. W. Smith, Secretary and Treasurer, Morgantown.

Morgantown Interstate (Electric).—See Morgantown & Dunkard Valley.

Mountain Central.—An officer writes that the projected extension from Campton, Ky., northeast to Hazel Green, has been abandoned for the present.

Pittsburgh, Binghamton & Eastern.—Building from Binghamton, N. Y., southwest to Clearfield, Pa., 232.5 miles. Grading under way from Renova, Pa., to above Westport. Contract let to the Holbrook, Cabot & Rollins Corporation, Boston, Mass. About 21 miles was built from Cedar Ledge, Pa., to Powell last year. Additional contracts will probably soon be let.

Branch located and most of the rights of way have been secured from Cedar Ledge to Oregon Hill, 32 miles. Work will probably be started this spring.

Red Bud & Belleville Interurban.—Incorporated in Illinois to build an interurban line from Red Bud, Randolph county, Ill., north through Monroe county to Smithton, 15 miles. C. Becker, Red Bud; J. Keller, Hecker, Ill., and B. A. Gundlach, Belleville, incorporators.

St. Louis & Oklahoma Southern.—This company has been incorporated with a capital of $10,000,000 to build a line from Benton County, Ark., southwest to a point near Oberlin, Bryan county, Okla., 260 miles. H. G. Baker and W. R. Eaton, of Muskogee; C. L. Stower, J. B. Christensen and J. H. Elton, of St. Louis, incorporators.

Southern Pacific.—The Cananea, Yaqui River & Pacific, building through western Mexico, it is expected, will be nearing completion by the close of 1908. The government concession requires that 248 miles of track shall be built this year, but the company plans to greatly exceed this mileage. Orders have been given for 30,000 tons of 65-lb. rails for delivery at Guaymas during 1908. Large quantities of construction materials are also arriving at Orendain, where the road will connect with the Mexican Central. The federal inspector of railroads reports that the following track has been finished: Main line from Guaymas southeast, 217.5 miles; from Mazatlan north toward Culiacan, 17.5 miles; Mazatlan south toward Tepic, 22.5 miles; Orendain toward Tepic, 7.5 miles; Nacozari branch, 18 miles; branch between Cananea and Nogales, 12.5 miles; branch between Alamos and Navajo, 47 miles; and on the branch between Corral and Cumaripa, 37 miles.

Susquehanna & New York.—This company, in 1907, finished an extension of its road from Pleasant Stream to Marsh Hill, Pa., from which point trackage arrangements have been made with the Pennsylvania into Williamsport. At Williamsport the company has shops and yards, and connection is made with the Philadelphia & Erie division of the Pennsylvania, with the Pennsylvania division of the New York Central and with the Philadelphia & Reading, giving a good connection from the coal fields of Pennsylvania to New England points. In addition the company has carried out revision work on its main lines from Tonawanda to Ralston, replacing light rails with 80-lb. sections and putting in heavy bridges to replace light structures.

Woodstock, Marengo, Genoa & Sycamore (Electric).—This company, which was incorporated last year to build an electric line from Woodstock, Ill., southwest via Marengo and Genoa to Sycamore, 38 miles, is ready to receive bids for material and for building the line. The company expects to begin grading work in May. Charles A. Spenny, Secretary, Chicago, Ill.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—A semi-annual dividend of 2½ per cent. has been declared on the $8,000,000 common stock of the Cleveland, Lorain & Wheeling, which is operated by the Baltimore & Ohio. The Baltimore & Ohio owns about 75 per cent. of its stock. This is the first dividend on the common.

Boston & Maine.—This company has renewed for one year at 6 per cent. $1,000,000 5 per cent. one-year notes maturing on Feb. 15 and $1,000,000 5 per cent. one-year notes maturing on March 15. It has also arranged to sell $1,300,000 Boston & Lowell one-year 6 per cent. notes. This arrangement was in addition to the renewal of $1,000,000 5 per cent. one-year notes which fell due on Jan. 15, and $500,000 Fitchburg Railroad one-year notes which fell due on the same date, both of which were renewed for one year at 6 per cent. All these arrangements were made through R. L. Day & Co., of Boston, and associates.

Boston & Worcester Street.—E. H. Gay & Co., New York, have offered $250,000 4½ per cent. first mortgage bonds of 1923 of this company at 96. The Boston & Worcester has paid 6 per cent. dividends on its stock since completion of the road in 1904.

Chicago, Milwaukee & St. Paul.—On January 1 train service was extended so that the Pacific extension is now in operation from Mobridge, S. Dak., on the Missouri river west to Marmarth, N. Dak., 193 miles. At the same time the train service in Montana was extended. The road is now in operation in that state from Harlowton Junction east to Musselshell, 92 miles. It is expected that the road will be in operation from the Missouri river to Butte in May or June. Rails are being laid on the completed grading at the rate of about four miles a day.

CHICAGO, ROCK ISLAND & PACIFIC.—For the five months ended Nov. 30, 1907, gross earnings were $27,200,000, against $24,700,000 in 1906. Including in the operating expenses for 1907, $498,000 on account of depreciation of equipment, net earnings were $7,900,000, against less than $8,950,000 in 1906. As no similar depreciation charge was made in 1906, the net earnings for 1907 on a straight comparison would be $8,400,000 instead of $8,950,000. The other increase of $556,000 over the 1906 operating expenses was largely due to increased wages and higher cost of materials and labor.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—A semi-annual dividend of 1 per cent. was on January 28 declared on the $47,000,000 common stock. Four per cent. has been paid annually since 1901, in which year $3\frac{1}{2}$ per cent. was paid. In 1900 3 per cent. was paid. This was the first distribution since 1893, when also 3 per cent. was paid.

Income results (partly estimated) for the 12 months ended December 31, 1907, were as follows:

		Increase
Earnings	$26,384,300.00	$1,789,400.00
Expenses (76.11 per cent.)	20,081,300.00	1,648,600.00
Net earnings	6,303,000.00	140,800.00
Other income	180,900.00	27,700.00*
Gross income	6,483,900.00	113,100.00
First charges and taxes	4,520,900.00	214,800.00
Available for dividend	1,963,000.00	101,700.00*
Dividends†	1,911,500.00	100,200.00*
Surplus	51,500.00	1,500.00*

*Decrease.

†5 per cent. on preferred, and 3 per cent. on common, in 1907; 5 per cent. on preferred, and 4 per cent. on common, in 1906.

CLEVELAND, LORAIN & WHEELING.—See Baltimore & Ohio.

CONNECTICUT RAILWAY & LIGHTING.—See New York, New Haven & Hartford.

DELAWARE & HUDSON.—This company has borrowed $6,000,000 for six months at $4\frac{1}{2}$ per cent. from the First National Bank and Kuhn, Loeb & Co., of New York City. The proceeds will be used to pay off $6,000,000 one-year notes of the Quebec, Montreal & Southern, which mature early in February.

FLORIDA EAST COAST.—Harvey Fisk & Sons, New York, have offered at 98 to yield about 7 per cent. $750,000 3-year 6 per cent. notes due Aug. 15, 1910. These are part of a total issue of $5,080,000 which were issued in two series, $3,500,000 dated Aug. 1, and $1,580,000 dated Aug. 15, 1907. These notes are secured by $7,258,000 first mortgage 5 per cent. bonds of the Florida East Coast, which is at the rate of 70 per cent. of the par value of the bonds. The notes are further secured by the personal endorsement of Henry M. Flagler, of the Standard Oil Company. The first mortgage bonds which are deposited as collateral are all the first mortgage bonds outstanding, and are a first lien at the rate of $18,000 a mile on the main line from Jacksonville to Miami, 366 miles, 37 miles of branches and all the rolling stock and other property of the company. The proceeds of these notes were used in the extension which is being built south along the Florida Keys to Key West, which was recently opened as far as Knight's Key, 47 miles from Key West.

HUDSON & MANHATTAN.—The Hudson Companies, through Harvey Fisk & Sons, New York, are offering to preferred stockholders at $98\frac{1}{2}$, $50,000,000 6 per cent. 2-year collateral notes secured by $22,500,000 $4\frac{1}{2}$ per cent. convertible bonds of the Hudson & Manhattan Railroad. This company's line is soon to be in operation from the Susquehanna station to Hoboken to Sixth avenue and 11th street, New York.

ILLINOIS CENTRAL.—New financing is being considered. On June 30, 1907, bills payable outstanding amounted to $10,300,000 against $1,400,000 a year earlier. These represented principally construction expenditures on the lines to Indianapolis and Birmingham.

MISSOURI PACIFIC.—This company has $6,000,000 two-year 5 per cent. notes outstanding which mature on February 10. In order to refund them it has sold $6,000,000 two-year collateral 6 per cent. convertible gold notes dated February 10, 1908, which are secured by $12,000,000 Kansas & Colorado Pacific first refunding mortgage 30-year 6 per cent. bonds dated February 1, 1908, guaranteed by the Missouri Pacific. These notes have been offered by Taller & Company of New York at 99, yielding 6 per cent. income. The Kansas & Colorado Pacific owns 1,450 miles of the Missouri Pacific lines, including the Colorado through line. This new mortgage is subject to prior liens, at the rate of $15,541 per mile. The authorized issue of the new bonds, including refunding of the prior liens, is limited to $30,000 a mile, or $43,500,000. These notes, being secured by bonds, are believed to be a legal investment for insurance companies in the state of New York. They are the first convertible notes ever issued by any company.

The Attorney-General of New York has rendered an opinion that in order to have their bonds qualify as legal investments railroad companies must pay dividends in cash. The bonds of the Missouri Pacific, heretofore legal savings bank investments, will therefore cease to be such on expiration of a year within which the company has not paid cash dividends equal to at least 4 per cent. on stock. The January dividend of $2\frac{1}{2}$ per cent. was paid in stock. If, however, the Missouri Pacific should before the end of 1908 declare a total dividend of 4 per cent. in cash the bonds of the company would still remain legal savings bank investments.

NATIONAL RAILWAYS OF MEXICO.—It is probable that the financial plan for the merger of the Mexican Central, the National of Mexico, the Mexican International and the Interoceanic will be announced shortly. Its general terms were announced in 1907, but it was postponed because of the financial situation.

NEW YORK CENTRAL & HUDSON RIVER.—The option given by the New York, New Haven & Hartford to the New York Central to buy a controlling interest in the $29,160,000 New York, Ontario & Western stock held by the New Haven at the price paid for it by the New Haven, $45 a share, has been again extended; this time indefinitely. The original option expired on April 1, 1907, and the second on January 1, 1908.

NEW YORK, CHICAGO & ST. LOUIS.—An annual dividend of 5 per cent. was on January 28 declared on the $11,000,000 second preferred stock. In 1907, 4 per cent. was paid, from 1902 to 1906 inclusive, 3 per cent., and in 1901, 2 per cent., the first payment on this issue.

NEW YORK CITY RAILWAY.—The receivers of this company have brought suit in the United States Circuit Court at New York against the Metropolitan Securities Company and its directors, alleging that these directors, most of whom were also directors of the New York City Railway, entered into a conspiracy whereby the notes of the New York City Railway were sold to the Securities company at a discount of 30 per cent. It is claimed that the Securities company derived a profit of $2,797,200. The New York City Railway asks for an accounting. The Metropolitan Securities Company is the owner of all the stock of the New York City Railway.

NEW YORK, NEW HAVEN & HARTFORD.—At a recent meeting of the stockholders of the Connecticut Railway & Lighting Company the Chairman said that the company is earning about 4 per cent. on its $8,100,000 4 per cent. cumulative preferred stock and 2 per cent. on its $9,000,000 common stock. The road is leased to the New York, New Haven & Hartford. It has 193 miles of track in trolley lines.

The $39,029,600 convertible 6 per cent. debentures offered in December at par to holders of stock and debenture bonds have been fully subscribed. Between $20,000,000 and $25,000,000 has already been paid in.

NEW YORK, ONTARIO & WESTERN.—See New York Central & Hudson River.

NEW YORK-PHILADELPHIA COMPANY (ELECTRIC).—This company operates trolley cars between Philadelphia and Jersey City. It owns about two-thirds of the stock of the Camden & Trenton Railway and all the stock of the Trenton & New Brunswick. These companies are now in default in interest payments on their bonded debts.

PITTSBURGH & LAKE ERIE.—Gross earnings for the year ended Dec. 31, 1907, were $14,900,000, against $14,500,000 in 1906, and net earnings $3,384,000, against $3,288,000 in 1906. Of the gross earnings, $13,300,000 were from freight, against $13,000,000 in 1906, and $1,400,000 from passenger, against $1,300,000 in 1906.

QUEBEC, MONTREAL & SOUTHERN.—See Delaware & Hudson.

ST. LOUIS & SAN FRANCISCO.—Kleybolte & Co., of New York, have offered at prices yielding $6\frac{1}{4}$ per cent., $669,000 6 per cent. equipment trust certificates maturing semi-annually from 1908 to 1918, inclusive. These cover 45 locomotives bought from the Baldwin Works for $743,690.

UNION PACIFIC.—The Attorney-General of the United States has directed that a bill in equity be filed in the United States Circuit Court at Salt Lake City, Utah, to set aside the control by the Union Pacific of the Southern Pacific and the San Pedro, Los Angeles & Salt Lake, and to have declared illegal its ownership of stock in the Atchison, Topeka & Santa Fe, the Great Northern and the Northern Pacific, on the ground that all these lines are its competitors. F. B. Kellogg and C. A. Severance, of St. Paul, who were the counsel for the Interstate Commerce Commission in the Harriman investigation of 1907, have been engaged as special assistants to the Government. See editorial columns.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 6. FRIDAY, FEBRUARY 7, 1908.

Engineers and contractors who have occasion to use concrete piles would do well to read C. R. Gow's article in the October number of the *Journal of the Association of Engineering Societies.* He believes that the concrete pile has come to stay and must be accepted by the engineering fraternity as a permanent addition to the list of foundation expedients, but like all innovations it can be overdone through excessive enthusiasm and the desire to try something new. "Economic considerations usually demand that a concrete pile shall be capable of replacing at least three or four wooden piles. To do this it must carry safely a load of approximately 30 tons. But it must be borne in mind that the ground under and around the pile must ultimately carry this load, and since there is a limit to the carrying capacity of any soil, there must also be a limit to the load we can concentrate on one pile of ordinary section." This imposes severe demands on a small section of concrete, requiring particular excellence of construction. Few, if any, of the present methods of making and driving concrete piles are free from objectionable features; they also involve an element of risk. Concrete pile construction falls into two general classes—those built in place and those cast and driven. The former leaves some doubt as to the final sufficiency of the pile because of the inaccessibility of the space in which the concrete is placed and the uncertainty as to what takes place during and after placing the concrete. The second, while of assured quality of construction, involves a factor of considerable uncertainty in the driving. Different conditions require different methods, and careful study by the engineer is recommended before making a choice. The author of the article describes several methods used in special cases, explaining the reason for their adoption. In connection with one of these, where it was necessary to use cast piles, he records an interesting fact. Construction of the piles was begun late in the fall and an unexpected freeze caught a large number, some before initial set and all before final set. These lay exposed throughout the winter, alternately freezing and thawing. It was decided to make a test to determine the actual condition of the piles after such an experience. After thawing one and testing it immediately thereafter for crushing strength, with results that were not very satisfactory, another was thawed and then allowed to remain in a warm room for four weeks before testing. It made practically as good a showing as an unfrozen pile tested at the same time, indicating that it had recovered practically full strength as soon as the freezing action was permanently removed. All the frozen piles were subsequently used.

"Thermostat," whose letter we print, makes a complaint which will fit a good many railroads, though he does not name a single one. As he speaks of the third rail his first incident must have occurred on the Long Island or the New York Central; and as his second happened at the Grand Central station, New York, it seems likely that he means the N. Y. C. But his grievance cannot be against that road, for it has a specific rule which forbids such neglect of passengers;* therefore by a "process of exclusion" the guilt is fastened on the New Haven road, which runs trains over the New York Central tracks. But, as we have said, the New Haven is not guilty above others; and, to be sober about it, we cannot swear that all N. Y. C. conductors fully and intelligently carry out Rule X. Like the Bible and the standard code, that rule lays down principles, but does not fit all cases with specific instructions. To do this it would need to be greatly amplified. On most roads another amplification would be necessary—that of the force of trainmasters. To educate conductors so that they will carry out with thoroughness the spirit of this rule, high grade trainmasters who know how to improve petty practices without being petty-minded, should ride on trains very frequently, getting into real touch with the men. The trainmaster who has to supervise 500 trainmen has far too heavy a task. Taking Rule X as it stands, the trouble is that in practice it does not come into action until passengers have already done a considerable amount of worrying. Telling passengers, after an hour, that they will be detained two hours longer, is all right, if that is the best that can be done; but the passenger demands, and often justly, that he shall be informed in 10 minutes of a delay of, say, 10 minutes, or be advised that conditions are uncertain. Possibly some reader will say that we are going pretty well into small details; but no New York Central officer can complain at this, for the "general notice" in the N. Y. C. rule book says that "the

*RULE X, N. Y. C. & H. R. R.R.—Whenever the passenger service is [illegible] arranged the public shall be informed of the probable length of time of the interruption, and, when ascertained, the time the service will be restored. Advices from the superintendent received by station masters and station agents must be posted in a conspicuous place at the station. Announcement must also be made in waiting rooms and on platforms, and to passengers when purchasing tickets. Conductors of delayed trains must also inform passengers.

strongest recommendation any employee can have is the fact that by . . kindly accommodation of patrons he has secured the good will of the community." To do this, an employee must devote his days and nights to perfecting himself in what seem to be petty details.

TWO ANOMALIES OF A RAILROAD SITUATION.

At a time like the present when the country is in the penumbra of recent panic and when business is recessive the noun "contraction" becomes a kind of all round watchword. Limiting the term to our railroads there is still for the word scope enough and to spare. There is contraction of train service, contraction of shopwork, contraction of improvements and contraction of credit measured by the high interest rate on the new railroad loan unless it happens to be very highly secured. The railroad manager is asking not as much what he can do as what he can do without—where he can economize most and where he can expand least, if at all. Such a situation always flings to the surface certain anomalies which just now, owing to somewhat exceptional causes, are peculiarly conspicuous.

The present stress in American railroading has followed close on two uncommon conditions, which to some extent have denoted cause and effect. One of them has been the era of corporation baiting shared by both federal and state authority and the first in a great degree an irritant and promotor of the last. In the states the anti railroad hostility has in a measure calmed down. At Washington it would calm down but for the assertiveness and persistency of the executive, to use the mildest words of description. But public sentiment toward the railroad still remains sub-acute and exacting and pushes some anomalous and unjust demands. The railroad, hard pressed to pay moderate dividends, perhaps even to pay fixed charges, tries to retrench. But public sentiment resists the privilege which it concedes to the private corporation. The big factory may close and discharge its thousand hands and there is no public note save one of passing regret. But let the railroad take off a single unprofitable train and public outcry rises. Certain fundamental rights of private capital are denied to the quasi-public capital invested in the railroad. True, the railroad corporation has derived from the community, crystallized into the state, a charter that conveyed a franchise and certain privileges including that of eminent domain. But the railroad has shared with the public the task of making the franchise valuable; it has been attended with greater or less risk to the invested private dollar; and public necessity and convenience have been served by utilizing the franchise. Who will say that, under such conditions the private dollar publicly invested has not served a community better than the private dollar privately invested? Yet hard times and forced retrenchment give us the paradox of public pity for the one, public censure for the other, and that whether the company is poor or prospered, diluted by water or solidified by past reorganization and loss.

Another anomaly or at least novelty, in the railroad situation bears upon the attitude of the railroad corporations toward labor in the existing period of stress and strain. Prosperity, reaching over several years previous to the present recession, had produced the usual result of higher wages and more thorough organization as well as enlargement of the unions. Some of the railroad companies not only had raised wages a number of times but raised them last year not long before the financial flurry and its aftermath. The railroad corporations, therefore, face the dilemma of risking a strike by a general reduction of wages on the one hand, or, on the other hand, of reducing the hours or the number of hands or both. Ordinarily the first alternative would have been adopted. Under the peculiar conditions the railroads are now almost universally adopting the second, although they may be forced to general wage reductions later when the number of unemployed makes a strike more improbable or its effects, should it come, less serious. The results in the ranks of "highly organized" railroad labor are anomalous and impressive. Instead of the usual and orthodox scaling down of wages evenly distributed with the minimum of suffering there is now an uneven distribution. A certain number of hands retain their old hours and pay; others, not a few, retain the old *rate* but, with lessened hours, diminished absolute pay; and a large number are discharged and get no pay at all. Organization of labor on the railroads and the consequential dread on the part of railroad managers of an organized and costly strike has thus forced privation and hardship on the man out of work instead of dividing them in a much lesser degree in reduced wages with the man who holds his job. One union man must starve that another union man may have the union wage.

The outcome of such an anomalous result of the theory of unionizing the railroad wage earners will be watched with interest as the enforced railroad economies proceed. As a disorganizing and weakening force on the unions its influence is manifest but that is only one branch of the general truism, that unions are strong during business prosperity and the reverse during adversity. The normal striker doesn't strike when another man is waiting for his job. But apart from that it will be instructive to see how far shorter hours, less absolute pay and imperilled work and wages brace up to greater efficiency the train man, shop man and track man. The head of a great railroad system not long ago called to his office the presidents of the unions, gave them some of the figures of reduced earnings, told them that many men must be discharged and that only greater efficiency of the men who remained would avert a sweeping reduction of the wage scale. That, in substance, represents the position of a good many heads of railroad corporations who front, not without grave solicitude, earnings that have run down while fixed charges, including wages, have run up. But anxiety has just now its place in the councils of organized labor as well as in the offices of railroad presidents.

SOME CAUSES OF WHEEL SLIDING.

The development of the high-speed brake, using increased brake pipe pressure and greater leverage in the foundation brake gear, has caused a gradual increase in initial brake shoe pressure up to more than 100 per cent. of the light weight of cars. Theoretically this high initial braking pressure should not cause flat wheels during ordinary stops from speeds above 40 miles an hour even under unfavorable conditions of wet rail, because the time required to bleed off the pressure in the brake cylinders through the high-speed reducing valve is less than the time required to reduce the speed to the point where the coefficient of brake-shoe friction begins to rise rapidly. Nevertheless flat wheels do develop, and frequently the size of the flat spots is such as to indicate that the wheel has skidded almost from the beginning of the stop. The not uncommon sliding for a car length at the end of the stop is not sufficient to produce a spot from 2 in. to 4 in. long, even with a sanded rail.

There are a number of causes of wheel sliding with these high braking pressures, which may occur singly or in combination. Some of them have not developed heretofore because the margin of safety between the braking pressure and the braking weight was great enough to take care of slight variations from the theoretical calculations of leverage and friction. They are nearly all due to defects in the design of the foundation brake gear, which is an equalized unit, while the wheels to which the brakes are applied are separate units.

In the usual arrangement of foundation brake gear the rod connecting the floating lever and the truck live lever pulls in a line from 14 in. to 17 in. to one side of the center of rotation of the truck. If both trucks rotate simultaneously and equally, the combined effect is neutralized, but if for any reason one truck turns more than the other when the brakes are set up hard there is an instantaneous increase in the brake-shoe pressures on the rotating truck which may be just enough to cause the shoes to lock on the wheels.

Every one who has watched the action of a truck when the brakes are applied has noticed the tilting which occurs, forward with outside hung brakes and backward with inside hung brakes. This results in a change in the static wheel loads, relieving the wheels under the high end of the truck of an appreciable part of their normal load. The brake-shoe pressure, however, is equalized and is the same for the lightly loaded wheels as for the heavily loaded wheels. This is perhaps the most common cause of flat wheels.

If the brake-shoe pressure is constant and at a maximum any instantaneous decrease in the pressure between the wheel and the rail may cause the wheel to lock. A bad joint in the track will cause the wheel to leave the rail altogether for an instant of time and give the brake-shoe a chance to take hold even though the opposite wheel on the axle is still carrying its normal load.

The method of hanging the brake-shoes below the center of the axle gives in effect a powerful wedging action to the shoe, which tends to drag under the wheel. There is no logical reason for this long continued practice except perhaps the limited clearance between wheels for inside hung brakes. Some experiments on street car trucks made a few years ago proved that brake-shoes hung opposite the center of the wheel were very effective in preventing flat wheels, even though a more powerful brake was used.

Sticking triple valves, giving undesired quick action applications at slow speed, are also a source of some trouble. The remedy is more frequent cleaning and oiling than was formerly required. With an increase in brake-pipe pressure from 70 lbs. to 110 lbs. there is a much greater pressure on the triple valve slide valve and this causes the oil to be forced out from between the valve and its seat in a short time. The valve sticks and does not respond to a light service application, but if this is followed by another application the valve jumps into quick action and is followed by all the other valves in the train.

CAUSES OF THE TERRA COTTA COLLISION.

The Interstate Commerce Commission gives in its annual report (see page 177 of this issue) what seems to be intended for its final conclusion on the Terra Cotta collision (Dec. 30, 1906); but as a résumé of the facts this statement is brief and incomplete, and as a decision it is still less complete. As this collision is one of the most notable of recent years and as it occurred on a block signaled line (the telegraph block system) it seems desirable that the facts and circumstances should be fully summarized.

The essential facts of the collision itself were given in the *Railroad Gazette* of January 11 and 18, 1907. These may be summarized as follows: Eastbound passenger train No. 66 of the Baltimore & Ohio was making its regular trip, on Sunday night, December 30, 1906, and had just made its stop at Terra Cotta station, about three miles west of the terminus at Washington, D. C. The time was between 6 and 7 p. m. and there was a dense fog. This train was run into at the rear by a following train of empty passenger cars, headed by engine No. 2120. Neither the engineman nor the fireman of No. 2120 saw the tail lights of No. 66, and the passenger train was pushed forward several hundred feet and its three cars wrecked. Forty-three passengers were killed and 67 injured. The stations involved, beginning at the west, are:

Silver Spring, day and night block office.
Takoma, 1.2 miles, day block office.
Terra Cotta, 3.2 miles.
University, 4.3 miles.
Q N, 5.3 miles, day and night block office.

The grade is descending from Silver Spring to Terra Cotta at about 1 per cent., with some irregularity. At Takoma the block signal usually is not operated at night after 6:30 p. m., the signal being at that hour (or soon after) put clear and the light extinguished. At Silver Spring the block signal is on the left of an engineman approaching from the west. At Terra Cotta there is a crossover, and at night, when Takoma is closed, it was the custom to give to all eastbound trains at Silver Spring, a permissive block signal indicating that the block through to Q N must be traversed under control and that a train may be switching at the crossover. The ordinary permissive signal is a green light, but in cases like this, where it is desired to give a special caution concerning a crossover, two green lights are displayed, the second being a lantern hanging on the signal post about 10 ft. above the ground. The signalman at Silver Spring gave to No. 2120 (as he had also given to No. 66) a white (clear) signal at 6:28 p. m. At 6:31 this train passed Takoma, the signal there being at red, but evidently not seen by either the engineman or the fireman; and the train passed that station at high speed and evidently continued at unchecked speed (though not using steam) until the collision occurred.

These are the facts as shown by the testimony of the signalmen, which was not shaken, and they indicate that the engineman of No. 2120 was not keeping a good lookout. This engineman had been on duty 48 hours with the exception of two periods of four hours each. During these two periods he had opportunity to sleep. During one or two other short periods he had been waiting, with no duties to perform, but had not slept. The statement of the signalman at Takoma, that his signal showed red and that the train passed his station at 6:31 at high speed was well corroborated by other testimony. The General Manager of the road in testifying before the Commission, accepted as correct the statements of the signalman at Silver Spring.

The enginemen tell a different story. Engineman Hildebrand, of No. 2120, claimed that the signal at Silver Spring was "double green"; that the time was past 6:30; and that, therefore, he was not bound to look for a signal at Takoma. All he would say concerning the indication of the Takoma signal was that he saw nothing as he passed there. But, on his own testimony, he was negligent in not approaching Terra Cotta with speed under control, there being a crossover there. Engineman Vermilion of No. 66 also testified that he had received a "double green" signal at Silver Spring, and that, therefore, he had concluded that Takoma had been closed for the night. But he acknowledged finding a white (clear) signal at Takoma, which, he said, surprised him. In view of the unshaken testimony of the signalmen, the most plausible explanation of the testimony of Engineman Vermilion and of the two firemen, who corroborated the testimony of their respective enginemen, is that they desired to support the theory which Hildebrand depended on to clear himself.

Engineman Hildebrand and also the conductor, the fireman and one brakeman of his train were indicted in the District of Columbia and tried for manslaughter, but, on December 23, 1907, were acquitted, after a trial lasting three weeks.

We make this summary at this time because, on account of the incompleteness of the Interstate Commerce Commission's report, and the unsatisfactory result of the criminal trial, railroad officers who are interested will, presumably, desire to form conclusions of their own. By reading again the testimony which we published a year ago, they can readily do this. The unreliable character of the trial before the court and jury is perhaps sufficiently indicated by the fact that, notwithstanding the clear indications of the preliminary inquiries, all the members of the crew of train 2120 were tried.

It is scarcely necessary to point out that the overwhelming preponderance of the support given to the signalmen's testimony goes to show that the opposing testimony was false. This conclusion is reinforced by the statement of the engineman's hours, raising a presumption that while running down grade he would easily fall asleep; and by the fact that, on his own testimony, he was running at dangerous speed. The Interstate Commerce Commission rightly calls attention to the employment of inexperienced block signal men, and to other collateral facts, but does not cite all of these facts, nor does it give sufficient emphasis to those that are cited. It is proper to recall these, for the testimony as a whole revealed loose or improper practices which go far to explain how such gross disregard of rules could come about. For example the omission to call to account enginemen who overran block signals appeared to have been common. An engineman who was willing to work excessive hours, at the risk of becoming too tired to attend to his duties, seems to have found it easy to do so, no vigilant officer being on watch to prevent such a dangerous practice. The practice of giving permissive signals constantly, even when clear signals could have been given, evidently tended to relax respect for the block signal rules, as one would naturally expect. Finally, the rule to regularly extinguish the Takoma signal light at 6:30 p. m., though not contributing to this collision, is shown to be one which ought to be changed. The worst result from it in this case was that it gave an opportunity to juggle with the facts as to the exact time that the trains passed different points. It is fundamentally unsound in that it permits an engineman to treat the absence of a signal as indicating "all right." This condition may seem to be provided for, when the order tells enginemen to treat such a block signal as though it were non-existent, but this is of questionable propriety, for whenever, by the light of the moon, or otherwise, the semaphore arm can be seen, the arm and the lamp seem to convey conflicting requirements. Even if the whole signal, post and all, were to be taken down and laid in the ditch it would still be desirable to have at that point some visible thing which the engineman could be required to see and to take note of. Again, the safety of the rule permitting enginemen to ignore a signal depends, in part, as was shown in this case, on their having accurate timepieces; whereas the block system should be safe regardless of inaccuracies in enginemen's watches.

The rule requiring passengers to show their tickets on entering the cars, which was adopted in the state of Missouri by the Chicago & Alton Railroad, December 1, has now been in force two months, and an officer of the road informs us that it has worked successfully. There is no friction or trouble and the people comply willingly. The circular which was issued announcing the change gave instructions that for the first week conductors might hold trains if necessary to allow passengers to go back to the ticket office to buy tickets, but it does not appear that serious delays were caused in this way. The reason why this new rule is necessary is that the law of Missouri, limiting passenger fares, forbids the railroads to charge an excess fare to passengers paying cash on the trains. Not being able to employ this inducement to buy tickets the company found itself confronted, on the advent of the 2-cent law, by a tremendous increase in the amount of cash fares, making it impossible in some cases for the conductors to make their collections. A number of local stations furnished an average of 30 cash fare passengers a day to certain trains. While, as in this case, the cash-fare evil is aggravated to some extent by the laws of the states, it is troublesome even where the railroads are free to adopt their own corrective measures, and it is much to be desired that such a rule should be adopted in a great many other places; that is to say, everywhere that it is possible to require such practice without causing serious delays to trains. The Alton tried a scheme of this kind ten or a dozen years ago, and, if we remember correctly, had it in force for a number of months on nearly or quite the whole of its lines, but there was considerable objection and we believe trains were delayed somewhat; and after a short time the old practice was resumed. It looked as though a good deal of the objection was based on other than sound and honorable reasons, and it can hardly be said that the experiment was continued long enough to warrant the acceptance of the apparently unfavorable results as conclusive.

Paul Kelly, the motorman of the elevated train of the Interborough Rapid Transit Company, New York City, which was wrecked at 53d street and Ninth avenue on September 11, 1905, has been tried, convicted and sentenced to state's prison for not more than two years and six months and not less than one year and six months. Kelly absconded immediately after the accident, but was persistently followed through many distant cities, and at last was captured. This accident, in which a dozen or more passengers were killed, one car falling into the street, was due to excessive speed on a sharp curve, the curve which leads from the Ninth avenue to the Sixth avenue line. Kelly's train was bound south on the Ninth avenue line, which is straight; but the switch was set for Sixth avenue, and Kelly passed around the curve without slackening speed. Home and distant signals were set against him. These signals consisted of lamps turning on vertical spindles. The side of the case of the lamp (the distant signal painted yellow and the home signal red) constituted the daylight indication. Kelly had been in the service of the road six months, running only on the Ninth avenue line. His previous experience had been on electric cars in St. Louis.

NEW PUBLICATIONS.

Course d'Economie Politique (Course in Political Economy). By C. Colson, Engineer in Chief of Highways and Bridges, State Councilor, Paris. Gauthier-Villars; 6th vol., 527 p., 6½ in. x 10 in.; paper cover. Price, 6 francs.

This volume is one of a number of books, forming together an encyclopedia of public works in which such questions as water supply, railroads, physics, steam engines and locomotives, bridges and masonry and the like are discussed. This sixth volume of the course on political economy deals with public works and methods of transportation, and by public works are meant all those that are executed for the purpose of general utility, by the organizations of collective interest. The book opens with an explanation of its scope and plan, and shows the distinction that should be borne in mind between works that are executed solely by the public through its own servants and by its own means, for its own use and behoof, and those works which are of a *quasi* public character but are executed by private enterprise, by virtue of a formal delegation of the public power, as in the case of England and the United States where the situation is quite different from that in France. In these English-speaking countries the companies have no contract with the state, they are proprietors in perpetuity of the works which they build, they usually fix their own charges and subsidies and a division of profits is rare. But any public service, howsoever it may be organized, can be viewed as coming within the domain of political economy, because it is always possible to calculate its money value, at least approximately, as well as its usefulness to the community or nation. Questions of this character are treated in the first seven chapters in so far as they relate to methods of communication. In this there is an attempt to determine the cost of transportation theoretically, and there is a discussion upon the influence of tolls on services rendered, and an inquiry into the principle of making those who profit by the facilities pay the cost in contradistinction to taxing the public for the maintenance. There then follows a general resume of the situation in the matter of highways of communication in France, and in some foreign countries, with especial reference to the standpoint of traffic, expense and receipts. This is done from both a practical and theoretical point of view. The discussion of this question is at first limited to an investigation of the utilitarian value of a proposed work, and an inquiry into the elements which enter into the cost of transportation, the lowering of which represents the sole direct benefit accruing from the creation of or an improvement in the means of communication, and to which the indirect benefits must be added.

This is followed by an expose of the methods to be pursued in order to keep the receipts as high as possible in comparison with the taxes, without impeding traffic, and without falling into an arbitrary method of handling it in the establishment of the rates. An examination is also made into the effect of a multiplicity of enterprises that are intended to serve the same needs, and the agreements that may be made between them. The question of the extent to which private enterprise may be associated with public service is handled in a way to show the advantages and disadvantages that may be presented by exploitation by the state or by corporations, as well as the object and character of the control that should be held in the hands of the public. This portion of the subject is concluded by a study of the various methods that have been attempted for the exercise of this control and association of the two interests from a financial viewpoint, such as subsidies, guarantee of interest and a division of profits. Finally in the last chapter there is a summary of the principles that have been set forth relative to means of communication, showing how they may be applied to the distribution of water, gas, compressed air or the electric current. It is also shown at the same time, how these same principles extend to such enterprises as the establishment of sewers, the draining of swamps, the construction of levees to prevent inundation and the regulation of streams where the direct benefit accrues to a certain locality, but which differ in the fact that those who participate in them do not necessarily do so voluntarily, as may be said of travelers, and the consumers of water and gas, but, because they are located in a certain locality, must share in the results perforce, so that, in order that all interested may share in the expense, it becomes necessary that their contribution shall be a forced one, and shall not partake of the nature of a payment for services rendered, and yet it must be a direct rather than an indirect tax.

Naturally the book is based upon the conditions of affairs as they exist in France, in comparison with conditions in foreign countries, and in the use of such comparisons a warning is issued against drawing conclusions too quickly, because it is always necessary to consider the differences of national customs, temperament, legislative tendencies and the general organization existing. The work concludes with a plea that the principles of political economy should always be considered, in order that the future of liberalism and civilization may be insured.

Einfluss der Armatur und der Risse im Beton auf die Tragsicherheit. Mitteilungen aus dem Koeniglichen Material-Prufungsamt zu Gross-Lichterfelde, West, bearbeitet und besprochen von E. Probst, Zivil-Ingenieur. 77 illustrations, 9 plates. Berlin: Julius Springer, 1907.

The use of reinforced concrete is recent and as compared with the use of masonry and of iron in structures there are many points that require exact determination. Reinforced concrete is not a homogeneous material, its value for structural purposes depending on its composition, the manner of making the concrete and on the character and position of the reinforcing iron. It was for the purpose of obtaining precise data for deductions as to some of the important points on which the use of concrete and of iron in conjunction depends that the tests detailed in this monograph were made. They were carried out at the Royal Testing Station at Gross-Lichterfelde West, their scope and character were planned jointly by the author and Mr. A. L. Johnson, of St. Louis, Mo. The results of the testing station are given in tabulated detail, the mathematical deductions are those of E. Probst. The engineer and the investigator in the field of structural materials will find both worthy of study.

It will be of interest and may be an inducement to consult the original to give a short sketch of the ground covered. A detailed description of the materials used in the concrete, the proportions of these materials, the character and dimensions of the reinforcing iron and the manner of preparing and the dimensions of the test pieces is given. Preliminary tests were made on a large number of prisms and cylinders to determine the tensile, compressive and transverse strength, together with the modulus of elasticity of the concrete. Four different kinds of iron bars were used: plain round, square twisted (Ransome), bulbous (Thatcher), corrugated (Johnson), each kind being tested to determine its modulus of elasticity, its elongation and its tensile strength. The main tests consisted in determining the transverse strength of reinforced beams, experiments as to the liability to corrosion in the iron after fissures had been developed, bending tests to determine the capacity of adhesion between concrete and the different styles of bars.

The graphic and mathematical interpretations and analyses of the results are the work of E. Probst and the testing station is in no way responsible for them. They are given in extended detail and are clear and comprehensive. His discussion ends with a calculation based on his deductions of the factors of safety secured by following the official formulae governing reinforced concrete work in Germany, Switzerland and France. The nine plates give autotype reproductions of photographs showing the condition of the test pieces after the test in about one-eighth to one-quarter natural size, and the illustrations and diagrams throughout the work are ample and clear. E. F. E.

Proceedings of the Society for the Promotion of Engineering Education. Vol. XV.; 690 pages; 6x9; cloth. Edited by Charles S. Howe, Arthur L. Williston and William T. Magruder.

This volume consists of the proceedings of the fifteenth annual meeting, held in Cleveland, Ohio, last July. There are the usual lists of officers, committees and members, followed by about 50 papers and the discussions. Most of the papers deal with methods of teaching, but some of them go into wider fields. The authors, with a few exceptions, are members of the faculties of technical schools and colleges.

CONTRIBUTIONS

Wilson's Curve and Switch Tables.

Chicago, Jan. 29, 1908.

To the Editor of the Railroad Gazette:

Referring to a letter from Mr. S. S. Roberts, printed in your issue of December 27, 1907, in which he calls attention to errors in the explanation of the Curve and Switch Tables published in your issue of November 8, 1907, I wish to state that the line under the expression "CC-2G" was intended to act as a vinculum or the equivalent of a parenthesis, making the formula the same as the one given by Mr. Roberts, namely, N (CC-2G).

The explanation of the combined uses of tables I. and II. is for a turnout from the outside of the curve and not from the inside, the mistake being a stenographic one in the copy furnished you.

In the sixth line from the bottom of the second column, page 552 (issue of Nov. 8, 1907), the term "straight jacket" appears. Of course this is a misprint of "straight track." E. B. WILSON.

To Eliminate Petty Grievances.

New York, Jan. 28, 1908.

To the Editor of the Railroad Gazette:

Noting your comment in last issue relative to inconvenience of a passenger on a New York Central train, would say that while the second section of your comment is somewhat of an improvement upon the first section, I think that, on the whole, you do not attach enough importance to the general theme of the weight of minor complaints of this sort in their effect upon public sentiment and influence. I think that such complaints as are referred to have had a very important influence in shaping adverse public sentiment concerning railroad matters—more so than some larger features, such as mergers, etc., that have attracted much more public attention. It seems to me, further, that the railroad papers, by advocating the elimination of these minor causes of complaint, might have put their patrons, the companies, in a much stronger position before the public.

I feel very sure that such minor difficulties as the unnamed correspondent refers to have had more influence in shaping public opinion than $100,000 arguments by Joseph Choate on the sacredness of contracts, the right of corporations to a square deal and all other matters of that sort. In one case there is something definite before the private individual, a grievance that he communicates to his father-in-law, his mother-in-law and all his friends and relatives; in the other a mere generalization on an abstract subject which the average citizen only hears of through newspaper headlines.

I submit that you and other journalistic representatives of railroad interests can do good work for your patrons by urging the cutting out of petty annoyances. F. W. SAWARD,

General Manager, *Coal Trade Journal*.

Keeping Passengers in Suspense.

New York, Jan. 20, 1908.

To the Editor of the Railroad Gazette:

Men that go down to the sea in ships seem to be in a perilous and lonesome situation, and people take great pains to be considerate of their wishes. They are accorded special notice in holy writ, and the prayer book recognizes all kinds of people—good and bad—when they are in such a situation. In modern times, since we have come to rely more on our own ingenuity and less on prayers, the wireless telegraph has been invented for the benefit of men thus isolated, and unable to communicate with the rest of the world. A passenger on a suburban railroad train, however, is as bad off as he has ever been at any time since the world began; and his condition seems to be growing worse. On a train running out of New York not long ago a half dozen cars filled with passengers were kept standing for an hour at a point not far from a station, while the men got rid of some obstruction on the track; and the only way that any person on the train could find out whether the detention was to be 30 minutes or 30 hours was to go out in the dark and, braving the dangers of the third rail and of being struck by lightning express trains on adjacent tracks, search for some unofficial and reckless employee who would take the risk of answering a civil question.

Of course, many ladies and other persons would prefer to remain in suspense rather than go in search of information under such conditions. One would naturally expect that after, say, 20 to 40 minutes, some brave spirit among the railroad men would find out what was the matter and spread the information in the cars. In this case, however, no such relief expedition came to us, and so the scores of passengers continued to sit decorously in their places, contented and ignorant. I was one of those who had an interesting story to read and, being in no particular hurry, have only a mild grievance. I am writing to you on behalf of those who had a more serious grievance but who did not know how to prosecute it. Why did not the telegraph and telephone stations within 500 to 1,000 ft. of that train impart some information to the passengers? Of course, they knew what the trouble was. They may have been utterly unable to predict the length of the delay, but, in such a case, passengers are glad to know that they are unable; to know that someone at least desires to measure the length of time which is going to be lost, even if he can't do it. Or, supposing the stationman or signalman is not fully informed, why should not the superintendent advise him at once? If the superintendent is not on duty (this was about 7 p.m.) why should not the train despatcher on duty be a man as big as a superintendent?

It would do no good for a state railroad commission to issue an order to regulate a matter like this, for improvement, if there is to be any, must depend on the railroad superintendent himself. A commission could say that passengers must be promptly informed, but the real issue hinges on what interpretation is put upon the word "prompt." Judging by the way relief trains are made up and sent to wrecks, it may often happen that to act in one hour is prompt. Surely a state commission, prescribing general rules, could not try to figure closer than one hour, but the railroad superintendent can do much better than this. On a road with block-signal stations every two or three miles communication ought to be had with headquarters from a delayed train usually in 20 minutes or even less.

A smaller but equally exasperating delay happened to me only last week. I boarded a train at the Grand Central Station, New York City, at 6.30 p.m. It started out on time and progressed beautifully for about one-eighth of a mile—that is to say, one-quarter of the distance through the yard; and then stopped. We were backed down into the station and stood there 30 minutes while the engine was repaired or changed. During that half hour we saw no relief expedition whatever; though the candy peddler, who had "worked" the train before it started, came back and renewed the attack. As in the former case, I had a book and so did not much care. I am writing now simply to let you know my poor opinion of the railroad. Here, again, although we were in a station, we were worse off, as before suggested, than if we had been 1,000 miles east of Nantucket lightship; for there Marconi would have helped us. THERMOSTAT.

Chilled Iron Versus Steel Wheels.

107 Fenchurch St., London, E. C., Jan. 25, 1908.

To the Editor of the Railroad Gazette:

The article entitled "Comparative Physical Tests of Car Wheels and Tires," running through the present volume of your paper, has proved very interesting reading, but to my mind it seems that the chilled cast-iron wheel does not come in for its fair share of commendation; in fact, it appears to be brought in for adverse criticism only, whereas by noting the results carefully, and endeavoring to bring them in line with actual running conditions, the chilled iron wheel apparently shows itself for all practical purposes equal to the steel wheel for ordinary freight rolling stock as in use in this country and the Colonies, and especially for narrow-gage light stock of all type, and therefore to be recommended to all who are aiming at obtaining the best results at the least cost, owing to the great economy effected in the first cost of the cast-iron wheel against that of the steel wheel, provided, of course, that the chilled wheels are purchased from a manufacturer of reputed standing.

The cast iron wheel tested on the short length of track, as mentioned in Chapter 2, is stated as having a depth of chill of about ⅝ in., whereas a fracture of a 28-in. diameter wheel of Messrs. Miller & Co.'s (a Scotch firm) make now before me shows a chill extending over [illegible] in. deep, which should therefore give even better results than the one tested.

Now, in the first chapter it is stated that "In the tests for both cast-iron wheel and steel wheel the permanent set was all in the rail. The rail * * * showed signs of a permanent set under a load of 20,000 lbs.," this seemingly applying both to the cast-iron and the steel wheel. Taking, for example, an ordinary 12-ton wagon, and assuming a tare of eight tons, this gives when fully loaded a wheel load of 11,200 lbs., therefore with regard to the question of giving a permanent set to the rail no notice need be taken.

Again, on referring to the diagram on page 10, it is shown that the area of contact is practically the same for both cast-iron and steel wheels up to 22,500 lbs., although owing to the co-efficients of slipping and skidding being slightly more for the steel wheel, a small advantage is on the side of the steel wheel, but hardly worth considering. Further, it is shown that the chilled iron wheel does not break or show signs of yielding until a load of 27,000 lbs. is applied, therefore this point need not be brought into very serious consideration, as the maximum weight per wheel would not approach within 50 per cent. of this under ordinary conditions.

In the test for wear, on a length of track it was shown that at three miles an hour the chilled iron wheel wore away at about $5\frac{3}{4}$ times faster than the steel wheel, while at 12 miles an hour the positions were practically reversed, owing, it is assumed, to the tires becoming heated. Granted this, the balance is all in favor of the chilled wheel, because the brake would ordinarily be applied when the speed of the truck averaged 10 or 12 miles an hour, and cause, according to the figures given, the steel wheel to wear at 4.6 times the rate of the chilled wheel, and this state of things should, without doubt, continue until the train was brought to rest, as when the speed had been reduced to three miles per hour, surely the tire would not get cooler?

The laboratory tests for abrasion are valuable so far as demonstrating the points of greatest density and hardness of the metals, but owing to the tests being made in a manner far from approaching ordinary running conditions, do not seem to be of much service in comparing chilled iron wheels against steel wheels. It would, however, be very interesting to know the result of the test for hardness on the Martel scale of the cast-iron wheel; surely one was made? But possibly this was suppressed owing to showing a superiority over the Schoen wheel.

In conclusion, may I be permitted to give a couple of extracts from a paper by Mr. W. E. Fowler, Master Car Builder, Canadian Pacific Railway, on the Chilled Iron Wheel? "The importance and value of the cast-iron wheel in railroad service lies unquestionably in the wearing qualities of its tread or tire, the more than steely hardness of which gives more mileage for the same amount of wear (or metal removed), than any other wheel in existence. And not only does it stand up well under its present service conditions—that of carrying heavy loads over steel rails made as hard as they can be without danger of breaking, it also withstands with comparative freedom from failure the tremendous friction of the brake-shoes when making stops from a high speed, or when descending long heavy grades.

It is not uncommon in mountain districts to see the grease on the face of the wheels smoking from this cause, the wheels themselves being too hot to touch, and the brake-shoes red-hot, and it will be, I think, very difficult to produce materials of any other kind, which will give us wheels so serviceable, so economically manufactured, and so valuable when worn out, as the chilled cast iron wheel."

And again: "The 600-lb. wheel costs about $10.80 new, and after giving a mileage of 40,000 to 70,000, it is turned back to the foundry at a scrap value of about $7.80, giving a cost per 1,000 miles of about 5 cents.

Can it be possible that this showing can ever be beaten with any other kind of wheel?

A. T. PERRIN,
Of Alexander Penney & Co.

The Bay Shore Cut-Off of the Southern Pacific.

The Bay Shore cut-off of the Southern Pacific out of San Francisco was opened December 8, notice of it being given in our issue of December 14. The construction work, which was very heavy, was described in the *Railroad Gazette* of March 15, 1907. This line forms a direct and easy entrance into the city for the Coast Line of the road, saving over $2\frac{1}{2}$ miles in distance, and as much as 30 minutes in time for some trains, as compared with the Ocean View line, which it supersedes. The latter climbs through the high ranges of hills on the south of the city and, in order to find workable grades, makes a considerable detour to westward. But even with this it has heavy helper grades of 158 ft. to the mile southbound and

Tunnel 2; Bay Shore Cut-Off.

Track from Tunnel 4; Bay Shore Cut-Off.

Tunnel 5; Bay Shore Cut-Off.

a maximum elevation of 292 ft. above city base. The new line pierces the hills avoided by the other. Although only about 10 miles long it has almost two miles of tunnels, cuts with a maximum depth of 96 ft., and over 3,600 ft. of permanent creosoted timber trestle and steel bridges carrying the road over city streets. The maximum grade of the line is 15.84 ft. to the mile, and it is only 20.3 ft. above city base at its highest point.

We show herewith some interesting views of the finished line. The right-of-way and general design are for a four-track road, but only two tracks have been built.

Tunnel Under St. Joseph's Orphan Asylum.

Annual Report of the Interstate Commerce Commission.

The first part of the twenty-first annual report of the Interstate Commerce Commission, sent to Congress recently, was given in the *Railroad Gazette* of January 10. The present article deals with other portions for which there was not room in that issue.

Decisions of the Supreme Court.—Of the whole report, which fills 157 pages, about 25 pages are filled with court decisions relating to enforcement of the commission's orders, to injunctions to restrain proposed changes in rates, demurrage charges, free passes, the Schlemmer and other safety appliance cases, and many other subjects, all carefully classified and digested. On three decisions by the Supreme Court of the United States special comment is made, these decisions being regarded as peculiarly important in their bearing on the work of the Commission. The first is that in the Texas & Pacific cotton seed case (204 U. S. 426), in which the court held that the only remedy against the payment of an unreasonable interstate rate was to apply to the Interstate Commerce Commission. No suit at law can be brought in the courts until the Commission has acted. This seems to mean that any claim for damages based on alleged unjust rates must be taken before the Interstate Commerce Commission. In the Illinois Central case (206 U. S. 441) the court held that as a general proposition the reasonableness of rates was largely a question of fact which must be passed upon in the first instance by the Commission, whose findings of fact would not be lightly disturbed; for the Commission will have studied the conditions and have seen the witnesses. In the Atlantic Coast Line case (206 U. S. 1) a jury in North Carolina found that the public interest required the running of an additional train at a loss to the road of $15 a day. The Supreme Court held that it was lawful for the state commission to compel such service. The court distinguished between a single rate and a schedule of rates; between a single train and an entire passenger service. The state must allow the road a reasonable return for its entire service, but still it may be justified in requiring a single train to be run at less than cost.

In the Illinois Central case referred to the court held that a railroad has no right to put its earnings into betterments and at the same time pay dividends, if the two appropriations together

Trestle Between Tunnels 3 and 4; Bay Shore Cut-Off.

Tracks and Tunnel 6; Bay Shore Cut-Off.

exceed a reasonable return on the value of the property. Improvements which are to increase the value of the property for many years must be paid for out of net income and not out of earnings.

Insufficient Railroad Facilities. The report, written probably two months ago, speaks of the shortage of freight cars and the lack of track capacity and other things which have blocked freight traffic during the past year, but the only recommendation is that "all who believe in the full development of the country should give earnest thought" to the problem.

Tariffs. An immense amount of work has been done in systematizing freight and passenger tariffs and condemning irregular and unlawful issues. Much is being done, but much remains to be done. In the year ending November 30, the Commission received 220,982 tariffs and about 100,000 notices of concurrence in tariffs. The task is declared to be by no means hopeless. The Commission believes that it is empowered by the law to modify the requirement that tariffs shall be posted in every station and proposes to issue an order allowing tariffs to be kept in the agent's office. He must keep those applicable at his station, and at one station on the road there must be a complete file of rates applicable from all stations. Every agent must have an index of this complete file. Agents must aid inquirers to interpret the tariffs, without asking them to give a reason for their inquiry.

Bills of Lading. The Commission expects soon to prescribe a uniform bill of lading which will be acceptable to all the railroads.

Uniform Classification of Freight. This is again mentioned and the Commission feels much satisfaction that the railroads are trying to carry out its wishes.

Opinions. The principal decisions made by the Commission during the past year are given in an appendix, and the more important ones are summarized in the report itself. These deal with free transportation, party-rate tickets, violations of the anti-trust act, unreasonable rates, estimated weights, elevator charges, compression of cotton in transit, undue discrimination in rates and in facilities, and through routes and joint rates. The number of contested cases decided from the time the revised law took effect to November 11, 1907, was 107. In 46 cases orders were made against the defendants; in 46 the complaints were dismissed, and in 15 no orders were issued.

Rebating. The Commission now has a "Division of Prosecutions" which has in charge investigations into criminal violations of the act to regulate commerce. This division prepares cases to be sent to the Department of Justice. Investigations made during the year show that rebating by payment of money or by billing at secret rates is now "far less" common than ever before, but preferences of a less tangible kind are still enjoyed by some shippers. These present practices are briefly described, including cases where a railroad buys property from a shipper at an exorbitant price, and even in some cases stipulating that the price of the property shall be determined by the number of shipments made.

Court Decisions.—A detailed résumé is given of court decisions since December 1, 1906, which have sustained the Interstate Commerce Commission law, such, for example, as that decision in the Standard Oil prosecution where a fine of $29,240,000 was imposed.

Work Done. During the past year the Commission has received 5,156 complaints, formal and informal, and has begun 415 formal investigations. The number of hearings held has been 276; more than three times as many as in former years. All departments of the work of the Commission in this direction show large increases. The aggregate amount of reparation awarded was $104,700, and about 200 reparation claims were denied. These claims are so numerous that the work has been made a special department of the Division of Statistics and Accounts.

Block Signal and Train Control Board.—The work of this board was noticed in the *Railroad Gazette* of January 10. In connection with the work of this board, the Commission suggests that Congressmen who want to have the board take up and consider all sorts of so called safety devices should have the scope of the law enlarged to provide for this.*

Block System.—A chapter is given, as in former years, briefly summarizing the accident reports as published in the monthly bulletins for the periods up to June 30, 1907. The number of passengers killed in train accidents for the last four years has averaged 303 a year. As in former years, the board recommends a law to compel the establishment of the block system and to empower the Commission to investigate train accidents. This subject and the necessity of suspending proposed increases in railroad rates until their justice can be investigated are emphasized by the Commission as the two specially important matters of the report. On the block system bill the Commission says, in part:

The collision horror continues to be a crying evil. There has, indeed, been a steady increase in the use of the block system on the railroads of the country, but in the great activity in passenger travel of the past few years, which has been rapidly growing year by year, the passenger business of non block signaled lines has increased, with that of others, and many passengers have been killed in collisions. In the few serious collisions that have occurred on block signaled lines the management and discipline in every case with possibly one exception have been shown to be glaringly faulty, demanding government investigation. This demand is urgent, as has been set forth in our previous reports.

So far as the Commission is aware the only objections to this proposal are: (1) That the accident record and its death list grow because traffic is growing, there being apparently no new causes, nor any reason existing now which has not existed for many years, which would warrant legislative action; (2) that the principal railroads are gradually extending the use of the block system without compulsion, and that therefore a law would be an unnecessary governmental interference with private enterprise; (3) that governmental action is liable to be harmful because of the difficulty of dealing by statute with such a subject as block signaling, embracing, as it does, complicated and delicate machines, a variety of details in operation and difficult scientific questions.

These arguments are adequately answered by obvious facts.

1. As percentages and averages in this matter contain very little instructive information, the first argument, as an argument, may be admitted. But it should have no weight unless we are ready to admit also that the evil referred to is incurable. Collisions continue to occur from the same causes that figured in the records forty years ago. Some of our railroads have taken successful measures to remove those causes; others have not. The principal remedial action has been the introduction of the block system.

2. The principal railroads have the block system in use and are extending it. But this extension is irregular and is subject to hindrances, and some prominent roads are extending it too slowly or not at all. A regulative and compulsory law is necessary to insure regular and uninterrupted progress. Errors of judgment on the part of railroad managers and engineers, or disagreements between such officers and their superiors, who, not well informed, refuse appropriations for signal improvements, have in well known instances proved decided obstacles to progress, and disastrous collisions have followed such procrastination.

3. The measure recommended by the Commission would not deal with the details of block signaling. As in the case of the safety appliance laws, it would simply require, in substance, that the railroads as a whole shall make progress in a direction in which the most intelligently managed roads are already making progress. The Congress would do a great service if it were only to compel the laggards to keep abreast of the standards of progress set by the best managed lines. The principal thing proposed, aside from the main requirement, is the provision for governmental supervision. Again making comparison with the safety appliance law, the situation as regards block signals is like that which the law of 1893 encountered in the case of automatic car couplers—a fair degree of uniformity (on the best roads) in the fundamental feature, but great diversity in details.

These details are not unimportant, however. Probably it is not a proper function of the Government to rigidly regulate or prescribe them, but it is important that they be given more publicity, and the Federal Government is the only authority which can bring about such publicity. In its two main provisions—(1) for a very liberal and unconditional requirement that the block system be used, and (2) for investigation, inspection, and supervision of block signal practice—the proposed measure is the same as that which was passed in Great Britain over seventeen years ago and which has produced such highly satisfactory results in that country. In a sense, supervision of block signaling has greater possibilities for good, as a governmental function, than has investigation of accidents, for it looks toward prevention of a certain class of accidents without waiting for the object lesson of an actual disaster.

It will perhaps be fair and just to require the railroads to adopt the block system in a shorter period of time than has been heretofore suggested. Some roads have made nearly or quite as rapid progress in the introduction of block signals as would probably have been required by law. It is believed, therefore, that no injustice will be done if railroads, or parts of railroads, having passenger receipts of $1,500 per mile per annum, are required to be brought under the block system in two years. Railroads having total receipts from all traffic of $3,000 per mile per annum should be subject to the same requirement.

Laws looking to the compulsory establishment of the block system are now in force in Massachusetts, Minnesota and Indiana, and the revised public service law of New York gives plenary powers in this matter to the public service commission of that State. There is as yet no indication that there will be any conflict between State and Federal laws on this subject, but as any law which the Congress, pursuant to the constitutional provision, may pass concerning interstate railroads will, without doubt, prevail as against any conflicting State statute, it is desirable that action be taken by the Congress without delay and before the state legislatures shall go further.

Investigation of Accidents. The investigation of collisions, derailments, and other serious accidents on railroads by competent experts is a matter deserving the careful attention of the congress. A recommendation to authorize such investigation has been made in previous reports, and the same recommendation is now again made. The daily and technical press have both endorsed the recommendations which have been made by this Commission. The causes of railroad accidents are often complicated and obscure and a cross examination and sifting of evidence is necessary in nearly every important case in order to bring out the truth and to rightly apportion the blame. Unlike some of the questions connected with the subject of rates, or other matters not affecting the safety of lives or the security of property, this subject of accident investigation (as well as that of block signaling) is one on which there is no doubt as to public policy. All persons are agreed that the lives of passengers on railroads should be better safeguarded, and there is little, if any, dispute as to the direction which any government activity should take.

As has been pointed out in previous reports, all railroad accidents should be reported to the Commission monthly, relieving the railroads' annual reports of this feature. To provide for this and as a definite embodiment of the recommendation for investigation a tentative draft of a bill is given in the Appendix.

Terra Cotta Collision.—In this chapter the Commission makes its first report on the collision at Terra Cotta, D. C., December 30,

*Senator Crane, of Massachusetts, on Jan. 9, introduced a resolution looking to the enlargement of the functions of the board.

1906, when 43 persons were killed. Acting under the Congressional resolution authorizing the Commission to investigate the subject of block signaling, a special inquiry was made into this accident. The report now embodied in the annual report is brief and apparently not intended as an exhaustive study or a formal decision. It says:

An extra train of empty passenger cars struck a regular train heavily loaded with passengers upon a division of road which was equipped with block-signal system, of manual control. Several intelligent and credible eye-witnesses testified that red signal was displayed against this extra train at a block-signal station passed by it shortly before the collision occurred; that the signal was disregarded, and that train proceeded at a high rate of speed. This was corroborated by telegraph operators who heard the operator in charge of that signal immediately report by wire the fact that this train had run by his red signal. The men who were employed on this train testified that if a red signal was there they did not see it. The testimony was conflicting and contradictory between the men on the train and those at the station as to the character of the signal displayed when this extra train passed the block signal station next preceding the one at which it was alleged the danger signal was disregarded.

Inquiry was made as to the care with which employees in charge of trains and engines and of block signal stations were selected, and as to the thoroughness with which their fitness for the positions was tested and determined. Many young and rather inexperienced men are employed as block-signal operators, but it was not shown that neglect or lack of experience on their part contributed to this disaster.

If the preponderance of evidence as to the condition of the signal at the last signal station passed by this train before the wreck occurred is accepted, the men in charge of that extra train are thereby convicted of having run by a danger and positive stop signal. On the other hand, if their own testimony as to the condition of the signal at the last signal station but one which they passed before the wreck occurred is accepted, they are thereby convicted of having entered the block under a caution signal, which, under the rules of the company, required that they run through the block with extreme care and with train under full control, and of having run through that block at a high and dangerous rate of speed, especially in view of the fact that at the time a dense fog prevailed; which fact, under the rules, would require extraordinary care and caution. Many references were made to incidents or instances of more or less important infractions of rules by employees and of absence of rigorous discipline by the company. This wreck was caused by disregard of rules and signals upon part of the men in charge of the extra train. Inquiry did not disclose act or omission on part of other employees or defect in the operating rules of the company which contributed to this awful occurrence. These men took charge of this train at noon and the collision occurred about 7 o'clock in the evening.

Concerning the collision at Lawyer, Va., where President Spencer was killed, the Commission made no investigation, but embodies in the report the conclusions published by the Virginia State Corporation Commission. These were given in the *Railroad Gazette* of May 24, 1907.

Safety Appliances.—From reports made to the Commission by its inspectors of safety appliances, the general condition of cars appears to be much better than it was a year ago. Somewhat fewer cars were inspected during the last year, the number being 271,617 for 1906, and 242,881 for 1907. Calls upon inspectors to investigate complaints of violation of the law were more numerous and they were also engaged more frequently as witnesses in court. For each 1,000 cars inspected in 1906 there were 139.34 defects; in 1907 there were but 94.14.

By an act of the last Congress the Commission's inspectors are required to examine mail cars and to report upon their construction, adaptability, design and condition. Since July 1, 1907, 70 postal cars have been inspected. Copies of reports of these inspections have been transmitted to the Postmaster-General, in compliance with the terms of the law.

Rigid enforcement of the interchange agreement, adopted as a result of conference between the Commission and the railroads, is largely responsible for the improved condition of equipment. The fact that cars cannot be delivered to nor received from connecting lines with defective safety appliances has practically resulted in double inspection. Cars are inspected upon arrival at a terminal or interchange point and again before delivery to a connecting line. This system works admirably and gives satisfaction wherever it is enforced. The roads most rigid in observing the interchange agreement are the ones upon which cars are found in the best condition.

Considerable increase in the number of men employed by railroads in repair work has been made at some points, but there are still places where more men could be employed to advantage. Difficulty in securing competent men has caused disabled cars to accumulate, and bad-order cars have been moved long distances to points where repairs could be conveniently made. As a result many complaints have been made concerning the movement of cars without drawbars and attached to one another by means of chains. This practice is extremely dangerous and the Commission has made every effort to put a stop to it.

The courts have decided that carriers must have men and material necessary to make safety-appliance repairs wherever there is likelihood of defects occurring, and to haul a disabled car past a repair point because it is more convenient to have repairs made at some point farther on is a violation of the law. A decision to this effect was made by Judge McPherson in a case against the Chicago, Milwaukee & St. Paul, November 27, 1906 (149 Fed. Rep., 486). This case has been taken to the Circuit Court of Appeals by the railroad company; argument has been had and the case submitted. A decision holding the movement of chained up cars unlawful was also made by Judge McCall on June 11, 1907 (154 Fed. Rep., 516).

In nearly all train yards of importance men are now specially employed for the purpose of looking after the condition of safety appliances. These men have become trained in their work and more readily detect defects than the ordinary inspectors who have other duties to attend to. The employment of traveling inspectors by railroads has also done much to improve conditions. These inspectors educate repairmen.

The number of cars equipped with air-brakes has greatly increased, due largely to the order of the Commission increasing the percentage of air brakes to be used in trains on and after August 1, 1906, and also to a rule of the Master Car Builders' Association requiring all cars delivered in interchange to be equipped with air-brakes. This rule went into effect September 1, 1907, but it was anticipated for some months previous to that date by practically all the large roads in the country, which refused to receive cars from their connections unless they were equipped with air-brakes. While this increase in the number of air-brakes used is gratifying, it must be noted that the maintenance of air-brake equipment has not been up to the standard. Insufficient attention is paid to the matter of piston travel, train pipe leakage, and the proper cleaning and oiling of triples.

Comparatively few train yards are equipped with testing plants, and cars are often permitted to leave terminals without a proper brake test. This results in many defective cars being hauled in trains and a consequent decrease in braking power. * * * Complaints are numerous concerning the bad condition of hand brakes. * * * Many employees have suffered serious injury in gravity yards because of defective hand-brakes, and to this cause may be attributed much of the damage to cars and their contents which is commonly laid to rough usage or carelessness in switching.

The safety-appliance law should be amended so as to cover all appliances included in the Master Car Builders' standards for the protection of trainmen; sill steps, ladders, roof hand holds and running boards. These appliances are necessary for the safety of employees, and it is important that they be kept in first class condition. There should also be an amendment to the law requiring the use of automatic air and steam hose couplers. Men are subjected to danger by going between the cars to couple and uncouple hose. Many casualties are due to this cause and as automatic appliances for the connection of steam and air hose are no longer an experiment, it is believed that their use may properly be enforced by law.

In general, carriers have shown a disposition to comply with the law and have co-operated with the Commission to secure its proper enforcement. The Commission has endeavored to secure the ends of the statute without prosecution wherever possible. Since our last report 171 cases, involving 716 separate violations of the statute, have been filed in court. In 29 cases, involving 117 violations, verdicts have been rendered for the Government; in four cases, involving 28 violations, there have been verdicts for the defendant. Two cases have been dismissed by the Government on account of technical error in complaint. The four cases in which verdicts in favor of defendant were rendered have been appealed.

Since the last report of the Commission, the important case of Schlemmer v. Buffalo, Rochester & Pittsburg Railroad Company (205 U. S., 1) has been decided by the Supreme Court of the United States [*Railroad Gazette*, March 15, 1907]. * * * In one count of a case against the Missouri Pacific, decided by Judge Munger, Nebraska, October 5, 1907, involving the height of drawbars, a verdict was rendered for the road, the court holding that the language of the regulation is indefinite in that the 3 in. variation from the standard height of 34½ in. might apply either way. * * * Up to date judgments to the amount of $45,000 have been had against carriers for violation of the statute. In a total of 282 violations involving fines amounting to $28,200, the repairs necessary would have cost but $68.03.

The question of the safe handling of trains on heavy grades has been brought to the attention of the Commission, it being contended that a literal interpretation of the law requires that trains shall be handled exclusively by means of air-brakes under all circumstances and conditions of train operation. The object and intent of the law is to save life. If trains cannot be handled upon these heavy grades without the use of hand-brakes it is certainly not the intent of the law to require that they be controlled by air alone. The Commission has examined the practices in handling trains on heavy grades in all parts of the country. A report concerning this matter is now being prepared and will be published later.

Medals of Honor.—By an act of Congress of February 23, 1905, the President of the United States is authorized to bestow bronze medals of honor on persons who by extreme daring, endanger their own lives in saving, or endeavoring to save, lives from any wreck, disaster, or grave accident upon railroads engaged in interstate commerce. Up to date 17 applications for medals under this law have been received by the Commission. Seven of these applications were not supported by sufficient evidence and could not be acted upon. In the 10 other cases, eight applications have been approved and medals awarded, two applications have been rejected. The names of persons to whom medals have been awarded will appear in an appendix to this report.

Uniform Railroad Accounts.—The report summarizes what has been done during the past year in prescribing methods of railroad bookkeeping. Before the beginning of the next fiscal year, July 1, 1908, rules will be prescribed for the financial accounts of railroads. Congress is again asked to authorize an official valuation of the property of all the railroads of the country, and the reasons for recommending this are given. The government is going to require the railroads to keep depreciation accounts, as being an essential feature of any system which is to show the true cost of maintenance, and a valuation is declared to be necessary as preliminary to this. Fifteen states have already provided for a more or less complete valuation of railroad properties.

Having prescribed bookkeeping rules for the railroads, the Commission now requires the person at the head of the accounting department to take the responsibility of seeing that the law is obeyed—that is, to see that the accounts are kept according to the prescribed rules.

State railroad commissions are uniformly in favor of doing everything possible to make their accounting forms uniform with those of the Federal Commission. This is especially desirable in connection with electric roads, for not more than one-fifth of such lines come within the jurisdiction of the Federal Commission. The National Association of Railway Commissioners has requested the Interstate Commerce Commission to establish a bureau of correspondence for the purpose of unifying statistical practice throughout all the Commissions, and this will be done.

The Commission proposes to establish a large board of special examiners to keep track of the accounts of all the railroads throughout the country.

Preliminary Statistics to June 30, 1907.—For the last fiscal year ending June 30, 1907, returns have been received for 894 railroad companies, representing an operated mileage of 225,584.30 miles, or, presumably, more than 99 per cent. of the mileage that will be covered by the final report.

This advanced report shows that the gross earnings of the roads it covers for the year 1907 were $2,585,913,002; passenger service, $683,980,921, or 26.45 per cent.; freight service, $1,826,209,111, or 70.62 per cent., and miscellaneous earnings, $75,722,970, or 2.93 per cent. The gross earnings averaged $11,463 per mile. This average exceeds the like average for any prior year since the Commission was organized. The gross earnings the year before averaged $10,460. The operating expenses of the roads covered by the 1907 preliminary report were $1,746,097,122, equivalent to $7,740 per mile. Net earnings were $839,815,880, or $3,723 per mile, and the net earnings for the corresponding roads for the year 1906 were $787,420,827.

The total income of the operating roads covered by the preliminary report was $997,350,465. There was charged against this amount for interest, rents, betterments, taxes and miscellaneous items the sum of $605,916,745, and also as dividends the sum of $259,233,580, leaving a surplus for the year of $132,200,140. The amount of taxes charged to income during the year was $73,617,082. Since the preliminary report pertains to operating roads only, it does not include any dividends paid by leased lines from the income which they received as rent. It may be said, however, that the dividends declared by subsidiary leased lines for the preceding year ending June 30, 1906, amounted to about $43,000,000.

The report also gives an abstract of the final report of the statistics for the year ending June 30, 1906. These statistics were reported in the *Railroad Gazette*, September, 20, 1907.

The Maffei Locomotive Works of Munich has delivered to the Baden State Railroad an express locomotive described as of the "Pacific" type, with frame of American design, which has made satisfactory trial trips with 13 eight-wheeled cars, and speeds reaching 68 miles per hour.

Car Surpluses and Shortages, Jan. 22.

The following table, from the current Bulletin of the American Railway Association's Committee on Car Efficiency, summarizes the situation of Jan. 22, in comparison with previous periods, as follows:

Date.	No. of roads	Surpluses Box	Flat	Coal gondola and hopper.	Other kinds.	Total.	Shortages Box.	Flat	Coal gondola & hopper	Other kinds	Total
Jan. 22, 1908	153	125,226	26,[illegible]58	110,928	45,111	339,053	392	132	79	135	738
Jan. 8, 1908	160	149,624	23,059	127,126	41,874	341,683	457	34	42	120	653
Dec. 24, 1907	158	87,714	14,740	62,150	42,276	206,880	187	81	191	265	724
Dec. 11, 1907	153	48,977	9,888	27,462	33,012	119,339	2,506	429	746	848	4,529
Nov. 27, 1907	160	16,246	3,645	10,028	10,429	40,348	11,908	868	2,964	2,224	17,964
Nov. 13, 1907	161	4,103	1,298	2,365	4,525	12,291	37,473	3,008	10,314	[illegible]	57,[illegible]93
Oct. 30, 1907	161	780	600	1,285	1,275	3,940	61,592	3,516	15,987	9,632	[illegible]

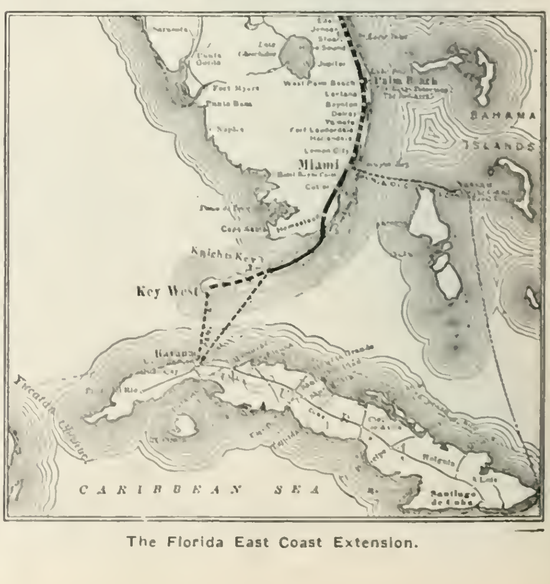
From Oct. 30 we see the conditions changing with each fortnightly report until on Jan. 8, 1908, there is a total of 341,683 idle cars of all classes on 160 roads, and on Jan. 22, 339,053 surplus on 153 roads. The figures for Jan. 22, while representing fewer roads than previous reports, include all the larger roads and are fairly comparable with figures for earlier dates.

While the most severe effects, as indicated by the surplus figures, were felt in the eastern and middle states, comprising roads, a large proportion of whose business is iron, steel and coal, it is notable that the earliest indications of surplus are in the northwestern states, which on Nov. 13 reported a large net surplus of box cars, while other groups still reported large shortages of all classes of equipment. On Nov. 27 the grand total surpluses exceeded the shortages, not only in the total cars, but also by classes. The surplus was still heaviest in the northwest, while the Eastern, North Atlantic, Southern, Pacific and Canadian roads still reported more shortages than surpluses of box cars. Coal and gondola cars had, however, begun to grow plentiful in the eastern and middle states, and by Dec. 11 there was a large surplus of cars in these classes.

The Canadian roads reported gradually diminishing shortages and increasing surpluses until Dec. 24, when the conditions quite suddenly became aggravated, and the reports for that and subsequent dates denote conditions similar to those existing in the United States. From the reports for Jan. 22 an improvement in the box car situation seems quite general, while the western roads have also reduced their accumulation of gondola and coal cars. These latter classes, however, still show large surpluses in the east, which will be gradually reduced if there is an improvement in the general business situation. What effect the unusual conditions of the past few weeks have had on the general car performance can only be estimated until such time as complete statistics covering this period are available. There is little doubt, however, that one of the results which will be shown is an enormous increase in empty car mileage, a large proportion of which would seem to have been unnecessary.

The Florida East Coast Extension.

The extension of the Florida East Coast Railway southwest along the Florida Keys to Key West has often been described in the *Railroad Gazette*. Articles describing the nature of the work



The Florida East Coast Extension.

or the progress made were published on Oct. 6, 1905; April 20, 1906; April 26, 1907; Aug. 30, 1907, and Oct. 11, 1907.

About the middle of January, track was laid on the extension as far as Knight's Key, 109 miles south of Miami and 47 miles short of the eventual terminus at Key West. On Feb. 5 the first train for which tickets were sold was run and on Feb. 6 regular passenger service was begun, with through connection to Cuba by a new steamer service from Knight's Key to Havana, 115 miles away, the Havana service of the Peninsula & Occidental Steamship Company from Miami being at the same time abandoned. Passengers leaving Miami at 11 a.m. are due to reach Knight's Key at 4 p.m. and Havana at 6.30 a.m. the next day.

The Ocean Viaduct. Trains in Crossing It Go out of Sight of Land.

The remaining 47 miles to Key West of the extension are to be finished within a year. Key West is only 90 miles from Havana, and it is planned eventually to connect the two points by a car-ferry service which will take trains straight through, making direct connection with the standard gage railroad system of Cuba. The accompanying photographs show typical scenes along the line of the extension and the temporary terminal at Knight's Key from which the boats for Havana start. The longest of the viaducts on the whole extension is from Long key to Grassy key, 5½ miles over the bed of the ocean. This is on the road already in operation. The rails are carried 31 ft. above the mean surface level of the water on a reinforced concrete viaduct. On this viaduct trains go out of sight of land. The accompanying map shows the route of the extension, the steamer connection from Knight's Key to Havana, and the proposed car-ferry connection from Key West to Havana.

Cocoanut Palms Along the Beach of One of the Keys.

It is expected that the completed route will get a large part of the passenger, express and light freight traffic between Cuba and the United States, besides a certain share in through freight traffic. Florida tourists in particular will be likely to take a trip to Cuba. Cuba is only about one-tenth under cultivation and there are great possibilities for profitable investment there which would be likely to be taken up if brought directly to the attention of Americans. On the other hand, a large proportion of even the wealthy Cubans have never left the island because of the dread of seasickness. A route which requires only five or six hours water trip is likely to attract many of these. One great advantage of the extension will be that deep draft vessels can be used between Florida and Cuba. Previously only light draft vessels could be used on account of the shallow water in Miami harbor.

The Florida East Coast Railway is the personal property of Henry M. Flagler, of the Standard Oil group of capitalists, and the extension is his personal enterprise. Every share of stock and every bond of the company is owned by Mr. Flagler, except $3,500,000 three-year 6 per cent. notes dated August 1, 1907, secured by all the outstanding first mortgage bonds of the Florida East Coast and also by the personal endorsement of Mr. Flagler, which were issued to provide funds for the construction work.

One of the results of the building of the Siberian Railroad has been the establishment of 2,200 creameries in Siberia. A large part

Temporary Terminal at Knight's Key for Havana Steamers.

Work Train on Ocean Viaduct.

of the butter made in them is exported to Germany and western Europe. Regular dairy trains with refrigerator cars carry this butter to Baltic ports, distant 1,830 to 2,550 miles. The number of creameries and the quantities of butter exported increase constantly. In the four months to July 31 over 11,000,000 lbs. were shipped.

Accident Bulletin No. 25.

The Interstate Commerce Commission has issued Accident Bulletin No. 25, giving a summary, in the usual form, of the railroad accidents in the United States during the three months ending September 30, 1907. The number of persons killed in train accidents was 346, and of injured, 4,990. Accidents of other kinds bring the total number of casualties up to 23,063 (1,339 killed and 21,724 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.

TABLE NO. 1.—*Casualties to Persons.**

	Passengers Kil'd.	Passengers Inj'd.	Employees† Kil'd.	Employees† Inj'd.	Tot'l persons reported Kil'd	Tot'l persons reported Inj'd.
Collisions	77	1,563	119	1,182	196	2,745
Derailments	33	1,076	80	713	113	1,789
Miscellaneous train accidents		24	37	432	37	456
Total train accidents	110	2,663	236	2,327	346	4,990
Coupling or uncoupling		.	87	986	87	986
Other work about trains or switches	.	.	81	4,910	81	4,910
In contact with bridges, structures, etc.	2	18	37	424	39	442
Falling from or getting on cars or engs.	60	672	227	3,534	287	4,206
Other causes	23	872	176	5,318	199	6,190
Total, other than train accidents	85	1,562	908	15,172	993	16,734
Total all classes	195	4,225	1,144	17,499	1,339	21,724

*In Table No. 1 "passengers" includes passengers travelling on freight trains, postal clerks, and express messengers, employees on Pullman cars, newsboys, live-stock tenders, and men in charge of freight.

†Accidents to employees resulting in slight injuries which do not prevent the employee injured from performing his accustomed service for more than three days in the aggregate during the ten days immediately following the accident are not reported.

That the enormous activity in traffic, which has been a factor in the explanation of previous bulletins, was still undiminished in the period here reported on, is indicated by the marked increase in casualties to passengers from causes not connected with train accidents (85 now, 58 a year before); for this item undoubtedly contains a proportion, larger than others in the table, of accidents which, from the railroad standpoint, are to be classed as unavoidable, and therefore in the long run showing totals more directly proportionate to the number of persons traveling.

Increases are shown in the other principal items (see Table 1*a* below), except Item No. 1; but in this connection it is to be borne in mind that Bulletin No. 24 represents a quarter in which the volume of traffic, and consequently the number of casualties, usually is lighter than in either of the other quarters of the year.

As to Item No. 1—passengers killed in train accidents—a black record is again presented. Three collisions (Nos. 26, 27 and 30, in Table 2*a*) and one derailment being responsible for 80 deaths in this class, an average of 20 passengers to each of the four accidents. Particulars of these and other notable collisions and derailments are given, following Table 2*a*.

TABLE NO. 1*a*. *Comparison of Principal Items with Last Bulletin and with One Year Back.*

	Bulletins No. 25.	No. 24.	No. 21.
1. Passengers killed in train accidents	110	48	52
2. Passengers killed, all causes	195	111	110
3. Employees killed in train accidents	236	202	215
4. Employees killed in coupling	87	72	81
5. Employees killed, all causes	1,144	954	1,072
6. Total passengers and employees killed, all causes	1,339	1,065	1,182

The total number of collisions and derailments in the quarter now under review was 4,279 as below.

TABLE NO. 2.—*Collisions and Derailments.*

[NOTE.—Collisions and derailments which cause no death or personal injury and which cause not over $150 damage to the property of the railroad are not reported.]

	No.	Loss.	Persons Killed	Persons Injured.
Collisions, rear	508	$524,607	31	605
" butting	277	570,473	121	1,229
" trains separating	128	52,848		68
" miscellaneous	1,332	617,613	44	843
Total	2,245	$1,765,541	196	2,745
Derailments due to				
Defects of roadway, etc.	111	$117,761	17	601
Defects of equipment	865	827,287	16	297
Negligence, train or signalmen, etc.	141	119,574	17	176
Unforeseen obstruction of track, etc.	87	135,020	12	122
Malicious obstruction of track, etc.	24	64,061	7	65
Miscellaneous causes	506	476,452	44	528
Total	2,034	$1,840,155	113	1,789
Total collisions and derailments	4,279	3,605,696	309	4,534

Following is the usual list of Class A train accidents—all in which the damage is reported at $10,000 or over; notable cases in which passengers are killed, and those doing damage less than $10,000 and down to $2,000, wherever the circumstances or the cause may be of particular interest.

TABLE 2*a*. *Causes of Forty-Nine Prominent Train Accidents (Class A).*

[NOTE.—R stands for rear collision; B, butting collision; M, miscellaneous collisions; D, derailment; P, passenger train; F, freight and miscellaneous trains.]

COLLISIONS.

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
1	R	F. & F.	0	0	$2,300	83	Engineman on duty 17 hrs. and asleep; passed automatic block signal set against him; also passed flagman.
2	B	P. & F.	0	23	2,600	12	Freight train wrongfully admitted to block section; struck passenger train standing at station; in freight part of air brakes had been cut off, but trainmen had not discovered the fact; had not tested at proper time.
3	R.	F. & F.	0	3	3,252	98	Engineman asleep; approached station at uncontrollable speed; 2 a. m.
4	M	P. & F.	0	1	3,400	4	Error in despatcher's order; two words, including name of station, written twice by receiving operator; despatcher did not detect error when order was repeated.
5	B	F. & F.	5	6	4,300	85	Approached station at uncontrollable speed; victims were employees in caboose of work train.
6	B.	P. & F.	8	32	4,600	7	Engine in charge of hostler encroached on time of passenger train; 8 passengers killed; hostler had been misinformed as to lateness of passenger train by operator, who had misread an order.
7	R.	F. & F.	0	0	4,800	2	Failure of air brakes; angle cock having been shut between first and second engines of "double-header." Angle-cock lever had been moved by cylinder-cock rod pressing against it.
8	R	F. & F.	0	0	5,000	101	False clear telegraph block signal.
9	B	F. & F.	0	1	5,550	52	Despatcher's order copied incorrectly (1,381 for 1,382), was repeated correctly.
10	M	F. & F.	2	8	6,500	51	Freight waiting on side track, 2 a. m.; men failed to see green signals carried by passing train; signals dim; train on side track 50 ft. from main track, not seen by men on passing train and whistle signal consequently not given.
11	B.	F. & F.	0	6	7,460	14	Careless management of block signals and failure to deliver meeting order; responsible operators had had only five months' experience.
12	B.	P. & P.	1	11	7,700	99	Engineman forgot meeting point (Sunday schedule), though he had been cautioned by conductor at beginning of trip; engineman killed.
13	R	F. & F.	0	2	7,704	88	Engineman, on duty 17 hrs. in last 19 hrs., fell asleep and passed automatic block signal set against him; also passed flagman.
14	B	P. & P.	1	7	8,200	10	Despatcher completed meeting order to inferior train before properly placing order for superior train.
15	B.	F. & F.	1	2	9,300	58	Failure to deliver meeting order; operator, without leave, had put substitute in his place for 30 minutes and had not properly informed substitute about the order.
16	R.	P. & F.	1	2	10,000	91	Freight train, 1 a. m., unexpectedly stopped, was not protected by flagman.
17	B	F. & F.	4	1	10,185	51	Conductor and engineman of extra freight overlooked schedule of regular train.
18	M	F. & F.	1	2	11,350	92	Cars escaped from yard and ran on main track; had been left unsecured by negligent switchmen.
19	B.	P. & F.	3	53	11,433	17	Freight train ran over misplaced switch and through crossover track into passenger train.
20	M	P. & F.	0	0	12,963	8	Collision at crossover; train approached station at uncontrollable speed.
21	R	F. & F.	0	2	13,710	18	Runaway on 3 per cent. grade; carelessness in starting from side track on grade, three trainmen being on the ground instead of at their posts on the cars or engine.
22	B	F. & F.	4	5	14,261	86	Operator (in service one month) accepted meeting order after train had passed, having been asleep.
23	R	P. & F.	0	5	14,350	40	Runaway on 1½ per cent. grade; insufficient brake power. In taking on cars trainmen had neglected to connect and test air brakes.
24	B	P. & F.	3	27	15,000	59	Conductor and engineman forgot meeting order.
25	M	P. & P.	0	36	16,080	95	Approached station at uncontrollable speed. (See text below.)
26	B	P. & F.	10	32	16,496	87	Operator turned eastbound passenger train to wrong diverging track; six passengers killed. (See text below.)
27	B	P. & F.	20	105	17,785	6	Conductor and engineman of freight misread despatcher's order. (See text below.)
28	B	F. & F.	0	2	18,558	97	Meeting order not delivered. (See text below.)
29	B	F. & F.	1	7	24,600	3	Freight ran past appointed meeting station.
30	B	P. & F.	26	33	25,000	89	Mistake in despatcher's order. (See text below.)
31	B	P. & P.	4	4	40,000	57	Meeting order not delivered. (See text below.)
	Total		105	424	$354,857		

DERAILMENTS.

No.	Class.	Kind of train.	Killed.	Injured.	Damage	Reference to record.	Cause.
1	D	P	5	13	$1,125	122	Failure of 100-lb. rail, 9 years old;

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
							cracked between ball and web; four passengers killed.
2	D.	P.	0	0	5,448	35	Interlocked switch thrown under moving train, detector bar having failed; bar ½-in. thick, 2½ inches wide, was supported by "motion-plate" clips.
3	D.	P.	3	8	7,300	29	Cause unexplained; engine running tender first. Two passengers killed.
4	D.	P.	1	8	8,223	79	Excessive speed on 10-degree curve.
5	D.	F.	3	0	9,370	112	Runaway on steep grade; air pump had stopped; engineman (killed) was capable and experienced.
6	D.	F.	0	0	10,176	111	Spreading of rails.
7	D.	P.	0	9	10,450	75	Track distorted by solar heat; track inspected one hour before.
8	D.	P.	14	19	13,700	116	Unexplained. (See text below.)
9	D.	F.	0	0	14,660	78	Runaway of 38 freight cars; had been left on side track without being secured by handbrakes; cars ran 27 miles and were then sidetracked by telegraphic order, and were wrecked.
10	D.	P.	0	31	16,000	82	Unexplained.
11	D.	P.	0	18	18,200	24	Misplaced switch.
12	D.	P.	5	27	18,800	81	Passenger train wrecked by running into parts of cars which had fallen upon its track in consequence of derailment of freight train on adjoining track, caused by broken flange.
13	D.	P.	0	9	23,000	63	Ran into hand car left on track by careless repairmen.
14	D.	F.	3	5	25,100	106	Runaway on steep grade; bad management of air-brakes.
15	D.	F.	0	0	32,200	62	Runaway of freight cars left standing on grade without hand-brakes being set.
16	D.	P.	0	25	45,100	120	Rail turned over, tie plates having been broken; rail, when no weight rested on it, stood in perfect position, though probably it had been loose some little time; track walker had just inspected the line.
17	D.	P.	2	13	56,000	124	Breakage of flange, wheel of tender.
18	D.	P.	0	32	63,000	114	Broken rail: train running 50 miles an hour on straight line; rail, 12 years old, had interior defect; greater part of loss due to fire from explosion of gas tank of sleeping car.
Total......			36	217	$377,852		
Grand total.			141	641	$732,709		

Collision No. 27 was between a westbound local freight train and an eastbound passenger excursion train of 11 cars. Twenty-eight passengers and two trainmen were killed and 102 passengers and three trainmen were injured. The freight train was running about 30 miles an hour and the passenger train about 40 miles an hour immediately before the collision. Both engines, six passenger cars, and three freight cars were wrecked. The men in charge of the freight train misread an order which they had received from the despatcher giving them the time at which the excursion train was due at the several stations. This order read:

Salem 9.10
Plymouth 9.25

But these men read it "Salem......9.25," and therefore allowed themselves 15 minutes more time in which to reach Salem than they could rightfully do; consequently they met the excursion train 1½ miles before reaching Salem. The figures "9.10" were not exactly opposite the word Salem, and this appears to be the explanation of the mistake in reading, though the operator in writing the order had made dotted lines from the name of the station to the figures showing the time, in order to insure a correct reading. In consequence of the figures being nearer the top of the sheet, as related to the words, these lines inclined upward from left to right. The engineman did not read the order aloud to the conductor, nor was it read either by the fireman or by any brakeman, though all these readings are required by the company's rules. The station operator who delivered the order (but who was not the same one who had written it) says that the conductor in his presence read the order correctly.

Butting collision No. 30, between eastbound passenger train No. 30 and a westbound freight train about 4 o'clock on a very foggy morning, killing 26 and injuring 33 persons, was due to an error in sending or receiving the number designating one of the trains in a despatcher's order. Two passenger trains running in the same direction, Nos. 30 and 34, being behind time, the train despatcher sent an order to the freight train giving it notice that the passenger trains would be a certain number of minutes late, respectively, between certain stations, thus permitting the freight to continue on its journey to meeting points different from those at which it would have met the passenger trains normally. One order was sent and delivered correctly. A second order, dealing with only one of the two passenger trains, was wrong. As delivered, it named the passenger train as "No. 30 thirty"; but it should have read "No. 34 thirty-four." Being read "30," it gave a wrong number of minutes as regards that train, and this led to the collision. Train No. 30 was represented to be an hour and ten minutes late, when, in fact, it was but 40 minutes late. A number of other orders were sent about the same time, so that the despatcher had both these train numbers in his mind; and the state railroad commissioners, who investigated the case, believe that the preponderance of evidence is in favor of the theory that the despatcher made the error in sending; but, so far as can be learned from the records at the despatcher's office and in the station telegraph office, and the testimony of the despatcher and of the station operator, the officers of the road say that it is impossible to decide which of these two persons committed the error. The operator wrote "No. 30 thirty," and declares that in repeating the order to the despatcher he sent in the same way that he had written. The despatcher, on the other hand, declares that he sent "No. 34 thirty-four," and that the operator in repeating wrote "No. 34 thirty-four." The operator had been in the service of the company at different stations for 23 years, and the despatcher had served as despatcher six years. The company gives good reputations to both of these men.

Derailment No. 8, causing the death of 14 persons and the injury of 19, is reported as due to some cause undiscovered. The train was running about 35 miles an hour on a 3-deg. curve, and it was thrown off the track just as it was passing a station. The cars in the front portion of the train ran to one side and were crushed against a locomotive standing on a side track, and the baggage car, reported as one of strong construction, penetrated the first passenger car—a smoking car—and killed or injured every person in this car, all the deaths being of persons riding in this car. The track was reported as in excellent condition, the rails weighing 80 lbs. per yard. The weight of the engine was 41 tons.

Collision No. 26, causing the death of 10 persons and the injury of 32, was due to a misplaced switch. The telegraph operator at S. turned an eastbound passenger train coming from single track to the left-hand instead of the right-hand of the two main tracks extending eastward from S.; that is, to the westbound track; and, after proceeding about three-fourths of a mile on the westbound track, this train collided with a westbound freight train. Under a general rule it is allowable for the operator at S. to send trains eastward to B. on the westbound track, and therefore the engineman took it for granted that the operator, in turning the train to the left-hand track, was acting in accordance with instructions from the despatcher; but in point of fact no such order had been given, and the operator had given a "proceed" signal under the mistaken assumption that the switch was set for the eastbound track. As soon as the train had passed his office he endeavored to telegraph to B., the next station east, and prevent the collision, but he was too late to do so. This operator had been in service at this office 15 days and in the service of the company five months 17 days. He had been on duty 20 hours, 50 minutes.

Collision No. 25 was due to the carelessness of an engineman in not keeping in mind a detail of a meeting order. Northbound train No. 38 and southbound train No. 35 were to meet at C at about 10 p.m. The order required the southbound train to enter the side track at a certain switch, and the train was passing from the main line to the siding at this point when it was struck in the side by the northbound train. The engineman of the northbound, contrary to the terms of the order, assumed that the southbound was to enter the side track at another switch, and, although he saw it approaching, he thought that it was already on the side track. The northbound engine and four cars were badly damaged, and the wreck took fire from an explosion of gas in the tank of one of the passenger cars. Of the total damage of $16,000, more than one-half is estimated as having been due to the fire, which includes the damage to five freight cars standing on the side track.

Collision No. 28 between a northbound and a southbound freight train was due principally to the failure of an operator to deliver a meeting order. He accepted the order from the despatcher after the freight train to which it was addressed had gone beyond his control. This operator, at L., had delivered a meeting order to two sections of a northbound regular freight train but on account of damage to one of the engines, which necessitated changing them, so that the engine and engineman of the second train were assigned to the first one, both trains were delayed about an hour. In consequence of this delay, the despatcher sent a second order changing the meeting point, but this later order was not delivered. The men of both the freight trains claim that, just before departing, they asked the operator if he had further orders for them, and that he replied that he had none. The operator denies this conversation. The operator, a few minutes after receiving the second order, was relieved by the night operator and in transferring his orders to the night man, informed him that the trainmen would come back to the office to sign for the order. This they did not do. The train despatcher is also held blameworthy for allowing the northbound train to pass another station 10 miles farther north, about an hour afterwards, without taking measures to stop it.

Collision No. 31, causing the death of two passengers and two trainmen, was due to errors in the writing of a telegraphic order, leading to its non-delivery, thus allowing a train to run past the meeting point fixed by the order. The order was to the conductor and engineman of train No. 412, and the train to be met was No. 611. In copying the order, the last number, 611, was copied 411. The order was received by the manager of the telegraph office in place of Operator B., who usually receives such orders, but who was temporarily out of the office. Just as the manager had finished, B. returned and took up the work of repeating the order to the despatcher. When he reached the last line and sent "411," the despatcher broke him and said "for 611." The operator acknowledged the correction but he did not properly correct his manuscript. He thought it was the address of the order (112) which was to be changed to read 611. After acknowledging the correction he sent the conductor's signature. An apparently correct repetition having thus been received at the despatcher's office, the despatcher authorized the order to be delivered to the inferior train at another station, so that it proceeded and met train 412. While the order was being written and repeated, the conductor of train 412 was standing at the window waiting for whatever orders the operator might have to give him; but he had not signed this order, and the operator committed a gross breach of the rules in telegraphing the conductor's name before the conductor had signed the order. After finishing with the despatcher, Operator B. gave to the waiting conductor two other orders, but omitted to deliver the one which he had just repeated. Operator B decamped and would not appear at the investigation of the accident which was held by the superintendent. He wrote, however, to the superintendent of telegraph claiming that he had not sent the conductor's signature over the wire. In the wastebasket of the office there was found the original order, with the address of the order, "To train 112," changed to read "To train 411," while on the table was a new order addressed to 411 which, evidently, Operator B. had made in place of the original, on the assumption that the correction which he had received from the despatcher referred, not to the train number at the end of the order, but to that in the address.

Table No. 3 gives the usual details of causes of accidents to employees in coupling and uncoupling cars, Table No. 3a the nature of such injuries, and Table No. 4 the details of causes of accidents to employees in falling from and getting on or off cars and engines.

Car Elevator for the Hudson & Manhattan.

At the Hoboken terminal of the Hudson & Manhattan Railroad's tunnels under the Hudson river a car elevator has been installed to carry passenger cars to and from the tunnels and the subway connecting with them. The passenger cars are 48 ft. long over all and 9 ft. wide; they weigh 61,000 lbs. empty and 85,000 lbs. loaded. The elevator has 100,000 lbs. lifting capacity and its platform is 50 ft. long and 12 ft. wide.

The elevator is in a wellway with reinforced concrete walls from the ground level to the tunnel. On the side walls are six steel columns supporting a steel girder framing directly over the hoistway and carrying the hoisting apparatus. This consists of two drum shafts each 50 ft. long, one placed near each side of the wellway. They are driven at their centers by four balanced worm gears, arranged so that the load on all four is equally distributed under varying platform loads. All thrusts are balanced by the worm shafts, which have right and left hand worms operating the worm gears. Both worms and gears run in oil baths in tight casings. They are driven by one 100-h.p. motor.

The main members of the platform are the two longitudinal steel girders, one under each rail. The floor is covered with diamond pattern steel floor plates. The platform is hung from 32 steel cables, ¾ in. in diameter, which pass under suspension sheaves below the floor and return to anchorage in the overhead structure. Half of the load is thus suspended directly from the overhead structure and half from the drums. In addition to these cables, there are eight counterweight cables of the same size. The platform weighs 32,000 lbs. and the counterweights, 64,500 lbs. The approaches to the elevator are protected by iron frame gates which close when the elevator platform is not at the landing. The movement of the elevator is controlled by a pilot switch operated by a hand shipping cable; the speed can be varied by the operator from 10 to 20 ft. per minute, the platform stopping automatically at the track levels. The rise from tunnel track to surface track is about 30 ft. The platform will be equipped with the third rail, charged only when the platform is at a track level, so that the cars may be run on or off under their own power. Provision has been made to hold the elevator platform securely in position while the cars are run on it.

Car Elevator; Hudson & Manhattan Railroad.

In addition to the usual service of handling cars to and from the tunnels, the elevator can be used for quickly changing motor trucks under a car body. For this purpose, the platform travels three feet above the surface tracks, blocks are put in place under the car body, the trucks are disconnected and the platform descends, leaving the car body suspended on the blocks.

This elevator has been in uninterrupted operation since it was installed, handling rails, ballast and other material in loads as high as 65 tons. It is believed to be the largest elevator in size and lifting capacity ever constructed. It was built and installed by the George T. McLauthlin Co., Boston, Mass., according to the design and patents of Martin B. McLauthlin.

Committee Reports at the Maintenance of Way Convention.

The ninth annual convention of the American Railway Engineering and Maintenance of Way Association will be held at the Auditorium Hotel, Chicago, on March 17, 18 and 19. Secretary Fitch has prepared the following outline of the committee reports to be submitted at this convention:

The committee on Roadway has had under consideration during the past year the subject of track elevation and depression inside cities, and also the practical work of grade and curve improvements outside cities, and presents in addition to its conclusions a summary of replies to its inquiries on track elevation and depression.

The Ballasting committee presents only a brief report.

The Tie committee presents a valuable report on the future policy of railroads with reference to sources of tie supply; a compilation of answers as to causes of failure of ties; also additional information on the live subject of tie preservation, together with a list of tie-treating plants in the United States.

The committee on Rail submits a series of blank forms for use in reporting rail failures.

The Track committee presents a report on turnouts and turnout material, including the recommended types of switch stands, switch points, frogs, guard rails and throat clearance; a report on the tiling of wet cuts and the curing of slides; a report on the subject of widening of gage on curves, the latter subject being a joint recommendation of the Track committee and a sub-committee of the Master Mechanics' Association.

Locomotive coaling stations and the use of reinforced concrete for roundhouses form the main features of the report on Buildings. Other subjects dealt with in this report are the best method of smoke removal, ventilation and heating of roundhouses; the use of movable and fixed cranes for facilitating locomotive repairs in roundhouses; arrangement of windows and roof lights, and proper ratio of light to floor surface in roundhouses.

The committee on Wooden Bridges and Trestles submits a valuable report on the cost of construction, maintenance and life of ballast floor trestles of the different types now in use, with designs explanatory of and types considered, an extension of the list of recommended safe unit stresses for timber; a report on the methods of preserving structural timber, their cost and efficiency, and their influence on the strength of timber; a report on the question of a standard specification for structural timbers.

The Masonry committee presents for final adoption the specifications for stone masonry, and in addition a report on the most economical size or combination of sizes for stone to be used in stone concrete, as applied to the different classes of railroad work. This committee has also in preparation an exceedingly valuable report on typical standard designs now in use for masonry, culverts, both stone and concrete. The last-mentioned subject will be published after the convention in a special bulletin.

The subject of snow fences, snow sheds and other means to prevent snow accumulating, and best methods of clearing tracks and of snow removal, form the principal feature of the report on Signs, Fences, Crossings and Cattle-Guards.

The report on Signaling and Interlocking will be of especial interest not only to engineers, but to transportation officials as well. The committee has prepared a valuable report on the subject of a comprehensive system of signaling; and in addition presents as an appendix three interesting papers by members of the committee dealing with the matter of signaling.

The committee on Records, Reports and Accounts presents a report on the subject of individual ledger accounts and on the proper system of right-of-way and track maps.

Rules governing supervision of signals is the subject of the report on Uniform Rules. Rules governing supervisors of track and structures have already been adopted by the association in previous years.

The Water Service committee has taken for its subject this year a revision of matters previously adopted by the association, and the committee submits a condensation of the recommendations heretofore approved by the association.

The committee on Yards and Terminals presents an interesting and comprehensive report on the subject of hump yards. The report contains a large number of diagrams showing the practice of various companies in reference to hump yards.

Under the auspices of the committee on Iron and Steel Structures a series of experiments have been made during the past year on the effect of moving loads on railroad bridges. The tests have been made with 12 instruments specially constructed for this purpose, and the work of making the experiments has been performed by a number of experts, under direction of the sub-committee above named. A preliminary report is presented on the tests already made, and forms a valuable contribution to the literature on this mooted question. The experiments referred to have been made on the Illinois Central, Rock Island, Burlington and Nickel Plate roads. In addition to this feature, the committee's report contains a discussion on the care of existing bridges—inspection, methods of field work and records of inspection; also a report on the classification of bridges as to safe carrying capacity. As an appendix to this report is to be considered an interesting and instructive paper by A. F. Robinson, Bridge Engineer of the Atchison, Topeka & Santa Fe Railway System, on "Open versus Ballasted Floor Bridges," giving the results of the use of ballasted floor structures on the Santa Fe.

The committee on Economies of Railway Location presented an exhaustive report on the matter of train resistance in 1907. A report of progress will be presented this year, in addition, as an appendix, an interesting paper by A. K. Shurtleff (C., R. I. & P.), entitled "Time as an Element to be Considered in Grade Reductions."

The convention will open in the banquet hall of the Auditorium Hotel on the morning of March 17. Both morning and afternoon sessions will be held. An evening session will be held on the night of the first day of the convention. The annual dinner will be given on the night of the second day.

Railroad Station Improvement.*

At the beginning of 1907 I congratulated myself that all the railroads in the country were not only convinced of the desirablity and the advantages of artistic and well-kept station surroundings, but that they were rapidly becoming so interested and enthusiastic in the work of co-operation with the Railroad Department of the American Civic Association that my work of persuasion was a thing of the past, and that in the future it would be simply a steady growth and development along the lines of artistic education, and the carrying on of missionary work in the railroad towns by the establishment of village improvement associations.

But last spring, instead of the encouragement to which we had become acquainted, orders were issued on many railroads, "no parking this year." This was followed from time to time with like orders regarding all improvements which were not absolutely necessary; in other words, retrenchment was the order of the day.

At first it seemed possible that this condition was confined to the West, or particularly where adverse state legislation had affected the business of the railroads, but I was soon led to fear that it was national in its scope and was the result of the governmental attacks which had disturbed the entire railroad world. To verify my suspicion I wrote to the heads of various railroads throughout the country, and the almost universal reply was along this line:

"I beg to advise that under existing financial conditions we are not giving much thought to questions of esthetic character, but we are trying to maintain the condition of our property for safe operation, also to maintain a sanitary condition in and about our coaches and buildings; we are not doing, nor do we contemplate doing in the near future much, if anything, for purely esthetic reasons."

All the officials assured me of their interest and appreciation of the work and of their keen regret for the conditions which compelled them to relinquish the work. And I am glad to say that orders have been universally given to preserve and care for the work which has already been done along the line of station ground improvements. The few railroads, I am advised, that are contemplating new work this year are the Delaware, Lackawanna & Western, the Grand Trunk and the Norfolk & Western.

I find my consolation in knowing that the work which we have already done can never be wholly undone. Many village improvement associations have emanated during the past five years from the little station park which was the nucleus for future park systems and general civic improvement. The massed planting to shut off the unsightly secondary buildings at the station was a suggestion to the villagers to be carried out in screening off their backyards, the grouping of the shrubs at the corners of the grounds where the blending of the different foliage made a beautiful and ever-changing picture was a desirable contrast to the straight lines of shrubs from the front door to the gate. The manner in which we have proven to the people the uselessness of fencing off the parks and converting them into a graveyard scene has led to the obliteration of door yard fences, thus transferring the ugly village streets into beautiful boulevards. All know how infectious the spirit of civic improvement is. From this beginning has usually come the improvement of the high school grounds, the courthouse square and the formation of a village improvement society and the general crusade against all that detracted from civic beauty.

There is a mistaken idea in some minds that railroad station ground improvements emanate from the village improvement association. The reverse is generally true. I have known many instances when the townspeople have sent their earnest request to the railroad officials to improve their station surroundings, but where upon investigation it was found that for many blocks on every side of the railroad property there was not one redeeming feature. Tumble-down buildings covered with circus posters, stock-pens, garbage piles, filth and squalor of every description led up to the railroad property, which although not in any sense artistic or attractive, was usually decent looking. The inconsistency of the request, under those conditions, was the first thought that occurred to the officials, and the suggestion that they clean up the town before troubling about the railroad property was a remark that might reasonably be pardoned. It is a most unusual thing for railroad officials to refuse to co-operate with a town on village improvement lines, although they sometimes balk at the suggestion of the townspeople that they lead the procession. I would suggest to any interested in this matter that any time they want a new depot or station park, or improvements along these lines, the best way to interest and influence the officials would be to clean up and improve the streets and property leading to the railroad, so that the contrast would reflect discredit upon the latter. I doubt if co-operation on the part of the railroad officials would ever be refused.

I will give as one illustration something that has come under my observation during this last year. In a northern Wisconsin lumber town (Tomahawk, on the C., M. & St. P.) an interest in civic improvement which had been created by illustrated lectures through the efforts of the railroad department led to the formation of an active village improvement organization and the formulation of plans for a more beautiful town. This meant the removal of the warehouses from the heart of the village to the suburbs, necessitating a heavy expense, but a purse was made up to assist in this work, and a committee waited upon the officials of the railroad ,who without the slightest hesitancy promised to build tracks to the new location, remove the old tracks and convert the property on which the warehouses stood into a beautiful park extending for several blocks through the center of the town. This work is now in progress and it is expected that before another year a wonderful transformation will be effected.

Other interesting work which has been accomplished by this town was the passing of city ordinances regulating the width and style of sidewalks, which are to be concrete, with combination concrete gutter and curbings, grass park midway between gutter and sidewalk, trees of uniform variety, and sizes to be planted at certain distance in the parkway, the removal of telegraph and telephone poles into the alleys and various other reforms. A carload of shrubbery (purchased at wholesale through the railroad company by a public-spirited citizen, who, by the way, is a member of the American

*A report, presented at the annual meeting of the American Civic Association at Providence, R. I., by Mrs. A. E. McCrea, chairman of the Railroad Department.

Civic Association), and the services of a landscape architect, were placed at the disposal of the town people who for a nominal sum could avail themselves of the opportunity to have their grounds planted and arranged artistically. Those who were too poor to pay were given the same consideration as the others, and the whole town is transformed from ugliness to beauty through this kindly act of one public-spirited man.

I could give many more examples of similar nature, but I only want to urge on the department the greatest of all advantages—that of co-operation between the people and the railroad.

Othniel Foster Nichols.

Othniel Foster Nichols, one of the consulting engineers of the Department of Bridges, New York, and well known to readers of the *Railroad Gazette*, died suddenly of apoplexy at his home, 42 Gates avenue Brooklyn, February 1. His death was without warning, as he had been in his usual good health, and on Monday, barely 12 hours before he died, he had taken lunch with his friends at the engineers' table in the Astor House.

Mr. Nichols was born July 29, 1845, at Newport, R. I., and received his education at the Brooklyn, N. Y., public schools and at Rensselaer Polytechnic Institute, where he graduated as a civil engineer in the class of 1868. Immediately after graduating he began his professional career as assistant engineer on the work of laying out Prospect Park in Brooklyn. His next position was assistant engineer of the Greenwich Street elevated railroad in New York, and he built the first elevated railroad foundations north of Cortlandt street. In 1870 and 1871 he became assistant to Edward Cooper, President of the New Jersey Steel & Iron Company, and from this office he went in 1871 to the Lima & Oroya Railroad in Peru as assistant engineer. He remained two years in charge of tunnel location and construction on this road and then became division engineer of the Chimbote Railroad, where he had charge of work of the same kind.

Mr. Nichols returned to the United States in 1876 and was assistant superintendent and engineer of the Edgemoor Bridge Company in its contract for building the Sixth Avenue Elevated Railroad in New York. The work was delayed by injunction and Mr. Nichols entered the service of the Park Department in charge of sewer work in the annexed district. In 1878 he went to South America again, this time as resident engineer of the ill-fated Madeira & Mamore Railroad project in Brazil, and subsequently spent the first half of 1879 in London in connection with litigation which grew out of this enterprise.

O. F. Nichols.

Mr. Nichols always retained a vivid impression of his South American experiences. He saw clearly the possibilities of development in the region where he had worked but had profound respect for the difficulties of getting anything done there on account of the climate, of labor conditions, and the distance from the base of supplies.

In 1879 and 1880 Mr. Nichols was assistant engineer in the bridge shops of the New Jersey Steel & Iron Company. In 1881 he was for a time assistant superintendent of the Peter Cooper glue factory, and from that time until 1885 he was resident engineer of the Louisville & Nashville bridge over the Ohio river at Henderson, Ky. In 1886 he was made chief engineer of the waterworks at Westerly, R. I., but resigned his position to become principal assistant engineer for the Suburban Rapid Transit Company in New York City. When this company was consolidated with the Manhattan Railway he became chief engineer of the Brooklyn Elevated and designed and built about half of the elevated roads in Brooklyn belonging to that company. In 1892 and 1893 he was general manager as well as chief engineer of the company, and at that time made his first surveys for the Williamsburgh bridge, which was then intended to be built by a private company allied with the Brooklyn Elevated. When Leffert Buck was made chief engineer of the Williamsburgh bridge, in 1895 he named Mr. Nichols as his principal assistant, and Mr. Nichols held this position until July, 1903, when he was appointed chief engineer of the Department of Bridges. Since 1905 he has been consulting engineer of the Department of Bridges, in charge of the Manhattan and Blackwells Island bridges. He was awarded the Telford premium by the British Institution of Civil Engineers in 1897. He was also ex-president of the Brooklyn Engineers' Club and a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, Society of Municipal Engineers, New York Engineers' Club, Brooklyn Institute of Arts and Sciences, American Geographical Society and the Institution of Civil Engineers of Great Britain.

The engineering profession will be shocked and grieved by the news of the sudden death of Othniel Foster Nichols, one of its distinguished members. The city of New York loses a most faithful servant, whose value was never greater than at present when enormous bridges are being built, to the design and construction of which Mr. Nichols has given the best years of his life—a life ripe in experience covering a wide field of railroad practice, shop practice, bridge engineering and erection, and especially the study and solution of transportation problems. In all these branches Mr. Nichols was an expert of high rank, and his professional attainments were united with rare executive ability. He had a live interest in everything pertaining to the welfare of the profession and to its progress. Membership in the American Society of Civil Engineers, in the Institution of Civil Engineers, in the Society of Municipal Engineers, in the Alumni Association of his *alma mater*, and in the other organizations to which he belonged, he did not regard merely as recognition of professional standing. To him it meant opportunity for further work with corresponding duties, which he fulfilled as few men have the energy to do in continuous efforts for the elevation of the profession and the maintenance of its dignity. Witness his contributions to its literature in the Proceedings of these learned bodies and his eager part in their discussions, his loyal service as head of the Engineering Section of the Brooklyn Institute of Arts and Sciences.

He was a most devoted friend. His friendship was not confined to intimates, but numberless acquaintances have reason to bless his memory for acts of unvarying kindness and substantial aid. Not only to young engineers just starting in the profession, but to men of every rank and calling, to widows and the fatherless, and to those otherwise unfortunate was he especially helpful. A most genial companion, he was a strong, energetic, generous, wise, hopeful man. His public and private career was beyond reproach. An inspiration to his fellows, a model of fidelity to duty, his place cannot be filled and his memory will be kept green by all who knew him. N. F. B.

The Prussian State Railroads have had since 1901 an uninterrupted growth in traffic and gross earnings, and until this year also a satisfactory yearly increase in net earnings, which in 1906 were 2½ per cent. more than in 1905 and 35 per cent more than in 1901. This year the increase in gross has continued, but as in some countries not so far off, the expenses have increased so much more that there will be a decrease in net. The reasons given for this are precisely the same as those which account of the notable decrease in net earnings in this country in 1907. The Prussian fiscal year ends with March. The latest reports do not show any decrease in gross earnings, such as has occurred here recently. In November the Prussian State Railroads had an increase of nearly 5 per cent. in gross earnings, while for the eight months of the fiscal year the increase was 5½ per cent. The railroads of the whole German Empire had an increase of more than 4¾ per cent in November. The demand for coal could not be satisfied; but the iron works were not the urgent buyers.

Transmission Line Crossings Over Railroads.

BY RALPH D. MERSHON.

The rapid increase in the number of electric transmission lines and the distributing circuits therefrom, is rendering every day more important and more perplexing the question so frequently encountered as to the protection, if any, which should be provided at railroad crossings.

The fear which the steam railroad operator has in regard to such crossings arises from two sources. He fears the damage which might result through mechanical agencies, in case the transmission line should fall upon the track. He fears, also, the damage which he thinks might result through electrical agencies. The fear of the electric current is usually the greater, probably because of the fact that most steam railroad operators have had little, if any, experience with electricity, and they attach to it more or less of the mysterious dread which people have for it generally.

The protection for which the railroad man generally asks, is a steel bridge constructed underneath the transmission line for that portion of its length which is across the railroad company's right-of-way; or at least for that portion of its length which is across the tracks. In some cases, it has been required that the transmission line be carried on insulators attached to this structure; such a requirement is an undesirable one from every standpoint.

There can be no question that a transmission line can be made as strong as any steel protecting bridge that can be installed, and, in general, strength can be obtained at a great deal less expense than is involved in installation of the bridge. A simple span of wire or cable supported at each side of the right-of-way, on steel structures if necessary, can be made as strong, both as to supporting structures and as to the cables, as any bridge which can be erected. It seems foolish, therefore, to insist upon the installation of a bridge below a transmission line for fear that, through mechanical agencies, the transmission line may be thrown down.

Probably no railroad operator would make special objection to have built across his tracks a construction similar to that of a well designed transmission line, if he knew no current was to be put upon it; but, in some instances, the mere idea of having current on the wires seems to introduce immediately a fear of the construction—both mechanically and electrically. In such cases, the ultimate source of the fear and objection to the transmission line crossings may be said to lie in the fact that the lines carry an electric current; and it is well, therefore, to examine into the possible ways in which the existence of an electric current on the lines may affect the safety of the property or employees of the railroad.

Assume a crossing with the same side clearance, overhead clearance and factor of safety as would be allowed in the case of a bridge. Assume that there is no electric current on the wires. Under such conditions, no damage except such as is equally likely in the case of a bridge can result to the property or employees of the railroad company.

Now assume that the electric current is put on the crossing. The added possibilities of danger are as follows:

(1) The possibility of overhead contact either direct or through some conducting object.

(2) The presence of the electric current in case the structure is thrown down by a train wreck, by wind, or other mechanical forces.

(3) The possible effect of the electric current in causing the line wires to fall.

The probability of (1), overhead contact, can be indefinitely reduced by increasing the overhead clearance, if such clearance as would be allowed for a bridge is not considered a sufficient insurance.

The probability of (2) can, so far as wrecks are concerned, be indefinitely reduced by sufficient overhead and side clearance; and, so far as wind or other forces are concerned, by proper design and construction with reference to ice and wind loads. The practice in these matters in the case of bridges would seem to be amply sufficient, especially in view of the fact that, as mentioned later on, in a well designed and properly operated transmission system, anything which would cause the line wires to be thrown down, would cause the power to be cut off by reason of the resulting short circuit.

The question, therefore, finally resolves itself into an examination of (3), the effect which the presence of the electric current might have in causing the line wires to fall upon the tracks.

The only conceivable way in which the presence of the electric current could be the cause of the contingency mentioned is that of the establishment of an arc which should burn off one or more of the line wires. Such an arc might be established between two or more of the line wires, or between one or more of the wires and the structures supporting the transmission line. An arc between a line wire and the supporting structure could occur only in case the structure is metal, or in case the insulators are supported upon metal pins connected to each other or to ground.

An arc between the line wires, if it be instituted at a point distant from the supporting structures, can hardly be conceived of as due to anything other than the swinging together of the wires, or to their having thrown across them, either maliciously or by accident, some conducting object. The chance for an arc to be started by the wires swinging together can be removed entirely by putting them sufficiently far apart. The chance for an arc to be established by something being thrown across the line wires can be made very small by recourse to the same expedient.

The occurrence of an arc between one or more of the line wires and the insulator pins or the steel structures carrying them, might be due to a direct puncture of the insulator by electrical means, or to breakage of the insulator by mechanical means, or to the establishment of an arc around the insulator to the pin by an initial creepage of current over the insulator surface, when the insulating value of such surface had been reduced by a film of moisture, dirt or other conducting or semi-conducting substance. It should be noted that the first and last of the three possible causes mentioned would be extremely unlikely except in the case of high voltage lines, and, even then, not at all likely, if the insulator be well designed, except in the case of lightning.

In the case of the occurrence of an arc from any of the causes mentioned, the arc would not, with a properly designed transmission system, exist for any considerable portion of time, since its occurrence would cause the automatic circuit breaking appliances in the generating station to operate, thus opening the circuit and stopping the arc. The amount which such an arc could do towards burning a line wire asunder, or otherwise damaging the crossing, would depend upon the amount of power behind the arc, the length of time it lasted, and the size or mass of the metal from which the arc was drawn. That is to say, it would depend upon the amount of heat generated in the arc tending to melt the wire or other metal concerned, and the amount of metal there was present to conduct away and absorb this heat, and thus diminish the melting action of the arc. The size and weight of the wires and other metal parts involved could be so proportioned relative to the destructive potency of any arc which might be formed that they would easily withstand the melting action, without being burned off, until such time as the automatic protective devices at the generating station opened and the arc ceased.

It would even be possible to make such provision that, in case an arc formed, it would rupture itself, even if the automatic protective devices at the generating station did not operate; and so that it would rupture itself before any serious damage to the crossing could occur. To accomplish this, it would be necessary to properly proportion not only the metal parts, but also the distances separating those parts between which an arc could occur; that is, the distances between the line cables and between the line cables and the supporting structures. Such proportioning should be done with reference to the voltage and power capacity of the transmission system; the less the voltage, the less the distances would have to be; and the less the power capacity of the system, the lighter could be the metal parts.

It would appear, therefore, perfectly possible to design a transmission line crossing so that it could not constitute a source of danger from either a mechanical or electrical standpoint. Such a crossing would preferably be one along the following lines:

(a) It should be so constructed that the line conductors (line wires or cables) and the supporting structures at each side of the track would be of proper strength to withstand the ice and wind loads which might come upon them. It should be self-sustaining; that is, should be capable of standing up under the action of wind and ice without reference to the remainder of the line, so that the line, on one or both sides of the crossing, might break without interfering with the crossing itself.

(b) There should be sufficient overhead clearance between the line and the track, so that there would be no possibility of contact except by deliberate intent.

(c) The line conductors should be far enough apart so that they could not swing together.

(d) The line conductors should be sufficiently massive so that an arc might exist between them for several seconds, without danger of burning or melting them off.

(e) If the supporting structures are of steel, or the insulator pins are of metal and the pins connected to each other, or to ground, the insulators should have cast metal caps cemented upon them. These caps, or extensions of them, should extend out on each side of the insulator for some distance along and underneath the conductor, in order to further protect the conductor, or else the conductors should have, in addition to the caps, a protection from arcs in the form of a serving of wire upon them for some distance on each side of the insulator. The result of such protection will be that an arc formed near the insulator will expend itself upon the serving wire, or metal casting, instead of upon the conductor itself.

It is not to be understood from the above that a crossing would necessarily consist of a single span. It might consist of a series of spans, meeting the above requirements, where several spans were necessary for crossing a number of tracks, such as would be found in a railroad yard.

A crossing constructed on the above lines would be as safe as any reasonable individual could ask, and at the same time would be a great deal cheaper than the steel bridges sometimes insisted upon.

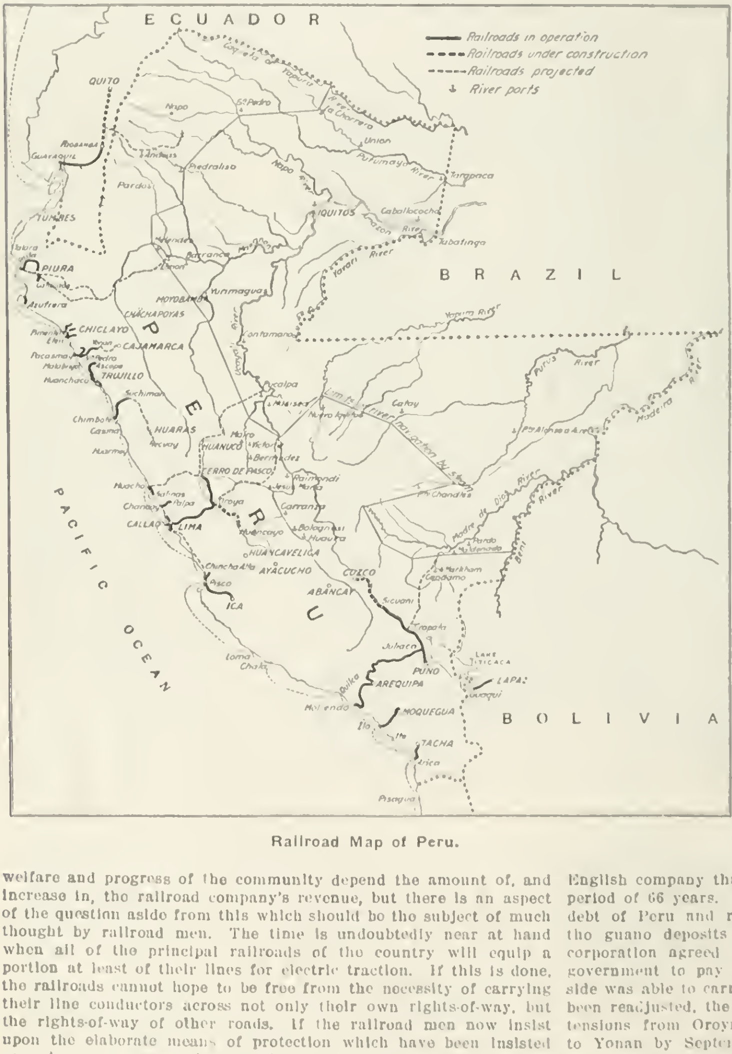
The matter of steel protective bridges is a very serious one to the transmission companies, not only on the score of expense of the bridges themselves, but because of the difficulty often met in installing them or getting permission to install them, especially when they are required in towns and are objected to by the municipality. If they are insisted upon, it will greatly retard the development of those sections of the country fortunate enough to be within electric reach of cheaply generated power, since the requirement of a bridge for a railroad crossing will, in many cases, prohibit the supplying of small customers with power. This, of itself, is a matter of importance to the railroads in that on the welfare and progress of the community depend the amount of, and increase in, the railroad company's revenue, but there is an aspect of the question aside from this which should be the subject of much thought by railroad men. The time is undoubtedly near at hand when all of the principal railroads of the country will equip a portion at least of their lines for electric traction. If this is done, the railroads cannot hope to be free from the necessity of carrying their line conductors across not only their own rights-of-way, but the rights-of-way of other roads. If the railroad men now insist upon the elaborate means of protection which have been insisted upon in some cases, and crystallize public opinion to the idea that such elaborate protection is necessary, they themselves will be confronted with the necessity of making use of the elaborate and expensive protection in question.

It behooves the railroad man, therefore, to consider this matter of crossings very carefully and with the utmost spirit of fairness, since in so doing he will not merely serve the interests of the transmission companies, but also the interests of his own and other railroad companies in the future.

The Railroads of Peru.

BY J. R. CAHILL.

In order to understand the location and workings of the railroad systems of Peru it is first necessary to get an idea of the physical features and industrial condition of the country. In size Peru is nearly one-fourth as large as the United States. It is divided topographically into three zones; the coast region, 1,500 miles long varying from 20 to 80 miles wide; the Sierra or Cordilleras of the Andes averaging about 300 miles wide, and the Montaña on the eastern slope of the Andes extending down way into the basin of the Amazon The Montaña comprises more than half the area of the country and is a tropical jungle immensely rich in rubber, hardwoods and gold. The Cordillera region includes two ranges of the Andes running parallel to the coast. It is the rich mineral belt and also supports a stock raising industry. The coast is given up to the production of sugar and cotton for export and tropical fruits and vegetables for home consumption. It is productive only near the rivers where irrigation is easy, the rest of the land being barren. Irrigation plans are being projected that will bring much more of the land under cultivation.



Railroad Map of Peru.

There are three general types of railroads: Trans-Andine roads, extending from the coast eastward across the Andes; short lines running from the seaboard up into the valleys of the coast region, and lines running in a general north and south direction through the Cordilleras. The first type carries the cotton and sugar produced in the valleys down to the ports at the termini and carries back imported manufactured commodities. The trans-Andine lines carry the products of the Montaña and the mines of the Cordillera down to the coast along with the agricultural products of the coast region. They carry back mainly lumber and other mine supplies. The lines running north and south exist for the immediate purpose of developing the mines and of serving as feeders for the trans-Andine roads. Eventually they will form a means of communication between the trans-Andine roads.

There are at present about 1,340 miles of railroad in Peru. Of these 1,053 miles are of standard gage. The remainder, for the most part unimportant lines, are of 3 ft. or of meter gage. There are two lines that may be called trans-Andine roads: the Central Railroad, from the port of Callao to Oroya on the east slope of the Andes, 138 miles, and the Southern Railroad, from Mollendo to Puno, 325 miles. There are three roads running north and south through the Cordillera: The Cerro de Pasco road from Oroya to Cerro de Pasco, 83 miles long; the Southern Road's branch north from Juliaca to Chiclacupi, 150 miles long; the Central Road's branch south from Oroya, about 30 miles of which has been built. This road is being continued to Huancayo. The Juliaca-Chiclacupi branch is being extended now to Cuzco. Eventually Cuzco and Huancayo will be connected.

Most of the lines are the property of the government of Peru. These are, however, operated by the Peruvian corporation, an English company that in 1890 leased the roads from the state for a period of 66 years. The Peruvian corporation assumed the foreign debt of Peru and received large land grants and a monopoly of the guano deposits together with certain other privileges. The corporation agreed to make certain extensions of roads and the government to pay $400,000 per year to the corporation. Neither side was able to carry out the bargain and the agreement has since been readjusted, the Peruvian corporation agreeing to complete extensions from Oroya to Huancayo, Sicuani to Cuzco and Chilete to Yonan by September, 1908. The road completed a short time ago from Oroya to Cerro de Pasco was built by American capital to develop the Cerro de Pasco copper properties. The road and smelters represent at present an investment of some $17,000,000. This road will also allow the coal fields in this region to be developed.

The railroads of the Peruvian corporation were mismanaged for many years and did not begin to earn money until the Cerro de Pasco enterprise furnished them with increased traffic. This business, combined with the heavy traffic from Mollendo to La Paz

Peruvian Railroad Scenery.

brought about by the extensive railroad building now going on in Bolivia, is now placing the Peruvian corporation on a paying basis. In the year 1905-1906 the preferred stock received a 1½ per cent. dividend, and in the year ending June 30, 1907, the gross traffic receipts amounted to $8,260,000, an increase of $905,000. The Peruvian corporation is now negotiating with American and German capitalists for a loan of $15,000,000 to enable it to improve its rolling stock and roadbed so as to be able to handle the traffic that is now swamping it.

The Central Railroad is a piece of the most difficult mountain construction ever built. In a space of 138 miles the road has six switchbacks, 10 large bridges and a dozen smaller ones, and is operated over 4 and 4½ per cent. grades. The cañons are so steep that tunnels are far more frequent than deep cuts. There are

Arequipa Station; Peruvian Southern.

56 tunnels in 80 miles of road, and very few of these are on tangents. Curves as sharp as 15 deg. are used. The cañon walls are so precipitous that in many cases in side hill cuts heavy retaining walls are built to reduce the amount of fill. At an elevation of 10,920 ft. above sea level at the Infernillo bridge the road plunges from a tunnel out across a steel truss hung between the mouths of two tunnels a couple of hundred feet above the river. At the summit is the Galera tunnel, three-quarters of a mile long at an elevation of 15,700 ft. In 98 miles the road rises 15,160 ft. in elevation. The average grade between Callao and Oroya is 2½ per cent. The 138 miles from Callao to Oroya cost originally $22,000,000, and was built by Henry Meiggs, an American. Twenty-four-ft. rails were used, weighing 60 lbs. per yard, and all rail renewals have been of the same kind of rails. Redwood ties

Mollendo, Terminus of the Peruvian Southern.

brought from California and Oregon are used. There are no tie plates. The curves are so sharp that the rails are tied together with steel rods. Steel rails with steel rail chairs are also used as additional ties on sharp curves. The track is ballasted with rock and gravel. Very little difficulty is encountered with the drainage of the roadbed as the rainfall is not very heavy. The principal difficulty is the frequent occurrence of rock slides resulting from steep slopes in side hill cuts. Owing to the high cost of lumber and its rather short life in parts of Peru, as little wood as possible is used in railroad structures. The main stations are built of Oregon pine, but all sheds and minor buildings are of corrugated iron laid on wooden frames for the smaller buildings. For larger sheds, cast iron columns and steel roof trusses covered with corrugated iron are used. The fences along the right-of-way through the Rimac valley are built of large blocks of adobe about 2 ft. thick. All the telegraph posts are of iron. Very little concrete work was used. Water tanks are of steel supported generally on cast iron columns.

The natives, having been raised in a country devoid of timber, are naturally very skilful in masonry work. The bridge abutments are all ashlar masonry, and the tunnels when not cut through solid rock are lined with ashlar. Side hill cuts are supported by heavy dry rubble retaining walls. The bridges are all steel structures. For short spans, Warren girders are used. The longer bridges are Pratt trusses or viaducts. There is one cantilever bridge. Old style Phoenix columns were used to some extent but most sections are channels and plates. Joints are generally riveted.

These bridges are now proving too light for the heavy locomotives necessary for handling the great increase of traffic, so they are shortly to be replaced. The passenger engines now used are of the Mogul type. The freight engines are of the Consolidation type. The new locomotives are of the Mastodon class, and their weight of 60 tons is proving too great for the present bridges. All the locomotives except a few small switching engines are of American manufacture. The old freight cars were all small ones following the English practice, but after the construction of the American Cerro de Pasco road the English company commenced using the ordinary 36-ft. American pattern car of 50,000 lbs. capacity.

Near Arequipa; Peruvian Southern.

Infiernillo Bridge and Tunnel 32, Elevation 10,920 ft.; Peruvian Central.

There are a few steel ore cars. Corrugated iron is used in repairing the roof of box cars. All the cars bought during the last few years have been of American manufacture.

Train hands and enginemen are for the most part drawn from the best of the native "Cholo" class, a mixture of Spanish and Indian. All track work is done by Cholo laborers, who are paid about 75 cents a day. The station agent and general clerical staff is composed of Peruvians of Spanish descent. The management is, of course, English. The standard of honesty among the train hands and station agents is very low and there is a great deal of difficulty in preventing stealing. The passenger rates, first class, are about 5 cents, gold, per mile. Cholos ride in the second class cars and Gringos and Peruvians ride first class. The freight rates are very high. The road through insufficiency of rolling stock has great difficulty in handling the traffic offered it, and this traffic is bound to increase to still greater proportions as new mines are being opened up and as the Cerro de Pasco mines are not working up to their maximum output as yet.

The Cerro de Pasco road that connects with the Central Road at Oroya is operated by the American capital owning the Cerro de Pasco mines. It is a far more modern road than any of the Peruvian corporation's properties, and is able to deliver more freight at Oroya than the Central Railroad can handle. The lack of facilities on the Central has been a big hindrance to the development of the Cerro de Pasco mines.

The Cerro de Pasco Railroad is 83 miles long, and its elevation ranges from 12,000 ft. to 14,000 ft. The grades are lighter, curves easier and bridges fewer than on the Central Railroad inasmuch as elevation does not have to be developed. The road follows along a cañon for about 15 miles and then crosses a level pampa. The maximum grade is 2¼ per cent. and the maximum curvature is 16 deg. Seventy-lb. rail is used, some of it of English manufacture. All rolling stock is of American manufacture. The output of the Cerro de Pasco mines, after it leaves the Cerro de Pasco Railroad at Oroya is being handled so badly by the Peruvian Corporation that the construction of a road parallel to the Central Road has been considered by the American company.

The Cerro de Pasco company holds a concession for a railroad from the Cerro de Pasco road eastward into the Montaña to the navigable headwaters of the Ucayali river. This will probably be built and will supply the mines with coke and lumber and at the same time open up an immense rubber territory. This means new business for the Peruvian Central and if it does not handle the traffic better it means another reason for a competing road from the Cerro de Pasco line to the coast.

The other of the two most important Peruvian railroads is the Southern Railroad running from the port of Mollendo up to the city of Arequipa, then over the Andes to Puno, on the shores of Lake Titicaca, where it connects by steamer with La Paz, in Bolivia. At Juliaca a branch shoots northward along the Cordillera towards Cuzco. It is now constructed as far as Chicacupi, 150 miles, making the entire mileage of the system 475 miles. This construction is not of the sensational type of the Central Road. The cañon walls are not so steep and precipitous, and the bridges and tunnels of the Central line have their counterpart in deep fills and cuts on the Southern. There is very little rainfall, so drainage channels need not be provided. Sixty-lb. steel is used, but the rails are in very poor condition and are now being replaced with 80-lb. section. Old rails are being sold for almost 2 cents, gold, per pound, for use in the towns for building construction. The rolling stock is of the same general description as on the Central Railroad. The new heavy locomotives are being used on this line, as there are few bridges. Such bridges as there are will be replaced by new structures now being fabricated in the United States. Curves are now being tie-plated.

The employees are of the same class as on the Central Road. Officials of the road blame the poor class of labor for the poor train service, and it is undeniable that the Peruvian Cholo gives poor service, being indifferent whether he works or not. It is also hard to get men of sufficient education to make good station agents and clerks. Owing to the small number of trains run it is very difficult for officials to travel between different points on the line without great waste of time. No motor cycles or motor cars are used.

The principal traffic of the Southern Railroad, at present, is furnished by the eastbound haul of railroad supplies for Bolivian railroad construction and for the extension of the Peruvian road towards Cuzco. Normally the eastbound freight consists of manufactured commodities supplying the mines of Bolivia and the Cordillera of Peru and the towns of Arequipa, La Paz and the other small towns subsisting off the wool industry and farming. The westbound freight is largely mine products and wool. Rubber production in the Montaña bids fair to increase the traffic greatly as several important properties are being opened up. The present congestion of the traffic is shown by the fact that it generally takes a month to get a shipment through from Mollendo to Arequipa, a distance of 106 miles. The Cholo enginemen refuse to take night runs on account of the poor rails, heavy grades and sharp curves, so no trains are operated at night. Probably the congestion will be relieved when the roadbed is placed in good condition. Upon the completion of the railroad from Arica to La Paz, which the Chilean government has agreed to build according to the terms of a recent treaty with Bolivia, the Southern Railroad will have a severe competition for the La Paz business that it will find it hard to meet. The new line will be about 300 miles long and will afford direct communication with the coast. The distance from Mollendo to La Paz via the Southern Road and Lake Titicaca is 563 miles by water and rail, involving a transshipment at Puno. In addition the terminus of the Southern Railroad, at Mollendo, is probably the poorest harbor on the coast of Peru. A breakwater is being built that will improve this somewhat but it will be an expensive work. It was started with riprap but it is now proposed to finish it with five-ton blocks of concrete placed with steam cranes. It is probable, though, that the Arica-La Paz road will not be completed for several years. In the meantime the Southern road will carry the railroad material for the road building in Bolivia.

Mountain Scenery; Peruvian Central.

Bolivia has just received $14,000,000 from Chile and Brazil in indemnities. This will all be devoted to railroad building, and with this money as an inducement, American capital is taking an interest in the construction of the roads. A contract made with Speyer & Co. and the National City Bank of New York provides for building 863 miles of roads. The total cost is estimated at $27,500,000, and the government contributes $12,500,000, which shall be repaid within 25 years. This leaves the government with capital for future extensions. The construction was started in 1906 and is being pushed rapidly. American rolling stock and track material is being used.

There are three roads to be built, the La Paz-Topiza line, the Oruru-Cochabamba line, and the La Paz-Puerto Pando line. The La Paz-Tupiza road will be 530 miles long. It connects with the Antofagasta road at Oruro, giving La Paz another connection with the coast and hence creating more opposition to the Southern Railroad of Peru. It will also connect at Tupiza with the Argentine road, being built into Bolivian territory, joining Buenos Ayres and Tupiza. This will divert more of the Bolivian traffic from the Southern Railroad.

The La Paz-Tupiza road has been graded as far as Oruro, and track has been laid for about 80 miles. The other two roads will serve as feeders that will develop valuable mining districts and open up a rich rubber territory. The Oruro-Cochabamba line will be 133 miles long. The roadbed has been graded a few miles out from Oruro and work stopped pending a change of plans. The La Paz-Puerto Pando line will be 200 miles long. The stimulus these roads will give to the rubber and mining industries in a now almost inaccessible region will create an increase of traffic from Bolivia to the coast that will probably compensate the Peruvian railroad for the diversion of a portion of the business to Chilian and Argentine ports.

The government of Peru has adopted a policy aiming to stimulate railroad building. The state gives concessions or franchises for proposed lines, in some cases guaranteeing interest on investments and in others giving land grants as inducements. It also grants various other privileges such as free passage of railroad material through customs, cash bonus per mile of railroad built and guarantee of freedom from competition for a specified term of years. In order to insure being able to meet such obligations the proceeds of the tobacco tax, amounting to about $1,000,000 yearly, have been set aside as railroad encouragement fund. The general railroad policy is to encourage roads into the Montaña from the two present trans-Andine roads to encourage a third trans-Andine road in northern Peru; to bring about a connection along the Cordillera between the two trans-Andine lines now in existence, and to connect some of the short roads that run from the coast ports into the valleys.

One of the hindrances to railroad operation in Peru is the high cost of fuel. The oil developments promise to lessen this somewhat. In the north of Peru oil fields are being worked and the government is commencing extensive prospecting work in fields that American consulting geologists have pronounced to be oil-bearing. On the Central Railroad of Peru it has been proposed to utilize the Rimac river in developing power and electrifying the road. Government engineers claim that the Rimac can develop 100,000 h.p. This is probably exaggerated, but there is no doubt of its being adequate to supply the demands of the railroad. Such an installation could also do considerable business in supplying power for the mining district that the railroad taps.

All roads that will be built running from trans-Andine roads into the Montaña have as their objective point a terminus on one of the navigable rivers flowing into the Amazon. Peru has 9,300 miles of navigable rivers in its eastern or Montaña territory. The Ucayali river alone flows north and south for almost the entire length of eastern Peru. Hence the roads into the Montaña have a network of water ways serving as feeders. Rubber companies receive large grants of land in return for opening up means of communication between the Montaña and the present railroads. One London company is making surveys now for a railroad from the Cuzco branch of the Southern Road to the Madre de Dios river. Another concession in force is from Huacho, on the coast, to the Cerro de Pasco road and thence east to the Ucayali river. The Peruvian government has made surveys for a third trans-Andine road to develop northern Peru. This will run from the port of Paita through the town of Piura and what is claimed to be the lowest pass in the Andes to the port of Limon on the Marañon river. It is proposed to run this road over the mountains with electric power. Several other minor concessions are in force. Concessions are generally obtained upon depositing with the government a stipulated sum to serve as a guarantee of good faith and which passes to the state if promises of construction are not fulfilled.

One of the most important of the new propositions is the Peruvian Pacific Railroad, a line to run from the port of Chimboto to Recuay in the Huaylas valley. Recuay is 11,000 ft. above the sea level. The road will be 166 miles long. The concession includes valuable coal mines that can give an output of 130,000 tons per year. This will do much to cheapen railroad operation in Peru. The road will open up a good agricultural territory as well as a mining district.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

V.

Recent Developments in Line Traffic.

The year 1870 may be put down as the fourth important date in the history of line traffic in modern commerce; 1816 was its real transatlantic beginning; the year 1840 had the first steamship line; 1850 marked the advance of steamship lines to economic independence as evidenced by their severe competition with each other and with the packet lines and by the carrying of steerage passengers. Eighteen hundred and seventy may be taken as a kind of focal date rather than as an exact date, marking the virtual disappearance of the packet lines and a great advance in steamer lines. It is true that there was at least one Atlantic sailing packet line running to New York as late as 1873 and one to Montreal in 1875, but 1870 may be safely taken as the date of their virtual disappearance—a process which had gone forward by great strides during the preceding decade.

The period central in 1870 and ending in 1873 was one of great prosperity throughout the commercial world. America was feverishly building railroads, transcontinental and otherwise. Europe was also on a boom and the response in ocean transportation was shown by the rapid establishment of new lines of the now thoroughly-proven ocean steamers.

We had new services to the Continent. In 1866, '67 and '68, the firm of Ruger Bros., of New York, established under different combinations line services to Bremen, and in 1869 they founded one to Copenhagen, Stettin and Christianssand, but all of these failed through the competition of the North German Lloyd. This strong company put on steam service from its home port to Baltimore in 1868, to New Orleans in 1869. In 1870 the Mississippi and Dominion Company started steamers from New Orleans to Liverpool. In 1868 the Boston & American Steamship Company started a steam service to Liverpool, but it did not survive many years.

In 1871 came the establishment of the American Line, running from Philadelphia to Liverpool in connection with the Pennsylvania Railroad. In 1872 there came a line from New York to Bristol, and the next year another from New York to Cardiff. In 1872 the Holland-America Line started its service from Amsterdam and Rotterdam to New York. In 1873 also the State Line was started between New York and Glasgow and the Red Star Line between Philadelphia and Antwerp. But the most significant and epoch making member of this group of new services was the White Star Line. The company back of this line had for several years been planning innovations and in 1871 they launched and sailed from Liverpool to New York their first steamer, the "Oceanic"—larger, longer, faster, more luxurious than anything afloat and with improvements in design that had to be copied in all passenger ships thence forward. Before that time the steamer had merely continued the practice of the sailors and they the practice of the merchant ships of the ages. These vessels had put the crew in the forecastle and more elegant quarters for captain, officers or passengers were erected in the stern of the ship. So in the steamer, but the White Star "Oceanic" ended all this for the better class passengers by appearing with cabins amidships where the motion in all directions is minimized in the same way that there is little motion in that part of a seesaw-board that rests on the fulcrum.

The period of prosperity and boom that was central in 1870 came to a sudden termination in the "crash" of 1873, the start of a long industrial depression which from 1874 to 1878 made great hardship and loss among ocean carriers. Here as on land many smaller and weaker companies disappeared and were absorbed by their stronger rivals.

From 1870 onward has been a period in which line traffic has had few if any epoch-making dates. It has proceeded gradually by improvements in kind of service rendered, in the number of lines and in the portion of the globe that they cover and connect.

In 1874 there was a strictly freight steamship line established between New York and Bristol. A predecessor in this direction had been the National Steam Navigation Company, which was formed in England during the Civil War to carry on trade with the South upon the return of peace. This was so long deferred that the company in 1863 opened service between Liverpool and New York with their large slow steamers, which had been intended to carry on a trade which until that time was entirely served by sail. These steamers were devoted chiefly to freight and emigrants, a very small number of cabin passengers being carried. The strictly freight line of 1874 has since been multiplied until the number almost or quite equals that of the lines carrying passengers also.

The greater part of these strictly freight lines take their departure from the smaller ports where railroad and passenger accommodations are meager and where the distance to Europe is greater than from New York so that there is small reason for a passenger to desire the longer voyage. The steamship owners, therefore, find no inducement to cater to the few passengers whom they might get and whom they could scarcely carry at a profit. As a counterpart to that passengerless traffic we have within the past 15 years had the freightless express steamers from New York in which the combined requirements of large crew and extensive bunkers and machinery for fast speed and large passenger accommodation have practically eliminated freight carrying.

In 1876 the same National Steam Navigation Company that gave so little attention to passengers was the first to carry fresh meat from America to Europe, and the next year they were also the pioneers in the transport of live cattle. Both of these improvements have been widely copied and have become important factors in ocean traffic. The refrigerated chamber has become of wide usefulness in carrying meat not only across the Atlantic, but practically around the world. For many years there have been lines of steamers devoted largely to carrying frozen meat to Great Britain from Argentine Republic, from Australia and from New Zealand. The artificially cooled chamber is also in use over the routes from Australia, South Africa and America to Europe for the transport of dairy produce and fresh fruits, and in all of these commodities the trade is growing rapidly.

In the period since 1870 connections have been established between the leading American ports and every European country of importance. In 1879 the Thingvalla Line from Copenhagen sent its ships to New York. French lines have come from Bordeaux and Marseilles. Spanish and Portuguese lines have been established. The Italian line has come, and in 1891 even the German Lloyd put on a New York-Italian service. Then came lines to the Adriatic and in 1899 to Constantinople.

This process of multiplication of lines went on so rapidly that by 1890 the port of New York alone had no less than 29 steamship lines to Europe, of which six ran express steamers, 23 carried both freight and passengers and six freight only.* Of these lines, 12 had sailings weekly or oftener and employed a total of 84 steamships.

The speed, frequency and excellence of the North Atlantic service centering at New York, but shared in no mean degree by Boston, Philadelphia, Portland, New Orleans and Galveston, partially explains why there are but a small total number of steamship connections between America and other parts of the world, and it has innocently helped to call forth many a bitter American lament because the best, the quickest and cheapest and the usual way to get from America to many parts of the world was via Europe. Typical of these laments is that of Senator Frye, of Maine, in his speech in the United States Senate, April 30 and May 1, 1884.

"A manufacturing concern in my city a few years ago undertook to sell cotton goods in Rio Janeiro. They forwarded them to New York, where they were shipped on an English steamer, carried to Liverpool, reshipped on another English steamer and carried in her to Rio Janeiro, and the mails went the same way."

After citing figures for Spanish-American trade and saying that England, France and Germany have nearly three-fourths of this trade, the Senator continued. "Why do these countries have three-fourths of all that immense trade in supplying these people and in taking supplies from them for their home market? For no assignable reason other than the fact that those countries have regularly established lines of steamers to the South American ports, speedy, prompt and reliable, while we have, comparatively speaking, none."

The answer to the Senator's eloquent lament is not far to seek. New York was then and is now the chief seaport assembling point, as was Liverpool, for the trade of a continent. These are great metropoli. Between them plies the very fastest and finest and most continuous ocean service. If you or your freight are anywhere near either of these ports, the quickest way to reach the other is to go to the nearest one and take the fast steamer for the other. It is just like the travel on land. Between New York and Philadelphia there is a magnificent passenger train service. Those cities are only 90 miles apart, but if a man lives 35 miles north of New York and desires to go to a place 35 miles north of Philadelphia he will probably find that the quickest and even the cheapest way for him to make the journey is to pass through both of the great cities and thus take advantage of the fast trains between them, and of the radial organization of local routes to each city, although this roundabout way nearly doubles the length of his journey.

In identical fashion the North Atlantic trunk route served as

*Scribner's Magazine, 9: 411.

a magnet to draw to itself the trade between all parts of the old world and all ports of the new world, just as the trunk railroads between Philadelphia and New York command the travel of a hundred towns adjacent to each metropolis. Each metropolis has good connection with its hundred towns and with the other metropolis.

Similarly Europe and especially Liverpool has developed connections with all parts of the old world and incidentally with that part of the New World called South America. Europe was the pioneer in getting these services instead of the United States, because those ports of the world were her economic dependencies and she was dependent on them while America was not. Furthermore, these countries are all cultural dependencies of Europe, South America is Latin, South Africa and Australia are British, Asia is sprinkled with European possessions, and 25 years ago as now was a great European market. With emigrants, with mail, with colonial ambitions, with manufactured export and raw import, Europe had need of connection with the ends of the earth and where the need was the lines promptly came. Some of them were subsidized, but most of them were not.

In the meantime we did not have these strong needs to communicate with Africa, Asia, South America and the isles of the sea. We were showering wheat, corn, cotton and meat into Europe by the millions of tons. Manufactures came back over the route, with millions of European emigrants and hundreds of thousands of returning American tourists. Here, to meet these heaviest needs, arose the world's fastest steamship lines. By their connection at Liverpool, New York was but a little farther from Asia and Africa and South America than was Liverpool. In point of time, New York was often no farther away by this devious route than she would have been by a direct one because the small American demand for direct service would have sufficed only to command slow steamers. At the same time the livelier demand and the subsidies paid for connection from Europe had resulted in faster steamers from England, France and Germany, and these, connecting with the Atlantic racers, gave New York as speedy connection with the far corners of the seas as it was possible for her to have, unless her direct lines could be in receipt of other income than traffic earnings—namely, subsidies.

Nor was this roundabout connection necessarily an expensive connection. We still had the charter vessels, both steam and sail, in great numbers plying wherever there was demand for full cargo traffic, or wherever any merchant could load a ship as they were continually doing. It was only a comparatively small traffic, the traffic in manufactured goods that sought the route to market via Europe, and the freights were rarely high for the North Atlantic end of the trip. The steamers that carried the wheat, corn and cotton eastward were always half empty coming west across the Atlantic and the stray products of any non-European clime were gladly taken at a reasonable rate. It was furthermore often the case that the large New York passenger steamers were at certain seasons so pressed even for eastbound freight that they took it at low rates across to Liverpool or Hamburg or Antwerp, whence it could easily go anywhere.

An even more remarkable situation has arisen frequently in the recent export trade from New York. It has been cheaper for the American shipper to have his goods forwarded via Liverpool to Australia or Africa than it was for the Englishman to have his goods go out on the same steamer. This anomalous condition has resulted from rate wars on direct lines from New York at a time when there were no rate wars from Europe, and the trans-shipping lines have had to put the rate via Liverpool down to meet the direct rate from New York.

The trans-shipping of freight due to the excellence of the North Atlantic steamer lines is not a monopoly of Liverpool or of the ports on the European end. New York also has a share of the traffic to those parts of the world where New York's connections are superior to those of Europe, for then it is advantageous for European shippers to trans-ship at New York. The commercial bond between the North Atlantic ports of the United States and the Gulf, Caribbean and West Indian ports is stronger than that of those regions with Europe. We feed them and buy their produce, therefore we have more lines to them than Europe has, and the quickest and best way to and from many of these ports is via New York. As early as 1891 there were 18 lines of steamers with scores of vessels plying from New York to these waters, and European forwarders have for a decade been advertising the speed and excellence of the New York gateway for European goods to the West Indies, for they go as far as New York on the fastest carriers of freight. The backers of a British line to Colon complained of the hardship resulting from the fact that it was four days quicker from Colon via New York than by direct steamer.

In the period since 1890 there have grown up steamer lines, freight steamers in practically every case, between New York and all important quarters of the globe, to wit: The Orient, Australia, South Africa and South America, East and West.

Just when line traffic began with these regions it would be hard to say. In practically every case it has come about gradually and at the hands of some firm that began as a mercantile house of the good old style of 1800. There have been a few large American merchant firms doing business in all these regions. They would load a sailing vessel back in 1850 or 1860 just as Girard did 50 years before and send her out to their agents or branch house at Valparaiso, Buenos Aires, Cape Town, Melbourne or Shanghai. Sometime later they would send another. They would occasionally take such freight as they could get for other shippers, and if trade was good there would be more vessels than when it was not good. When steam vessels became cheap enough to use, they were occasionally employed, and the despatchings of some firms that were dignified by the name of lines, in the prosperity of one year were not worthy of mention in the depression of the next. In 1891* the depression in Argentine Republic due to the Baring failure had disorganized the New York shipping trade. Before that Mr. Norton & Sons, of New York, and other firms had been sending from New York four to 12 steamers a year. They kept their services alive and for a decade have been running lines of slow chartered freight steamers.

The question of just what constitutes line traffic is not always easy to decide. In 1891 two New York firms were receiving about 25 steamers a year chiefly loaded with China and Japan tea. These same vessels went out to any port of the world to which their owners could be so fortunate as to charter them. At the same time Edward Perry & Co. were despatching about one steamer a month to East Asia. They had the habit of sending it when they got enough freight, and while the firm were freight carriers, they could scarcely be called the operators of a line, for a line has a schedule. The *Railroad Gazette* credits the first "line" to East Asia to the year 1899.

The connections between the United States and Australia are typical of the development above described. In 1853 two New York firms that had been despatching vessels for themselves and such others as desired to participate, agreed to take turns in sending out their sailing vessels. In 1878 a Boston firm began to send out sailing vessels regularly and in 1884 it began to alternate with the two New York firms. In 1890 a fourth company was added to the list of turn takers. In 1898 an English firm put on a line of steamers from New York outward, and the four American firms who had been sending sailing vessels only now united to form a rival steamship line. There soon came a third steamship line, European owned, and line traffic, on a modern basis but carrying freight only was thoroughly established.

The same decade, 1890-1900, that saw the phenomenal expansion of American exports and the establishment of line traffic to the Orient and to Australia also witnessed the establishment of two semi-merchant steamship lines from New York to the west coast of South America. During this same period also a transformation occurred in the South African trade identical with that which has just been described in the Australian trade.

The last few years in this decade were important ones in the establishment of steamer lines in the place of the old sailing vessels despatched occasionally. In 1899 the consolidated fleet of sailing vessels engaged in the American coasting trade around Cape Horn were sold and replaced by steamers which plied regularly in the long service between New York, San Francisco, Puget Sound and Hawaii until the opening of the Tehuantepic Railway in 1907, give them a more expeditious way of getting their freight from ocean to ocean.

The line traffic on the Pacific has had a more orderly and normal development than upon the Atlantic. It was well established to the Orient upon the opening of the first trans-continental railroad, and with the building of a new railroad line to each fresh port there has followed the establishment of a new steamship line to the Orient. These will be referred to more fully in the chapter on the railway steamship line.

The evolving ocean service has passed from the individual vessel, operated by its owner in the merchant carrier stage, to the common carrier with a world-embracing system. This evolution has been going on during the past century and it can also be seen to-day in all its stages. The trading schooner picks its way through Polynesia and along the shores of many half civilized lands. The private owner still fills his American coasting vessel, sometimes a steamer, with his own lumber and sends it off to market. The oil producer loads his own cargoes of oil in his own ships for export to foreign countries. A single firm in recent years has sent a full ship load of locomotives of its own manufacture half way round the world for delivery. The west South American and Australian trade of New York was, until recent years, carried on chiefly by merchants who loaded their own vessels,† sometimes filling them partly with the cargo of other shippers and sometimes entirely with a cargo of their own consignments. The cheapening of steam power

*Scribner's Magazine, 10: 597.

†The fact that these vessels were often chartered, does not in any way affect the service.

since 1890 has caused the introduction of steamers on these routes between 1890 and 1900, and the original mercantile firms, which began years ago by sending out their own sailing vessels, turned to the running of lines of steamers. They are now being competed with in some cases by other lines which are public carriers only, and the continuance of the merchant as a carrier in these services is something of a relic in the world's commerce. In time it is likely to disappear here, as in Great Britain, before the more specialized organization in which the shipping firm devotes itself to the business of carrying, and leaves the mercantile operations to other firms. This specialization is the method of the larger commerce as we now see it in the trade between America and Europe. The same change is foreshadowed in these old-fashioned services, as shown in the recent reorganization of the New York-Australian carriers.

Each of four different merchant firms had been for years running sailing vessels to Australasia on its own account. When British steamship companies offered rival service as common carriers, the four firms united and formed a steamship company, also a common carrier. It would be easy for them to sell out the steamship business* and continue as merchants only, thus completing the advance of the common carrier for general traffic in this service, as it has been completed in so many before.

There yet exists along with all the services mentioned above a vast traffic of private character—the so-called tramp or charter traffic in which any individual, who so desires, loads a ship and sends her wherever his interests dictate. Thousands of vessels are hired by any one who can ship a full cargo. Such charter traffic is limited by this fact to cheap and bulky materials. It is also of declining importance in the greatest ports, because in these the line steamers suffice. But for small and out-of-the-way ports, shipping bulky raw produce, the charter or independent vessel will be an important factor for many decades to come. The vessel will in the majority of cases be hired for the particular cargo in question.

It is easy to let an account of the nineteenth century line traffic with its splendid developments cause one to underestimate the present importance of the unobtrusive, eighteenth century survival, the single chartered vessel—the sea beast of burden. According to Mr. Walter Runciman, Jr., M.P., a British ship owner of New Castle on Tyne, in a letter to the North of England Ship Owners' Association,† there were at the end of 1901 the following totals of British shipping: sailing vessels 7,227, steamships 8,147, and of the latter he estimated that 1,247 were liners and 6,900 tramps for hire. Excepting the small Scandinavian fleets and a few continental firms the world tramp shipping is British * * * an investment of over £120,000,000 of genuine unwatered capital * * * 'They do the carriage not only of British and Colonial trade but so far as tramp shipping is concerned 80 to 90 per cent of foreign trade as well.' 'Silent and unseen and unknown of man they are really the backbone of our shipping business.'‡ This statement implies that the German, French, Italian, Japanese and American merchant navies are largely devoted to line traffic. The sailing vessels were almost entirely in the charter class.

(*To be continued.*)

*The vessels themselves are chartered, but the business and good will are valuable.

†*Syren and Shipping*, July 8, 1903.

‡Editorial in *Fairplay*, July 3, 1902, p. 886.

Derailment of a Standard Gage Train by Wind.

Readers of the accident record for the month of December, which was published in the *Railroad Gazette* of Jan. 24, page 109, will recall that one of the derailments, resulting in one death and six injuries, was caused by a severe wind storm. This was on the Colorado & Southern near Marshall, Colo., December 24. Four cars were overturned but the engine remained on the track. We give herewith two photographs showing the scene of this accident, from which it will be seen that it occurred in an open country a few miles from a range of high mountains. These mountains, which are seen in the extreme right of the upper view, seem to have had the effect of deflecting the wind so as to produce an exceptionally high velocity at the point of the derailment. The track it will be seen is in good condition, the rails are 80 lb. and the ballast and drainage good. That high winds are not uncommon in Colorado is evident enough from the somewhat numerous accidents of this kind which have occurred in past years to narrow gage trains, but this is the only accident of the kind, in recent years, to a standard gage train, so far as we recall. Marshall is 24 miles north of Denver and it is 5,410 ft. above the sea.

Derailment of a Passenger Train by Wind Near Marshall, Colorado.

In Italy they are detailing soldiers to learn railroading. They are employed as brakemen, switchmen and in making up trains, and when sufficiently proficient receive a testimonial which entitles them to employment on the State Railroads when vacancies occur. A short road out of Rome is worked entirely by engineering troops.

GENERAL NEWS SECTION

NOTES.

James C. Towers has been sentenced to imprisonment for life at Boulder, Mont., for murder and train robbery on the Northern Pacific, May 7, 1907.

On the Pennsylvania Lines West of Pittsburgh 159 grade crossings of streets and highways have been abolished within the past six years, mostly within cities.

The Missouri Supreme Court has declared unconstitutional the law of that state requiring railroads to give a free return pass to the shipper of each car of live stock.

The Chicago, Burlington & Quincy now uses telephones on its train wire between Aurora, Ill., and Galesburg, 129 miles (double-track). Gill's selector is used for calling the stations.

Chicago papers say that at the end of January many ticket speculators in that city vacated their offices, having concluded that under the recent sweeping decision of the United States Supreme Court it will be useless to try to continue their business.

The Wells-Fargo Express Company has appointed an industrial agent for the state of Texas, who is to confer with producers of vegetables and fruit in that state with a view of promoting their business in distant markets.

The estimate of the expenses of the New York State Public Service Commission, Second District, for the next fiscal year is $262,000, which, however, the legislative committee does not feel certain will be the final maximum.

At the meeting of State Railroad Commissioners held at Oklahoma City last week a "Tri-State Commission" was organized, with J. E. Love, of the Oklahoma Commission, Chairman. This compound "commission" will meet in Galveston, Tex., April 16.

According to a press despatch from Louisville, the Louisville & Nashville announces that in consequence of the prohibitory law now in effect in Georgia and Alabama, the road will not receive shipments of intoxicating liquors to be carried into those states.

The Railway Commission of Canada, reviewing numerous reports of railroad accidents, urges railroads to take more precautions against the injury of employees in clearing up wrecks and in moving disabled engines. Men engaged in such work should perform their duties under the direction of a responsible foreman.

At the end of this week the Black Diamond Express trains of the Lehigh Valley between New York and Buffalo will be discontinued. The company hopes that the causes—adverse legislation, state and federal orders, increasing costs, dull business, etc.—will soon abate so as to permit the reinstatement of the trains.

The coastwise steamship lines carrying freight between North Atlantic and South Atlantic ports have announced uniform freight tariffs showing considerable increases. Southbound, classes one, two and three have been advanced two cents per 100 lbs. and classes four, five and six one cent per 100 lbs. Most of the commodity rates, which cover a large part of the heavier staple articles, remain unchanged.

Texas newspapers say that the Southern Pacific lines in that state will dismiss their "train agents." For the past two years 16 of these men have been employed, their duty being to take the place of the conductor in collecting tickets and fares. An officer of the road says that with the effective operation of the law forbidding the scalping of tickets, the work of the train agent will be less necessary than in the past.

The Trunk Lines announce that after March 1, a carload shipment will not be delivered at a number of different places, except on payment of an additional charge. It appears that carload shipments of provisions and other goods from the West are regularly brought to New York at carload rates and each car taken to a number of different steamship docks to be unloaded. It is proposed now to charge $9 for each delivery after the first one.

The Interstate Commerce Commission, which has been asked by prominent railroad officers to suspend the operation of the law, which goes into effect March 4, limiting the hours of telegraph operators, is now being asked by many telegraphers to refuse any suspension. Over 1,700 telegrams from telegraphers were received in three days. A provision in the law empowers the Commission, after a full hearing in a case, to postpone the date on which a common carrier shall comply, but it is understood that the members of the Commission put on this proviso a very strict construction, holding, in effect, that before ordering a postponement, it would be necessary to have a hearing in respect to each office affected.

The Attorney-General has this week begun suits covering 101 violations of the Safety Appliance Law, the railroads to be prosecuted and the number of violations charged against each being as follows: Atchison, Topeka & Santa Fe, 14; Baltimore & Ohio, 13; Baltimore & Ohio Southwestern, 1; Chicago, Burlington & Quincy, 4; Denver & Rio Grande, 13, Illinois Central and Y. & M. V., 2; Missouri Pacific, 5; Pennsylvania, 2; St. Louis Southwestern, 1; St. Louis & San Francisco, 3; Southern, 4; Southern Pacific, 17; Union Pacific, 2; Wabash, 1; Wabash Pittsburgh Terminal, 14.

William Coffin, Division Freight Agent of the Pennsylvania Railroad at Camden, N. J., has issued a booklet describing the business and industrial advantages of southern New Jersey, in which he offers to give all inquirers any desired information concerning commercial matters in that territory. During the past year 12,000 carloads of perishable freight have been shipped from southern New Jersey to other states over the West Jersey & Seashore, which is the principal part of the Pennsylvania system in that region. During the same time the West Jersey & Seashore carried from the farms 85,000,000 quarts of milk.

The Interstate Commerce Commission holds it to be a discrimination to permit anyone to ride on limited passenger trains between stations where passengers are not carried regularly, and that it is illegal to refuse to sell tickets to stations where such trains stop, unless the exceptions are plainly stated in the tariffs. The decision made was in case of a man who demanded a refund on a ticket he was compelled to buy over the Lake Shore from Chicago to Toledo. He was going only as far as Elkhart, but was made to pay through to Toledo, Elkhart not being a passenger stop. Such limitations must hereafter be shown in the posted tariffs.

Since the first of January the General Manager of the Pennsylvania Railroad, by issuing a suitable notice, has greatly reduced the volume of telegrams sent over the company's wires, the reduction at the main telegraph office of the railroad company in Broad Street Station, Philadelphia, amounting to an average of 1,500 messages a day for the month of January. It is about four years since a similar shrinkage was produced, by a similar order, the reduction in numbers having been somewhat larger then than now. Like the issuing of passes, the writing of telegrams would seem to be a matter which can be kept within satisfactory bounds only by repeatedly "jacking up" the persons responsible.

The special session of the North Carolina Legislature, called to consider the passenger rate question, adjourned on Saturday last. A bill was passed providing for a rate of 2½ cents a mile and, so far as appears from the press despatch, there are no exceptions to this, although, presumably, the law takes into account the proposition, which was made by the Southern Railway, to sell mileage tickets at rates less than 2½ cents. A proposal to delegate extensive authority in this matter to the State Corporation Commission was not adopted, and a resolution was passed expressing the hope that, with the higher passenger rates now permitted, the roads would not find it necessary to reduce the wages of their employees.

Arica-La Paz Railroad.

The Chilean Government has given a German bank and a German firm a $15,000,000 contract for building the Arica-La Paz Railroad. The line will run from Arica, the most northern port of any consequence in Chile, to La Paz, the capital of Bolivia, about 335 miles. It is to be completed within four years. The government is to provide the right of way and to admit free all material and machinery used in building the road. It is understood that the only interest the bank has in the matter is that it takes the government 5 per cent. bonds that are to be issued to pay for the road. It is to be built in accordance with the treaty made with Bolivia on March 21, 1905, when Chile took over that portion of Bolivia that bordered on the Pacific ocean. The address of the contractor is on record at the Bureau of Manufactures, Washington, D. C.—*Consular Report.*

Terms of a Recent Railroad Pool in England.

The consolidation of two English railroads, the Great Central and the Great Northern, under a joint committee composed of the boards of directors of the two companies, was described in the *Railroad Gazette* of January 17, 1908, page 75. Further particulars of this consolidation have been issued to the shareholders of the two companies. With the exception of the Lancashire, Derbyshire & East Coast and the Sheffield District Railway, the undertakings of the two companies are to be worked and maintained by the joint committee. Out of the net receipts for each year, after allowing to each company interest at the rate of 3½ per cent. a year on the authorized capital issued and to be issued, the joint committee is to pay $19,016,660 (£3,803,332) to the two companies in the proportion of 47 per cent. to the Great Northern and 43 per cent. to the Great Central. These are the ratio proportions of their net receipts for the year 1906 to the earnings of both for that year. Out of the balance of the net receipts, if sufficient, the Great Central is to be allowed $500,000 (£100,000) for new capital expenditures. Any net receipts remaining are to be divided between the two companies in the following proportions. Down to and including the year 1910, 57 per cent. to the Great Northern and 43 per cent. to the Great Central. After the year 1910 and down to and including the year 1912, 56½ per cent. to the Great Northern and 43½ per cent. to the Great Central. After the year 1912, 56 per cent. to the Great Northern and 44 per cent. to the Great Central.

Motive Power Apprentices; New York Central.

The following extracts are from an address by J. F. Deems at the annual dinner of the National Society for the Promotion of Industrial Education:

"On March 6, 1906, the present apprentice system was organized on the New York Central Lines. Its object is to provide for the motive power department an adequate recruiting system which will eventually produce from the ranks a large number of skilled workmen, a number of foremen, a sufficient number of good draftsmen, a few master mechanics, and an occasional superintendent of motive power. The interest of the railroad is identical with that of the apprentices in that the better all around training the boy receives, the more valuable he becomes to the railroad. The course of training has been outlined with the intent to educate the boy in the trade and not out of it. The general plan is two-fold and provides for shop instruction of the apprentice in the trade and for his instruction in educational subjects allied to his trade during working hours while under pay. The plan is now in operation at the 10 larger shops and already includes over 500 apprentices. The work is so arranged that each apprentice may go as rapidly or as slowly as his ability will allow. All principles are handled through shop problems and must have practical bearing. We are somewhat handicapped by the lack of text-books for apprentice instruction, as the literature of such instruction has yet to be written. Classes are held from 7 to 9 o'clock in the morning each apprentice reporting for two mornings per week. The immediate and direct results of the system have been: Increased output (notwithstanding the four hours per week spent in class), less spoiled work, ability to read drawings, to lay out templates and to make sketches, a better grade of apprentices, increased interest in the work, suggestions as to improved methods and tools, draftsmen for company drafting rooms and apprentices for special work as needed. The officials of our railroad are already enthusiastic over the results obtained in these courses."

Fire Dangers on Underground Electric Railroads.

On one of the motor cars of the District underground railway in London on January 8 at Sloane Square Station there was an explosion and electric flashing. The Board of Trade made an examination and on January 17 issued a report on this accident, whose conclusions may be summed up as follows, the reference being to a correspondence which had been going on in the daily press: "The apprehensions of danger expressed by the writers . . . . are not justified by the facts. The main danger in any such cases of fire will be from panic. For this reason we deprecate the writing for publication of alarmist letters." This report is signed by Major Pringle and A. P. Trotter, Electrical Adviser, of the Board of Trade.

It was found that above floor level there was some blistering of the varnish on the woodwork around a window and doorway and that two panes of glass were blackened with smoke and fumes. No glass was broken. When the blistering and the smoke was rubbed off, the red paint work underneath was undamaged.

Below floor level the metal pipe carrying the electric light wires and a metal junction box was fused. The under side of the timber flooring just above this pipe and junction box were charred in places, but nowhere deeper than one-quarter of an inch. Inside the car no mark of fire was visible on the flooring, seats or sides. All woodwork in proximity to electric conductors on these cars is non-inflammable. This wood will char under the effect of intense heat from electric flashing, but will not catch fire. "The real combustibles, if we may use the word," the inspectors say, "in this fire were copper, iron and brass." Such electric arcs continue until burnt out or exhausted or until the current is cut off, as happened in this case. The ordinary method of extinguishing a fire is useless for electric arcs.

The cause of this explosion was probably the failure of the insulation on the electric light wires owing to damp. The heating of the wires resulted in the liquefaction of a small block of bitumen; an explosion of bitumen vapor followed causing smoke and fumes. Subsequently there was electric flashing along the pipe and at the junction box under the car.

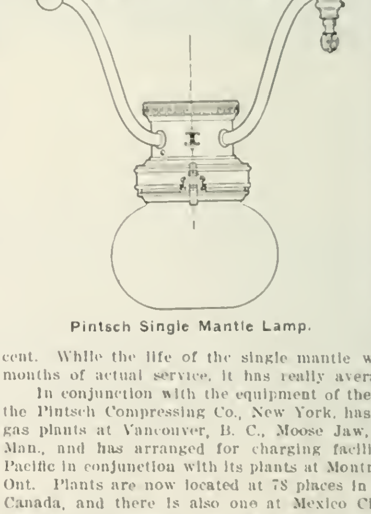
There was no difficulty at all with the center doors and the eight passengers stepped out on the platform without apparent alarm. No complaint of injury or danger was made to any railroad officer.

The Government and the Block System.

When a certain churchman of high rank, after the execution of Anne Boleyn, ventured to remonstrate with Henry VIII., the much-married King of England, for sending his wives to the headsman at the Tower, the King merely smiled pleasantly and assured the ecclesiastic that his point was not well taken, and for reasons that he would at once make clear. "You see, Your Eminence," said Henry, leaning back on the comfortable cushions of his throne and twirling his thumbs reflectively, "you see, when a man runs his matrimonial train in several sections upon a single track, as I do, the safety of the public requires that we shall adopt the block system."—*Harper's Magazine.*

Pintsch Mantle Lamps.

The Safety Car Heating & Lighting Co., New York, has just installed 8,000 of its latest type of single mantle lamps on cars of the Canadian Pacific. This type of mantle lamp, No. 3500, which is shown in the accompanying illustration, is the one introduced some months since. In tests made by J. E. Denton, Professor of Engineering Practice at Stevens Institute of Technology, the hourly consumption of Pintsch gas was found to be 2.12 cu. ft. per hour, giving 99.5 candle power at a cost of 1 cent an hour. When the company introduced the four-mantle or multiple mantle lamp, it was pointed out that such repair parts as the mica chimneys, cup reflectors, ring reflectors, clusters, cluster stems and domes, as used in the four-flame lamps, would be eliminated. With the same consumption of gas, the candle power was increased three times. Now, with the introduction of the single mantles, the same candle power is maintained, the consumption of gas decreased one-third and the necessary maintenance of mantles reduced 75 per cent. While the life of the single mantle was estimated at three months of actual service, it has really averaged four months.



Pintsch Single Mantle Lamp.

In conjunction with the equipment of the Canadian Pacific cars, the Pintsch Compressing Co., New York, has also installed Pintsch gas plants at Vancouver, B. C., Moose Jaw, Sask., and Winnipeg, Man., and has arranged for charging facilities on the Canadian Pacific in conjunction with its plants at Montreal, Que., and Toronto, Ont. Plants are now located at 78 places in the United States and Canada, and there is also one at Mexico City, Mex. At Chicago, gas can be supplied to 25 roads; at Cincinnati, Ohio, to 14; at Kansas City, Mo., to 15; at St. Louis, Mo., to 18, and at the other points to from one to 12 roads. The company has published an interesting map showing the roads using Pintsch light, the supply stations being also indicated.

Radical Reforms.

For a prompt and simple solution of the transit problem, commend us to Assemblyman Cuvillier. He introduced on January 22 a truly epoch-making measure, which requires "that all trains, owned, leased, operated or controlled by the New York Central & Hudson River Railroad Company, the West Shore Railway, the Harlem Railway Company and the Putnam Division of the Harlem Railway Company, and the New York, New Haven & Hartford Railway Company shall, after the passage of this act, stop each and every train at the station now established at Park avenue and 125th street, within the state of New York, borough of Manhattan, for the purpose of receiving and discharging passengers."

For the theory of this measure we have only praise and wonder-ment, but we can, nevertheless, offer a few humble suggestions. For example, if it is practicable to make the West Shore trains traverse a river and four miles or so of intervening house-tops in order to stop at the 125th street station, too much speed cannot be made in ordering the Lackawanna trains to stop, say, at the Fulton street station of the subway, and the Erie trains at Wall street. On the other hand, considerations of fairness would suggest some trifling exemptions. It is unreasonable, we think, to require, as Mr. Cuvillier's bill does, all trains running between Boston and Providence, or between Rochester and Syracuse, to call at the Harlem station. However, these are minor points, and perhaps it is as well to make the railroads do as much for us as possible. The main thing is that we are wasting money on Public Service Commission and new traction lines when we have statesmen who, like Mr. Cuvillier, can make all these appear superfluous.—*New York Evening Post.*

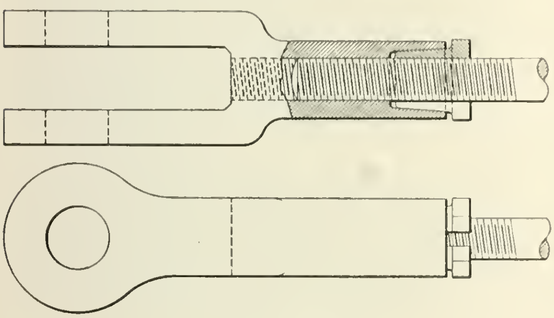
Wages in South America.

The last annual report of the Buenos Ayres Great Southern gives the following comparison of average weekly wages paid on Argentine and English railroads:

	Argentine.	England.
Enginemen	$16.10 to $23.25	$6.90 to $10.20
Firemen	9.70 " 14.15	5.10 " 6.55
Guards	$9.70	4.85 " 7.30
Switchmen	5.80 to 7.30	3.60 " 6.80

The Hillman Locked Clevis.

A patent has been granted to E. D. Hillman, M.E., for an adjustable clevis that can be locked at any desired position. The accompanying drawing shows clearly the locking device, which consists of a conical split nut fitting into a conical recess in the stem of the clevis. When the clevis has been properly adjusted, the nut is



Hillman Locked Clevis.

screwed into the recess of the shank until the threads of the rod and nut and the sides of the nut and recess bind. The locking feature can be used in either drop forged, malleable iron or steel clevises. Standard clevises can be treated in the same manner. This device should be of value wherever adjustments are necessary, such as in brake-gear, switch and signal work, cranes, bridges and various rigging. It will be put on the market by the U. S. Metal and Manufacturing Co., New York.

Paint Tests.

The Paint Manufacturers' Association, Chicago, has been arranging for a series of paint tests to extend over five years. Some of the tests are to be made at the Carnegie Technical Schools, Pittsburgh, Pa., where committees of the association and of the faculty will test 232 mixtures to establish standard formulae.

English Electric Railroads.

The London & North Western has announced that its proposed electric line to connect Euston with Watford, for which Parliamentary approval has been granted, will not be built at present owing to the financial situation. This line is to cost between $13,000,000 and $15,000,000 and is to give relief to the main line and a better suburban service to Watford, partly by a subway. During the last year or two there has been little street railway construction work done in the United Kingdom except the underground trolley system of the London County Council, one or two lines on the surface contact stud system and extensions of some of the more important tramway systems. It was hoped that electrical manufacturers would receive enough work from steam railroad electrification to make up for the lack of street railway work, but they have not. What is described as the first single-phase electric line in England is nearly finished. This is a section of the Midland Railway from Morecambe via Lancaster, to Heysham. The London, Brighton & South Coast single-phase line, between London bridge and Victoria, a large undertaking altogether, is not yet anywhere nearly finished.

Electrical Exhibition at Marseilles.

An "International Exhibition of the Applications of Electricity" is to be held at Marseilles in the south of France from April 19 to Oct. 31, 1908. Marseilles, whose population is more than 500,000, has now an elaborate system of distribution of electrical energy. The entire South-East district of France also, which has hitherto received its electrical supply from a few small power stations, will now have the advantages of a great system of distribution by a series of hydro-electric generating stations, which, when completed, with reserve stations, will have a total capacity of 150,000 h.p. A territory with a population of over 3,000,000 is, or shortly will be, thus supplied with electricity and open to all branches of electrical industry. The object of the exhibition is to bring the numerous possible applications of electricity to the attention of the public and to establish new commercial relations for electrical manufacturers in this territory. The exhibition will comprise the following sections:

1. Transmission and Distribution of Electrical Energy;
2. Applications of Electricity to Industries in general;
3. Applications of Electricity to Domestic Industries;
4. Applications to Domestic Economy;
5. Applications to Public and Private Lighting;
6. Applications to Heating and Ventilation;
7. Applications to Machinery for Lifting and Manipulation,
8. Applications to Mines and Quarries;
9. Applications to Traction;
10. Applications to Agriculture;
11. Applications to Military and Naval Engineering;
12. Electro chemistry, Electro-metallurgy and the Allied Sciences;
13. Telegraphy and Telephony;
14. Applications to the Medical and Surgical Sciences;
15. Electrical Instruments for Measurement and Calibration;
16. Raw Materials and Manufacturers used in Electrical Industries;
17. Practical and Theoretical Teaching of the Science of Electricity.

A special corps of engineers under the direction of the General Commissioner will take charge of the erection, repair, maintenance and proper working of the exhibits, as well as their packing and return shipment, at the close, and if desired the commercial interests of those exhibitors who are unable to be present. Paul Dieny, Park Row building, New York, is the Commissioner for the United States.

Resolutions on Forest Preservation.

The Board of Directors of the American Institute of Electrical Engineers adopted the following resolutions on January 10:

Whereas, The American Institute of Electrical Engineers recognizes that water powers are of great and rapidly increasing importance to the community at large, and particularly to the engineering interests of the country; and,

Whereas, The value of water powers is determined in great measure by regularity of flow of streams, which regularity is seriously impaired by the removal of forest cover at the headwaters with the resulting diminution in the natural storage capacity of the watersheds, this impairment frequently being permanent because of the impossibility of reforestation, owing to the destruction of essential elements of the soil by fire and its loss by erosion; therefore

Be it Resolved, That it is the opinion of the American Institute of Electrical Engineers that the attention of the national and state governments should be called to the importance of taking such immediate action as may be necessary to protect the headwaters of important streams from deforestation, and to secure through the introduction of scientific forestry and the elimination of forest fires the perpetuation of a timber supply; and further

Be it Resolved, That the Committee on Forest Preservation be instructed to communicate these resolutions to all members of Congress and to the governors of all the states.

A 25,000-H.P. Rolling Mill Engine.

The Allis-Chalmers Co., Milwaukee, Wis., has shipped to the Carnegie Steel Co., Sharon, Pa., a monster rolling mill engine of over 25,000 h.p. capacity and weighing more than 1,250,000 lbs. Two of the castings weighed 118 tons each after machining, and other parts are in proportion. The heavier parts were shipped on special, reinforced 100-ton cars. The engine is horizontal, twin-tandem, with cylinders 42 in. and 70 in. x 54 in. It runs condensing at 175 lbs. steam pressure and a speed of 150 to 200 r.p.m. In spite of its size and power, it is easily controlled and needs only one engineer. The character of service requires quick reversal at the end of each run of the rolls, and the load varies quickly from nothing to maximum. The reversing mechanism is of the Reynolds-Marshall type, run by a small independent engine with oil cylinder lock, and another small engine works the throttle valves. All these units are under the control of the engineer. The engine can be reversed in a few seconds.

This company is also building 12 gas-engine-driven blowers for the Carnegie Steel Co.'s Homestead plant and the new works of the Indiana Steel Co. at Gary, Ind. It built large vertical steam-blowing engines recently for the Northwestern Iron Co., Mayville, Wis., and other prominent plants, and has on its erecting floor engines of this type for the Wickwire Steel Co., the Tonawanda Iron & Steel Co., the Pennsylvania Iron & Steel Co. and the Republic Iron & Steel Co. Between three and four hundred Allis-Chalmers vertical steam-driven blowing engines, and nearly as many more of the horizontal type, are in service at various iron and steel producing centers of the country.

Advance in Freight Rates in Mexico.

Consul W. D. Shaughnessy states that increases are to be made in freight rates on the Mexican railroads, averaging, on specified commodities, about 12 per cent. The railroads desired average increases of about 20 per cent., but the government commission reduced this. Included under special tariffs are commodities like coal, coke, lumber, grains, sugar, ores, etc., which form the bulk of the freight moved by the railroads. The matter of the classification of ores and the revision of the special tariffs covering ores has been referred to a sub-committee for consideration. It is calculated that these increases will result in the material enlargement of the revenues of the railroads and provide them with the funds for the construction of needed improvements. The railroads have insisted that increases in rates are necessary, for the reason that the cost of labor and of materials has increased from 60 to 150 per cent. since the revision of rates in 1900.

Tug Takes 11,616-Mile Journey.

The newspapers announce the arrival at Panama of the "Catherine Moran," a 154-ton tug, 90 ft. long. Needing a new tug for service at Panama, the Canal Commission bought the vessel from the Moran Towing Company, of New York, and on October 26 it started on its trip. The course was laid close to land, but followed, in the main, the route laid out for the battleship fleet now making its way to the Straits of Magellan. A stop was made at one southern port before the tug entered the Gulf of Mexico, and it touched at six other places for coal and other supplies. A total of 11,616 miles was traversed at 9.13 knots, an average of 219.6 knots a day. The tug burned on the voyage 601 tons of coal.

Annual Dinner of the American Institute of Electrical Engineers.

The annual dinner of the American Institute of Electrical Engineers will be held at the Waldorf-Astoria, New York, on the evening of Wednesday, February 19, at 7 o'clock. As on former occasions, the speeches this year will be on the relation of the electrical engineer to public service corporations. It is called the "Public Service Dinner," and among the speakers who have promised responses to toasts are many men prominently identified with public utilities, either as members of commissions or operating heads of large organizations. The price of the dinner will be $5, not including wine or cigars. As usual, ladies will be present. Guests will be seated at small tables accommodating eight persons. The dinner committee is composed of Robert T. Lozier, Chairman; A. A. Gray, Frederick C. Bates and George H. Guy.

INTERSTATE COMMERCE COMMISSION RULINGS.

Import Rules on Plate Glass Upheld.

The Commission, in an opinion by Commissioner Clements, has announced decision in the two cases of Pittsburgh Plate Glass Co. v. Pittsburgh, Cincinnati, Chicago & St. Louis et al., and of the same complainant against the Illinois Central. The complaints in these cases alleged unjust discrimination in rates against domestic shippers of plate glass in favor of import shipments, because the rates of the former are relatively higher than the inland rail proportion of the total charge from the point of origin in a foreign country; but the Commission held that under the law as interpreted by the United States Supreme Court in the Import Rate case the Commission cannot consider such disparity in rates alone as constituting unjust discrimination.

Further findings of the Commission were as follows:

In considering the question of alleged unjust discrimination in favor of shippers of import plate glass moving from the ports of entry in this and adjacent foreign countries to interior American destinations and against domestic shipments between points in the United States, it is the duty of the Commission to look to the circumstances and conditions affecting the matters involved, not only in this country, but in the entire field of commerce here and abroad. It is well settled by the highest judicial authority that the existence and effectiveness of competition between carriers, whether by rail or water, whether subject to the Rate Law or not, and competition of markets, or the absence of such competition, are, among other things, pertinent to the question of similarity of circumstances and conditions, and as to whether the discrimination complained of and shown is or is not undue or unreasonable.

To make the total through charge from a foreign port of origin the measure of the rate to be charged on domestic traffic from the port of entry in this country through which the import shipment moves, would be to establish a hard and fast rule difficult if not impossible for the rail carriers in this country to conform to in the establishment and publication of their rates in view of that uncertain and flexible element involved in the ascertainment of the total through charges, to wit, ocean rates.

Discriminations of the nature referred to in sections 3 and 4 of the Rate Law, in so far as they result from the *bona fide* action of a carrier in meeting circumstances and conditions not of its own creation, and which are reasonably necessary for that purpose, do not of necessity fall under the condemnation of the law.

Transportation from a seaport of the United States or an adjacent foreign country to an interior American destination, in completion of a through movement of freight from a point in a foreign but not adjacent country, whether on a joint through rate or on a separately established or proportional inland rate applicable only to imports moving through, is not a "like service" to the transportation of traffic starting at such domestic port, though bound for the same destination.

As held in numerous decisions of the Supreme Court, it is neither required by law nor just, that the rates of a carrier on traffic subject to intense competition shall mark the measure or limit of its rates on traffic not subject to such competition. Being bound to consider the more intense competition to which the transportation of the foreign product is subject as one of the "circumstances and conditions" affecting the relative adjustment of rates, the Commission cannot, solely upon the basis afforded by a comparison of the inland proportion of the through rate from the foreign port of origin with the rate applying on domestic shipments of plate glass in this country, condemn the latter as unreasonable or unjustly discriminatory. As rates applying on domestic shipments of plate glass between points in this country were challenged mainly on the ground of unjust discrimination and not on account of their unreasonableness *per se*, and as there is no basis in the record of the case as presented for a determination as to whether these rates are or are not just and reasonable of themselves, the complaint is dismissed without prejudice.

The complaints were dismissed.

TRADE CATALOGUES.

Motor Starting Devices.—Bulletin No. 4559 of the General Electric Co., Schenectady, N. Y., describes d.c. motor starting rheostats and panels. Rheostats with no-voltage release and those with both no-voltage and overload release are illustrated and described, as well as rheostats for starting reversible shunt or compound wound constant speed motors. The bulletin also shows a variety of panels in which different types of starting rheostats are used. Dimension diagrams for different capacities of rheostats and panels are included.

Shay Geared and Rod Locomotives.—The Lima Locomotive & Machine Co., Lima, Ohio, has issued catalogue No. 15. This company makes the Shay geared locomotive and also direct-connected or rod locomotives. Illustrations of the different classes are shown and the principal dimensions and hauling capacities of the different sizes given. The standard specifications for the construction of the locomotives are printed and there is also some useful information on the last pages. Besides locomotives, the company builds logging cars.

Springs.—The Standard Steel Works, Philadelphia, Pa., has published an illustrated catalogue showing types of steam railroad and electric railway springs. These include semi-elliptic springs, single and multiple full elliptic springs, coil, draft, bolster and other springs. Specimen dimension sheets are reproduced on which specifications may be conveniently made when ordering springs.

Heaters.—The Consolidated Car Heating Co., New York, is distributing a circular showing its new vestibule heaters. They are made both stationary and portable and are designed for motormen's vestibules in electric cars and for small ticket offices or other places where but little heat is required. The standard type is arranged for $1\frac{1}{2}$ amperes at 600 volts, consuming 900 watts.

Corliss Engines.—The Murray Iron Works Co., Burlington, Iowa, is distributing a pamphlet giving the nomenclature of Murray Corliss engines. It consists of half-tones and line drawings of different assembled engines and parts, the names of the latter being indicated on the drawings. The nomenclature is quite full, no part being overlooked.

Bolsters.—Part catalogue No. 4 of the Gould Coupler Co., New York, is devoted to the company's Crown type body and truck bolsters. It is illustrated with half-tones and working drawings showing separate bolsters and the body bolster with draft gear applied.

Variable Speed Motors.—The Northern Electrical Manufacturing Co., Madison, Wis., has issued booklet No. 54, discussing variable speed motors and advocating the single voltage shunt field control, which is the system used by the company.

Acetylene Lights.—The Alexander Milburn Co., Baltimore, Md., has issued an illustrated catalogue and price list of several types of portable acetylene lights for different kinds of service. A list of agencies and customers is included. One of these lights was described in the *Railroad Gazette* of January 24, 1908.

MANUFACTURING AND BUSINESS.

The Hess-Bright Manufacturing Co., Philadelphia, Pa., intends to occupy within six weeks a four-story building, with a floor space of 15,000 sq. ft., at Twenty-first street and Fairmount avenue.

The United States Steel Corporation announced on Tuesday that the 25,000 shares of preferred stock offered to employees under the profit sharing plan of 1908 at $87.50 a share have been largely over subscribed.

Raymond D. Carter, formerly Managing Editor of the *Newark Morning Star*, has been appointed General Advertising Agent of the Central Railroad of New Jersey and Editor of its monthly magazine, *The Suburbanite;* office at 143 Liberty street, New York.

H. W. Nutt, who for the past year has represented Buell & Mitchell, New York, in Boston, Mass., has been appointed District Manager for the New England states of the General Fireproofing Co., Youngstown, Ohio, with office at 161 Devonshire street, Boston. Mr. Nutt had previously been Assistant General Sales Agent of the American Steel Hoop Co. (now merged in the Carnegie Steel Co., Pittsburgh, Pa.), Secretary of the American Tube & Stamping Co., Bridgeport, Conn., and Vice-President of the Superior Steel Co., Pittsburgh, Pa.

Iron and Steel.

According to press despatches, British mills have made contracts for 17,000 tons of rails for shipment to Africa and 14,000 tons for Australia.

The New York Central & Hudson River is asking bids, under revised specifications, on 3,500 tons of structural steel for the northeast corner of the new station building at the Grand Central terminal, New York.

The United States Steel Corporation has an inquiry for a large tonnage of rails from an important road for early delivery. The Pittsburgh & Lake Erie is believed also to be in the market for several thousand tons.

Judge Gary, of the United States Steel Corporation, announced last Tuesday that the rail manufacturers and many of the railroads had reached a satisfactory agreement on rail specifications. The new specifications provide, he said, for a heavier rail with improved section and with the practice in manufacture somewhat improved. The additional cost of the new rails, if any, is to be paid by the purchasers.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

American Society of Civil Engineers.

At the meeting of this society held February 5, there was a paper on Overhead Construction for High Tension Electric Traction or Transmission by R. D. Coombs; also one on A New Suspension for the Contact Wires of Electric Railways Using Sliding Bows, by Joseph Mayer. Both of these papers were printed in the proceedings for December, 1907.

ELECTIONS AND APPOINTMENTS.

Operating Officers.

Canadian Northern.—A. Wilcox has been appointed Superintendent at Port Arthur, Ont., in place of J. R. Cameron, promoted.

Canadian Pacific.—J. Brownlee, hitherto Superintendent of the Moose Jaw division, has been appointed Superintendent of the Cranbrook division, in place of John Erickson. Allan Purvis, heretofore Chief Clerk to the General Superintendent of the Pacific division, has been appointed Superintendent of the Kootenay line, with headquarters at Nelson, B. C.

International & Great Northern.—Henry Martin has been appointed Superintendent of the Fort Worth division in place of C. Hightower, resigned; office at Mart, Tex.

Effective Feb. 1, the office of Assistant General Manager is abolished.

Southern.—J. F. Hays has been appointed Manager of the line between Hendersonville and Lake Toxaway (Transylvania Railroad), with office at Brevard, N. C.

Wisconsin Central.—F. M. Gates, Chief Clerk in the car service department, has been appointed Car Service Agent, relieving P. W. Drew. Mr. Drew continues as Superintendent of Telegraph

Traffic Officers.

International & Great Northern.—N. M. Leach has been appointed General Freight Agent in place of G. H. Turner, resigned.

Engineering and Rolling Stock Officers.

International & Great Northern.—J. F. Enright has been appointed Superintendent of Machinery, with headquarters at Palestine, Tex. The office of General Master Mechanic has been abolished.

Southern.—The master mechanics of the Atlanta, Birmingham, Knoxville and Selma divisions have been ordered to be transferred as follows: Master Mechanic John F. Sheahan, of the Atlanta division, to be transferred to Knoxville; Master Mechanic J. B. Michael, of the Knoxville division, to be transferred to Selma; Master Mechanic G. Akans, of the Selma division, to be transferred to Birmingham; Master Mechanic N. N. Boyden, of the Birmingham division, to be transferred to Atlanta.

Union Pacific.—Charles E. Fuller, late Superintendent of Motive Power of the Chicago & Alton, has been appointed Assistant Superintendent of Motive Power of the Union Pacific; office at Omaha, Neb.

CAR BUILDING.

The Woodward Iron Co., Birmingham, Ala., has ordered 10 all-steel hopper cars of 100,000 lbs. capacity.

The National Car Line, Chicago, has ordered 10 tank cars of 60,000 lbs. capacity from the Bettendorf Axle Co.

The Grand Trunk Pacific has ordered 2,400 freight cars from the Canada Car Co. and 500 freight cars from Rhodes, Curry & Co.

The Republic Creosoting Co., Indianapolis, Ind., has ordered five 8,000-gal. and one 10,000-gal. tank cars from the McGuire, Cummings Manufacturing Co. These cars will be 31 ft. 6 in. long and 8 ft. 6 in. wide. The special equipment includes:

Bolsters	Monarch
Brake-beams	Monarch
Couplers	Monitor
Draft rigging	Cardwell

RAILROAD STRUCTURES.

Butler, Pa.—The city council has under consideration a proposition of the Baltimore & Ohio to replace the wooden overhead bridge on Lookout avenue with a steel structure, 27 ft. wide and 57 ft. long.

Cleveland, Ohio.—The Pennsylvania freight house on the lakefront was recently destroyed by fire.

Edmonton, Alb.—An understanding, it is said, has been arrived at between the city of Edmonton, town of Strathcona, province of Alberta, and the Canadian Pacific regarding a high level bridge to be built by the railroad here, at a cost of about $700,000. Bids for the work, it is said, will be asked for at once.

Fort William, Ont.—The McKay & Kakabeka Falls Railway is planning to cross the Canadian Pacific, Canadian Northern and Grand Trunk Pacific tracks at West Fort and the Canadian Pacific tracks in Fort William by overhead bridges or subways.

New York, N. Y.—The New York, New Haven & Hartford has filed plans for putting up four new passenger stations in the Borough of the Bronx on its Harlem River branch, at a total cost of $190,000.

Prince Rupert, B. C.—It is reported that the Grand Trunk Pacific is arranging preliminaries for the construction of a great hotel.

Rennie, Man.—Contract is reported let to S. C. Hill & Co. for putting up two trestle bridges near Cross Lake for the Grand Trunk Pacific. The larger trestle is to have 75 spans and the other 31 spans.

Sacramento, Cal.—The Western Pacific, it is said, will build its main shops here.

Toronto, Ont.—It is thought that City Engineer Rust will be instructed to prepare plans for a street railway bridge over the western gap at Queen's wharf to cost $60,000.

Washington, Pa.—At a joint meeting of the Commissioners of Washington and Westmoreland counties in Pittsburgh, the contract for the proposed bridge over the Monongahela river between Donora, in Washington county, and Webster, in Westmoreland county, was let to the Toledo-Massillon Company, who offered to do the work for $189,000.

Winnipeg, Man.—William Mackenzie, President of the Canadian Northern, is quoted as saying that bids will be asked for early this year to build the proposed union station and hotel here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTIC, QUEBEC & WESTERN.—This company, which has finished its line from New Carlisle, Que., north to Port Daniel, about 20 miles, has given a contract to the New Canadian Co., Ltd., of Paspebiac, and work is under way from mile 20 to mile 102. (Aug. 23, p. 215.)

BATON ROUGE, HAMMOND & EASTERN.—See Illinois Central.

BOSTON & MAINE.—The double-track work between Johnsonville, N. Y., and Troy, about 16 miles, which was started in April, 1907, has been finished and was put in operation last month. The method of abolishing 19 grade crossings between these points has not yet been decided upon.

BRITISH COLUMBIA (ELECTRIC).—Bids, it is said, will shortly be asked for by this company to build about 63 miles through southern British Columbia. Work to be started this spring. R. H. Sperling, General Manager, Vancouver, B. C.

CANADIAN PACIFIC.—This company has been granted an extension of four years to complete the Esquimalt & Nanaimo branch. Location work is about finished and it is expected to ask bids for building the line this month. Contracts for 10 miles from Wellington, B. C., have been let to John Bright, of Nanaimo, and a contract has been given to A. Carmichael to secure the right-of-way. (Dec. 13, p. 732.)

This company, it is said, will this spring extend the line with present terminus at Nominique, Que., west to the line with northern terminus at Maniwaki, 41 miles.

CHARLESTON, PARKERSBURG & WESTERN.—An officer writes that this company has 30 miles of track laid on the line it is building from Charleston, W. Va., north via Sissonville, Spencer and Palestine to Parkersburg, about 60 miles. Some engineering work is now under way on the rest of the line, but it is undecided when grading will be begun. C. P. Peyton, Chief Engineer, Charleston.

DURHAM & SOUTHERN.—This company last year carried out revision work on six miles of its line between Apex, N. C., and Angier.

FAIRCHILD & NORTH CAROLINA.—This company is building with its own men a yard about one mile long at Owen, Wis.

ILLINOIS CENTRAL.—The Baton Rouge, Hammond & Eastern is to be operated by the Yazoo & Mississippi Valley beginning Feb. 27. Work is to be rushed on the section from Baton Rouge, La., east to Covington, 65 miles, of which 20.75 was built in 1907. (Nov. 22, p. 636.)

INDIANAPOLIS, LOGANSPORT & CHICAGO.—This company, which has projected a line from Logansport, Ind., south to Indianapolis, 66 miles, has all the surveys made and rights of way for 25 miles and franchises for entering Indianapolis secured. Grading has been finished on 2½ miles at Indianapolis. Contracts for this work have been let. Walter Osmer, Chief Engineer, Logansport, Ind.. The line is eventually to be extended, to have a total of 163 miles in Indiana and 23 in Illinois. (May 10, p. 663.)

MISSISSIPPI CENTRAL.—Contract is reported let by this company to O. A. Gibson to build 14 miles of its road from Itoxie, Miss., east toward Brookhaven.

MISSOURI & NORTH ARKANSAS.—This company now operates 130 miles of railroad from Seligman, Mo., southeast to Leslie, Ark. Track-laying is just being finished on 31½ miles from Woodruff, which is nine miles north of Seligman, on the St. Louis & San Francisco, northwest to Neosho, where connection will be made with the Kansas City Southern, over which the company has trackage rights into Joplin. The roadbed for 100 miles south of Leslie is being graded by M. C. Burke and L. S. Joseph; 26 miles of track is laid and the grade is practically ready for 20 miles more. It is expected to finish track-laying on this section by July. From Kensett for 30 miles southeast toward Helena grading contracts are let for 14 miles to the Dalhoff Construction Co., of Little Rock, Ark., and the next 15 miles, one-half to the Alabama Construction Co. and one-half to James Dishman. These firms are putting up the embankment across the White and Cache river bottoms with revolving derricks and Page buckets. From Cotton Plant to Helena, 55 miles, grading is 80 per cent. done and track material is being received. It is the intention of the company to finish connecting links for a through line from Joplin to Helena, 361 miles, about Oct. 1 next.

NEW YORK SUBWAYS.—The New York State Public Service Commission of the First district has approved the plans for the Broadway-Lexington avenue subway from the Battery, at the south end of Manhattan Island north, under Church and Vesey streets to Broadway, thence under Broadway and Lexington avenue to the Bronx side of the Harlem river, where it will branch into two spurs, one to Woodlawn Cemetery and the other to Pelham Bay Park. The estimated cost of the work with a line across the Island at Canal street is $67,000,000. The Commission passed a resolution asking the Board of Estimate to assent to the scheme. This consent is necessary because the new route is made up of several modifications of roads laid out by the old Rapid Transit Commission and approved at the time by the Board of Estimate. As soon as the Board of Estimate approves, the Public Service Commission will begin obtaining the necessary consents from property owners, and when these are received will probably advertise for bids. (Jan. 10, p. 73.)

NORTHERN OF MAINE.—Grading is to be started about May 1 on this proposed line, projected from Van Buren, Me., west along the northern boundary of Maine via Grand Isle, Madawaska, Frenchville, Fort Kent and St. John to St. Francis, 62 miles, for which contracts are to be let soon. The work will include one bridge. Edson E. Goodrich, President, Waterville, and Henry F. Hill, Chief Engineer.

OWENSBORO & ROCKPORT BRIDGE & TERMINAL COMPANY.—Plans and specifications are nearing completion and work is expected to be started this year on this proposed line from Owensboro, Ky., north to Rockport, Ind., 12 miles. A. H. Kennedy, President, G. H. Cox, Secretary, Owensboro. (May 24, p. 727.)

PADUCAH NORTHERN.—Incorporated in Kentucky to build a line from Paducah west 13 miles to a point on the Ohio river, where, it is said, the Chicago, Burlington & Quincy and the Cleveland, Cincinnati, Chicago & St. Louis will build a bridge. The company is also to have terminals in Paducah, and its tracks are to be used for an entrance into that city by the C., C., C. & St. L. and the C. & E. I. Surveys are being made. It is reported that the Burlington has projected an extension from Herrin, Ill., to the Ohio river, and will use the tracks of the Paducah Northern into Paducah. G. C. Wallace, President; E. Palmer, First Vice-President; L. M. Rieke, Second Vice-President; M. O. Overly, Secretary, and J. C. Utterback, Treasurer, Paducah.

PARRAL & DURANGO.—This company, which last year built three miles of railroad south of Mesa de Sandia, Durango, has work under way on about nine miles from Kilometer 80 to Paraje Seco. Contract let to R. M. Dudley, of Mesa de Sandia. An extension is projected from Kilometer 95 to Guanacevi, about 115 miles.

PAYETTE VALLEY.—Surveys are being made by this company for an extension from New Plymouth, Idaho, southeast to Falk's Store, seven miles.

PENINSULA RAILWAY (ELECTRIC).—An officer writes that this company, which started work and finished about eight miles from Bartow, Fla., west to Mulberry, last year, has rights-of-way secured and 1,000 tons of rails on hand. The company expects to begin work soon on the remaining 37 miles to finish the line to Tampa. At Mulberry the company has its power stations. The Florida Engineering Company is the resident engineer and W. H. Evers, Bartow, is Chief Engineer.

QUEBEC & NEW BRUNSWICK.—Application is being made to Parliament for permission to build a line from a point near St. Johns Junction, Que., to the State of Maine boundary, and to secure trackage rights over any road in that state. Hon. J. Costigan is President.

ROBERT LEE, FORT CHADBURNE & EASTERN.—This company is building a line from Robert Lee, Tex., northeast via Rawlings to Winters, 35 miles. Work was started last December by J. E. Hunter, of Robert Lee, who has the contract on the section from Robert Lee to Rawlings, 13½ miles. Grading has been finished for 2¼ miles. Additional contracts are to be let during the first half of this year. The company is planning to make other extensions for which definite plans have not yet been decided upon. J. Austin Spencer, President, and S. J. Bross, Chief Engineer, Robert Lee.

ROODHOUSE & VIRDEN RAILWAY.—See St. Louis, Terre Haute & Quincy Traction.

ST. LOUIS, TERRE HAUTE & QUINCY TRACTION.—This company has been incorporated in Illinois with $50,000 capital to build an electric line from Quincy, Ill., southeast and then east to Taylorville, 143 miles. Surveys finished and franchises secured for the entire line and all the rights-of-way secured or guaranteed. E. Yates, President; H. C. Simons, Vice-President; F. W. Knollenberg, Secretary and Treasurer, and G. H. Lawrence, Chief Engineer. Parts of the line are to be built under the names of the Roodhouse & Virden Railway and the Virden & Taylorville Traction, which see below.

Surveys and estimates have been finished by the Roodhouse & Virden Railway, and it is expected to begain work early this year on its proposed electric line from Roodhouse, Ill., east to Virden, 33 miles. H. C. Simons, President, Virden.

The Virden & Taylorville Traction expects to begin grading work early this year on its proposed electric line from Virden, Ill., east to Taylorville, 28 miles, with a branch for which surveys have been made north to Divernon, four miles. The work includes a bridge over the Sangamon river. J. Gelder, President, and G. H. Lawrence, Chief Engineer.

SAVANNAH, AUGUSTA & NORTHERN.—An officer writes that this company is making surveys to build from Savannah, Ga., northwest to Chattanooga, Tenn., with an extension east to Augusta, Ga., in all 425 miles. Grading finished on 58 miles and track laid on 30 miles between Statesboro, Ga., and Garfield. Contracts let to W. J. Oliver, of Knoxville, Tenn. W. H. Lynn, 111 Broadway, New York, is interested.

SPOKANE & INLAND EMPIRE (ELECTRIC).—This company, which built 50½ miles of extensions to its line in Washington last year, has given contracts to Grant, Smith & Co., of Rosalia, Wash., to build an extension of its eastern division from Palouse, Wash., southeast to Moscow, Idaho, 15½ miles.

TAMPA NORTHERN.—This company, which built 39 miles of road in Florida last year, has given a contract to B. H. Hardaway, of Columbus, Ga., for building nine miles from Envill Junction, Fla., to Brooksville. Surveys under way from Brooksville north to Thomasville, Ga.

TUSCALOOSA BELT RAILWAY.—Contracts have been given by this company to the Birmingham & Gulf Construction Company, Birmingham, Ala., for building its proposed line from Tuscaloosa, Ala., northeast to Gadsden, 120 miles. Eleven miles in operation in Tuscaloosa. Geo. H. Ross, Superintendent, Tuscaloosa.

VALLEY RIVER.—This company, which was incorporated last year to build a line from Mill Creek, W. Va., south to Clover Lick, 43 miles, for which surveys have been made, has work under way on the line from Mill Creek south to Valleyhead. (Dec. 6, p. 702.)

VIRDEN & TAYLORVILLE TRACTION.—See St. Louis, Terre Haute & Quincy Traction.

WALCOTTVILLE & COLDWATER.—An officer writes that this company will build its proposed line from Walcottville, Mo., to Coldwater, 30 miles, during 1908. O. G. Wales, Kansas City, Mo., is interested.

WESTERN ILLINOIS & IOWA (ELECTRIC).—Incorporated in Illinois with $2,500,000 capital to build an electric line in Hancock county. The incorporators are P. A. Neuffer, J. E. Hauronick, H. H. Phillips, C. J. Horn and R. M. Cole, all of Chicago

WOLF, MAGANTIC & LOTBINIERE.—This company, which was chartered to build a line from Lime Ridge, Wolf county, Que., north toward Quebec, about 100 miles, has surveys made from Lime Ridge to Lyster, 60 miles. A charter has also been granted to continue the line from Lime Ridge south to Sherbrooke, 20 miles. The company will apply at the next session of the legislature for subsidies, and if its application is granted it is expected to begin construction work early this spring. W. H. Lamby, Secretary, Inverness, Que.

RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—December gross earnings increased 2 per cent. and net earnings after taxes decreased 13 per cent. The operating ratio for the month was 70 per cent., against 75 per cent. in November, 1907, and 64 per cent. in December, 1906.

See Houston Belt & Terminal.

BUFFALO, ROCHESTER & PITTSBURGH.—William A. Read & Co., New York, have offered at 101½, yielding nearly 4½ per cent., $500,000 consolidated mortgage 4½ per cent. bonds due 1957, a legal investment for savings banks in New York and Connecticut.

CANADIAN PACIFIC.—Gross earnings for December were $6,400,000, against $6,000,000 in 1906. Net earnings were $2,100,000, against $2,300,000 in 1906. For the six months ended December 31, 1907, net earnings were $14,430,000, against $14,590,000 in 1906.

CHESAPEAKE & OHIO.—Gross earnings for December were $2,142,000 against $2,052,000 in 1906, an increase of 4 per cent. Net earnings were $573,000 against $735,000 in 1906, a decrease of 22 per cent. For the six months ended December 31, 1907, net earnings were $5,248,000 against $4,730,000 in 1906.

CHICAGO & MILWAUKEE ELECTRIC.—On January 28 receivers were appointed for this road. An earlier receivership was instituted on the evening of December 31, 1907, but after the road had been for less than three days in the hands of its President, A. C. Frost, as receiver, this was terminated. The institution of this receivership played a large part in injuring the company's credit. It was impossible to sell bonds to get funds to finish the extension to Milwaukee. There are only about eight miles of this to be finished, more than half of the work on which has been done. The total cost of completing the extension, according to President Frost, would be about $250,000. The receivers appointed by Judge Grosscup in the United States Circuit Court at Chicago were as follows: W. Irving Osborne, Vice-President of the Central Trust Co., of Chicago; D. B. Hanna, Third Vice-President of the Canadian Northern Railway, and Albert C. Frost, President of the company. Owing to objections raised to the appointment of Mr. Frost, he withdrew on January 31 and was succeeded by H. A. Haugan, President of the State Bank of Chicago. Receivers were also appointed for A. C. Frost & Co., and a receivership suit was brought against the Republic Construction Co., which was building the Milwaukee extension.

CHICAGO & WESTERN INDIANA.—Proctor & Borden and Potter, Choate & Prentice, New York, have offered at 95 and interest, to yield 4¼ per cent., $400,000 consolidated mortgage 4 per cent. bonds due 1952 of the Chicago & Western Indiana, guaranteed by the Chicago & Eastern Illinois, the Wabash, the Grand Trunk Western, the Chicago & Erie and the Chicago, Indianapolis & Louisville.

CHICAGO, MILWAUKEE & ST. PAUL.—President Earling is quoted as having said at Seattle on January 31 that negotiations have been made for a line of steamships between Puget Sound and the Orient. J. W. Hiland, Third Vice-President, and F. A. Miller, General Passenger Agent, have gone to China and Japan to investigate traffic conditions. The establishment of the line depends on their report.

CHICAGO RAILWAYS.—The North Chicago and the West Chicago Street Railroads were on January 25 sold at foreclosure sale to representatives of the protective committee. These two companies are to be taken over by the Chicago Railways Company. N. W. Harris & Co. and the National City Bank of New York are to buy the $12,000,000 first mortgage bonds provided for in the reorganization plan for the rehabilitation of these properties. These bonds will be a first mortgage on 300 miles of track, serving without competition the north and west side of Chicago, embracing a territory with a population of 1,500,000.

COLORADO & SOUTHERN.—Gross earnings of the system for December increased 17 per cent. and net earnings 26 per cent. For the six months ended December 31, 1907, gross earnings increased 16 per cent. and net earnings 21 per cent.

See Houston Belt & Terminal.

DELAWARE & HUDSON.—Railroad gross earnings for December increased 15 per cent. and railroad net earnings 5 per cent. There was a decrease of 77 per cent. in net earnings of the coal department, so that there was a final decrease of 17 per cent. in net earnings of all departments.

For the year ended December 31, 1907, railroad gross earnings were $20,100,000, against $17,000,000 in 1906, an increase of $3,100,000, or 18 per cent. Expenses and taxes increased $1,500,000, leaving $8,000,000 as the net earnings of the railroad department, an increase of $1,600,000, or 25 per cent. over 1906.

DETROIT, TOLEDO & IRONTON.—On February 1, George K. Lowell, Vice-President and General Manager, and Benjamin S. Warren, General Counsel, were appointed receivers by the United States Circuit Court at Detroit, Mich., following default on $2,776,400 consolidated mortgage 4½ per cent. bonds on which semi-annual interest fell due February 1. The company's directors impute the receivership directly to adverse railroad legislation, particularly that section of the Rate Law which prohibits a railroad from having any interest in coal properties except for its own use. The income results for the year ended June 30, 1907, were however, very unsatisfactory. In 1905 the Detroit, Toledo & Ironton was reorganized from the Detroit Southern and control of the Ann Arbor was acquired, making a through line from Ironton, on the Ohio river, north to Ann Arbor, on Lake Michigan. The owners planned to develop the combined property by an extension across the Ohio river at Ironton, Ohio, to coal lands in northern Kentucky, on which it had acquired options. A bridge at Ironton was begun. The Detroit, Toledo & Ironton itself operates 438 miles of road, and, including the Ann Arbor, 734 miles.

GEORGIA SOUTHERN & FLORIDA.—Samuel F. Parrott, Vice-President of the Georgia Southern & Florida, was, on February 3, appointed receiver of the Macon & Birmingham, which has since February 1, 1904, been operated by the Georgia Southern & Florida. The Macon & Birmingham operates 105 miles from Macon, Ga., to La Grange.

GULF & SHIP ISLAND.—Cramp, Mitchell & Shober, Philadelphia, have offered, to yield 6¼ per cent., $460,000 5 per cent. car trust bonds maturing semi-annually to 1918, secured on

500 freight cars at $774 each	$387,000
3 passenger coaches at $6,900 each	20,700
1 chair car at	12,740
1 combination baggage car at	5,195
1 baggage car at	4,755
2 passenger locomotives at $15,500 each	31,000
6 freight locomotives at $15,250 each	91,500
Total	$552,890

The excess of 17 per cent. is being paid by the railroad company.

GRAND TRUNK PACIFIC.—On January 14 this company offered at 94 in London $5,000,000 (£1,000,000) 4 per cent. debenture stock ranking equally with the same amount already issued and guaranteed by the Grand Trunk. The proceeds are for additional rolling stock, which is to be used by the Grand Trunk until it is required by the Grand Trunk Pacific. The advertisement offering the stock says that about 800 miles of the Grand Trunk Pacific will be ready for traffic this fall.

Hocking Valley.—In December, gross earnings decreased 13 per cent. and net earnings 65 per cent. The decrease in net earnings was more than compensated by an increase in other income.

Houston Belt & Terminal.—The Houston Belt & Terminal Company, of which the Santa Fe, the St. Louis & San Francisco, the Trinity & Brazos Valley and the St. Louis, Brownsville & Mexico, are owners is to take over the Houston terminal property of the Gulf, Colorado & Santa Fe as the nucleus of important terminals to be built at a cost of several million dollars.

Illinois Central.—Gross earnings for the six months ended December 31, 1907, increased 5 per cent.; net earnings decreased 11 per cent.

International & Great Northern.—Estimated gross earnings for the week ended January 31, 1908, were $195,000, against $311,000 in 1907. This is a decrease of 37 per cent.

Louisiana & Arkansas.—Gross earnings for December were $64,188; operating expenses were $63,986, and net earnings were $202, against $16,643 in 1906, a decrease of 99 per cent. For the six months ended December 31, 1907, net earnings were $184,000, against $177,000 in 1906.

Macon & Birmingham.—See Georgia Southern & Florida.

Mexican Central.—See National Railways of Mexico.

Minneapolis, St. Paul & Sault Ste. Marie.—By reason of comparison with a time of severe winter weather in 1906, this company shows a large increase in net earnings for December, which were $512,000, against $350,000 in 1906. The operating ratio was 52.7 per cent. in 1907 and 61.9 in 1906.

National Railways of Mexico.—Earnings in December, 1907, increased as follows over those for December, 1906:

On the National of Mexico there was an increase of 2 per cent. in gross earnings and a decrease of 4 per cent. in net earnings.

On the Mexican International there was a decrease of 5 per cent. in gross earnings and a decrease of 20 per cent. in net earnings.

On the Interoceanic of Mexico there was an increase of 8½ per cent. in gross earnings and 17 per cent. in net earnings.

On the Hidalgo & North-eastern there was a decrease of 7 per cent. in gross earnings and of 9 per cent. in net earnings.

On the Mexican Central there was an increase of 23 per cent. in gross earnings and 8 per cent. in net earnings. Gross earnings of the Mexican Central for the six months ended December 31, 1907, increased 28 per cent. and net earnings 31 per cent.

New York City Railway.—The Metropolitan Street Railway has defaulted the semi-annual interest, due February 1, on its outstanding $12,500,000 general collateral trust mortgage 5 per cent. bonds.

New York, New Haven & Hartford.—Gross earnings for the six months ended December 31, 1907, were $29,500,000; net earnings were $9,100,000. For the six months ended December 31, 1906, gross earnings were $28,300,000 and net earnings were $10,400,000. In 1907 the figures were compiled according to the Interstate Commerce Commission rulings.

Norfolk & Western.—Passenger earnings for December decreased 2 per cent.; freight earnings, 10 per cent., and gross earnings, 8 per cent. Operating expenses increased 4 per cent., leaving a decrease of 30 per cent. in net earnings. The operating ratio was 73 per cent., against 65 per cent. in 1906. For the six months ended December 31, 1907, gross earnings increased 13 per cent. and net earnings 5 per cent.

Pennsylvania.—Shipments of coal and coke originating on the lines of the Pennsylvania Railroad east of Pittsburgh and Erie, were 3,050,000 tons for the 1908 year to January 25. For the 1907 year to January 26 they were 4,127,000 tons.

Gross earnings of the Lines East of Pittsburgh and Erie directly operated by the Pennsylvania Railroad for the year ended December 31, 1907, were $164,800,000, against $148,200,000 in 1906, an increase of $16,000,000, or 11 per cent. Operating expenses increased $17,800,000, or 17 per cent., leaving a decrease of $1,200,000, or 3 per cent. in net earnings.

Gross earnings of the Lines West directly operated by the Pennsylvania Company for the year ended December 31, 1907, were $54,200,000, an increase of $8,100,000, or 12 per cent. over 1906. Net earnings were $14,400,000, an increase of $12,000, or 9 per cent. over 1906.

Reading Company.—The Philadelphia & Reading Railway is one of the very few companies to show an increase in net earnings for December, which were $1,274,000, against $1,218,000 in 1906. This is particularly noticeable because gross earnings show a slight decrease.

St. Louis & San Francisco.—This company has sold $3,000,000 6 per cent. seven months' notes dated January 29, 1907, to Hallgarten & Co., of New York. These notes are issued in denominations of $50,000 and are subject to call on five days' notice in sums or multiples of $150,000. All have been sold, partly in Europe.

See Houston Belt & Terminal.

St. Louis, Brownsville & Mexico.—See Houston Belt & Terminal.

Southern.—Gross earnings for December decreased 14 per cent.; net earnings 30 per cent. and net earnings after taxes 38 per cent. The operating ratio was 82 per cent. against 75 per cent. in 1906. For the six months ended December 31, 1907, there was an increase of 4 per cent. in gross earnings and 8 per cent. in operating expenses. Net earnings decreased 8 per cent.; taxes increased 33 per cent. and net earnings after taxes decreased 12 per cent.

See Georgia Southern & Florida.

Southern Pacific.—Gross earnings for December were $11,073,000 against $10,995,000 in 1906. Net earnings were $3,319,000 against $4,044,000 in 1906. For the six months ended December 31, 1907, gross earnings were $69,100,000 against $62,100,000 in 1906. Net earnings were $20,084,000 against $24,355,000 in 1906. The following official statement is made covering both the Southern Pacific and Union Pacific:

In 1906 only the net revenue from the operation of dining cars, hotels and other facilities used in connection with the transportation lines of the companies was included in the transportation operations. The classification of the Interstate Commerce Commission in effect since July 1 1907, deals with this revenue as "outside operations," and in thus dealing with it, the revenue is included in the gross revenue and the expenses in the operating expenses. To bring last year's gross revenue and expenses in respect of these "outside operations" in accord with those of this year, the gross revenue expenses for the five months ended November, 1906, in the case of the Union Pacific were increased $414,134, and in the case of the Southern Pacific were increased $595,603. Net revenue for Union Pacific amounting to $61,800 and for Southern Pacific amounting to $94,573, is already included in the gross revenue.

Southern Railway.—A. B. Andrews, First Vice-President, was on January 27 appointed receiver of the Tallulah Falls Railway. On January 6 receivers were appointed by a Georgia state court, but these receivers were discharged later in the month. The Tallulah Falls owes about $1,500,000 to the Southern Railway for advances. The application for a receiver was made by the Southern Railway. The Tallulah Falls runs from Cornelia, Ga., north through Rabun gap, to Franklin, N. C., 60 miles. According to the last annual report of the Southern, the Tallulah Falls is eventually to be used as part of a low grade through line from Maryville, Tenn., via Bushnell and Franklin, N. C., between "the Knoxville territory and north and west thereof" and "the consuming territory of Georgia and South Carolina, avoiding the necessity of handling traffic over the heavier grades via Asheville and Spartanburg."

Tallulah Falls.—See Southern Railway.

Third Avenue Railroad.—Frederick W. Whitridge, receiver of this company, was on February 1 appointed receiver also of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway, and the Dry Dock, East Broadway & Battery, which own street railway lines in New York City. The Third Avenue Railroad owns nearly all the stock of both companies. The Forty-second street company operates 24½ miles of track. Control was bought by the Third Avenue in November, 1905. The company was in the hands of a receiver from March, 1900, to April, 1901. The Dry Dock company has 17½ miles of track. The Third Avenue bought control in 1897.

Toledo & Ohio Central.—On February 1 the Toledo & Ohio Central assumed the operation of the Marietta, Columbus & Cleveland, which runs from Marietta, Ohio, to Palos, on the Toledo & Ohio Central, 45 miles, with a 4 mile branch.

Union Pacific.—Gross earnings for December were $6,530,000 against $6,380,000 in 1906. Net earnings were $2,635,000 against $2,894,000 in 1906. For the six months ended December 31, 1907, gross earnings were $42,900,000 against $39,000,000 in 1906, and net earnings $17,600,000 against $19,000,000 in 1906. See Southern Pacific.

The suit brought by the United States Government to set aside the Union Pacific's control of the Southern Pacific and the San Pedro, Los Angeles & Salt Lake and its stock holdings in other transcontinental lines was filed on February 1 at Salt Lake City.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

OFFICERS:

W. H. BOARDMAN, *Prest. and Editor.*
E. A. SIMMONS, *Vice-President.*
RAY MORRIS, *Secretary*
R. S. CHISOLM, *Treas.*
I. B. RINES, *Cashier*
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BRAMAN B. ADAMS
CHARLES H. FRY
FRANK W. KRAEGER
GEORGE L. FOWLER
HUGH RANKIN
BRADFORD BOARDMAN

CONTENTS

VOL. XLIV., No. 7. FRIDAY, FEBRUARY 14, 1908.

The American Railway Association proposes to reduce the per diem rate for interchanged freight cars as soon as possible—that is to say, on March 1—to 25 cents (from 50 cents), and to thereafter fix it at the most equitable figure that can be arrived at through the combined wisdom of five experts. This is the substance of the resolutions providing for a letter ballot, which were adopted at the special meeting called for this purpose and held at Chicago last week. There can be little doubt that the proposition will be adopted. The resolutions are:

That the question of a change . . . be presented to the members for a letter ballot; the rate to take effect on March 1, if approved by a majority of the membership and two-thirds of the cars owned or controlled . . . The ballot to close on Feb. 25.

That a special commission of five be appointed by the Executive Committee to determine: First, the payment per day which the using road should pay the owning road for the use of its cars; second, an effectual method to secure the enforcement of the existing rules for the return of equipment on demand.

The conclusions of the Commission will be submitted to a letter ballot, and if confirmed will become effective on the first of the month following the announcement of the vote by the Secretary.

This would seem to give due consideration to the needs of the most strenuous objector. The only real remaining ground for dissatisfaction is that the rate will still remain arbitrary, in the sense that it cannot be quickly changed, and that it must be the same everywhere. Moreover, the five commissioners will have to exercise their wills rather than their reasoning powers to settle some of the questions that will come before them. But if they make their report with reasonable celerity it will have to be a decidedly poor one not to merit prompt and universal acceptance; for a code of arbitrary rules, universally applicable, seems at present to be the only practicable way of managing freight car interchange in this great country.

Storing coal under water is admittedly the best way known of minimizing deterioration, as well as of avoiding spontaneous combustion or accidental ignition. The advantages of this method of storage have been determined in Great Britain within the past five years. The British Admiralty has been the most noted as well as the most extensive investigator, although its studies were antedated by individual experimenters, who were able to record definite and conclusive results. The methods and conditions of these experiments and their results were given in English engineering journals and are more or less generally known. But that the idea has been in use in this country since about the time attention was first drawn to it in England may be new to many. In 1902 the Western Electric Company, Chicago, having had much trouble from spontaneous combustion with Illinois coal stored in quantity, determined on water storage as the simplest and most effective preventive. A large hole was dug in the ground, the coal dumped in and flooded. When the large new plant at Hawthorne (Chicago) was built something more than a year ago, the scheme was elaborated to its present proportions. A concrete pit to hold 10,000 tons was built, with tracks across on concrete arches, and alongside, and the reserve supply of coal is kept in the bins thus formed. To deposit the coal in these submerged bins costs about 5 cents a ton. It is removed by a locomotive crane with a grab bucket. The water for the bins comes from the roofs of nearby buildings. The cost of the pit, which is 310 ft. x 114 ft. and 15 ft. deep, was at the rate of $7,000 per 1,000 tons of capacity. When the coal is used it is loaded into cars, allowed to stand 24 hours to drain and then put into the overhead bunkers of the power station, from which it feeds to the stokers. It is therefore used within 48 hours after coming from the pit, and burns well. Since the water removes all of the finely pulverized material, it is equivalent to using washed coal. It will be recalled that the British experiments included storage in both sea and fresh water, and in the former instance the quality of the coal actually was improved, presumably from its permeation by the salt. The effect of salting the water has not been tried at the Western Electric Company's pit.

PENNSYLVANIA RAIL ORDER FOR 1908.

We received news after we went to press last week that the Pennsylvania Railroad, on February 6, placed definite orders with steel manufacturers for 55,000 tons of rail to be delivered during 1908, so that this new order, in addition to 30,000 tons on hand from the 1907 order, will give the company 85,000 tons for use this year, or enough rails to lay some 550 miles—considerably more than the main line distance from New York to Pittsburgh. The orders were distributed as follows: United States Steel Corporation, 27,500 tons; Cambria Steel Co., 11,000 tons; Pennsylvania Steel Co., 11,000 tons; and Lackawanna Steel Company, 5,500 tons. These rails will be rolled under entirely new specifications. In view of the increasing severity of road service and the recognized necessity for developing an improved rail, the Pennsylvania has for some months been conducting exhaustive examination of the entire art and practice of rail manufacture. A committee of experts representing the railroad and two important steel manufacturers was appointed last summer to make a special study of the subject and the experiments which this committee made were perhaps without precedent in their completeness and in the importance of the scientific data supplied. A new rail section has been developed and we hope to have the opportunity to show this fully in the near future, but the important point for present consideration is the statement in the official announcement that the company places upon the manufacturer the responsibility for the character of the rail produced, recognizing that it is a purchaser and not itself a manufacturer. In all branches of trade it is the privilege of the purchaser to require results. In few or no branches does the purchaser attempt to prescribe the exact way these results shall be obtained. The new Pennsylvania specifications adhere to this excellent principle and allow considerable latitude in the methods of manufacture so long as the result is a sound rail. We have for a long time maintained that exactly this thing should be done; that the burden of proof should be put upon the manufacturer, not upon the user, and that rigorous and exacting test of the finished product will work better than a set of specifications so minute that the manufacturer, once he has complied with them, places himself beyond criticism, whether the result comes up to expectations or not. The Pennsylvania in this instance has devised tests so exacting that it is to the interest of the manufacturers to discard all material which is in any way open to suspicion.

The new specifications do not require any fixed discard, responsibility for this being thrown entirely upon the manufacturer, and they provide that rails shall be free from injurious mechanical defects and flaws, without attempting to describe the particular defects or flaws that will cause the rejection of the rail. In other words, instead of saying to the rail manufacturer, you must make us a rail from ingots which have been cropped to a certain specified per cent., the company in effect says merely, you must make us rails that will not break The methods of testing are very complete, and to place the company's rail practice upon a sound historical basis and to insure that whatever future changes are made shall be based upon accurate data, a system has been devised whereby the history of all rails purchased by the company shall be fully recorded. In order to identify the part of the ingot from which a particular rail was made the new specifications require, in addition to the usual marking, that a letter shall be stamped on each rail to indicate its position in the ingot. A special committee has also been appointed to keep continually in touch with the rail question, in order to enable the company to secure the best rails which at the time of any order it is possible to manufacture. In placing its orders, the Pennsylvania specifically invites the steel manufacturers to fill part of the allotment with open hearth rails in order to ascertain more clearly the actual service differences between open hearth and Bessemer. It is understood that standard prices will prevail.

THE SHADOW IN THE RAILROAD FORECAST.

Under normal conditions a period of financial stress, as affecting especially railroad properties, follows certain fixed lines. Economic theory and practical experience alike confirm them. There is first the antecedent process, often reaching over years of time, of undue expansion. The structure of credit and of business becomes topheavy Presently some single failure, usually of magnitude, discloses the general condition. Panic and contraction follow next, at first smiting the financial centers, with its familiar symptoms of tight money, hoarding and swift fall of security prices. It hits business next, and the blow deflects instantly upon the railroads. Earnings fall and compel economies, some of them harsh and painful and not always effective enough to prevent reduction of dividends Next comes the recovery, sometimes slow, sometimes swift The wreckage is cleared away, credit revives, money rates fall. On the railroads, earnings increase, dividends are reassured, and the crisis passes. Such, in the briefest forms of statement and distilled to its final terms, is the normal story of a panic period. Were external conditions now normal also, one might almost consider our period of trouble over and the railroad situation bright. Indeed, the purely fiscal recovery has been quicker than usual, and the actual wreckage to be cut away less.

But, unfortunately for the railroads, external conditions have been rare, and promise for some time to be abnormal. Heretofore the railroads have been able to work back from hard times not only with a large measure of public sympathy and co-operation, but also under the protection of well defined law They could rely on a deep and instant public respect for the basic rights of property and, on the other hand, upon statutes which had stood long, which the courts had interpreted and which rested on the precedents of judicial ruling. The deepest shadow on the railroad situation is the change in these respects which has come to pass. During the last year or two railroad statute making has stretched beyond all bounds. It is not merely that twenty-five or thirty states have passed positively hostile acts, but that the volume of statutes is so vast. They vary in different states and in adjacent states are inconsistent with each other. They impose severe or ridiculous restrictions on railroad operation. The most serious of them veer head-on against the "due process" amendment of the federal constitution, yet even so must travel the long and slow path through the courts that leads to their death, but meanwhile doing their mischief If unrepealed by legislatures, it would take years for the higher courts to expound the statutes of the last twelvemonth. But, luckily for the railroads, many of the worst of those statutes are of such a character that they tend to repeal themselves, and a second legislature undoes the policies of the first. In federal law, with the statutes less in number and not so complex and contradictory, there is much the same uncertainty as in the states. Hardly a day passes that one does not read of some new question raised under the Sherman Act; and, over all, hangs the doubtful action and attitude of Congress.

A railroad situation is unpleasant when the corporations are mired in such a morass of legislation, federal and state. It is worse when it is up against any unfriendly public sentiment. That sentiment left to itself and to logical outworking would have cleared up soon enough. Reverting again to the rule of experience in such cases, any popular movement against a large vested interest is apt to run to extremes. At first started by discolored abuses, civic feeling goes wild in the effort to check them. Honest men, acting under quick impulse, often join in such a movement But presently sobriety succeeds rashness. The pocket nerve of communities begins to be touched, the cry of hardship is heard and the radical turns conservative. But here again we happen now to strike an abnormal condition. From those exalted official quarters whence we should expect the conservative keynote comes instead the word of flame. It is taken up as a countersign by every federal law officer; it stirs up state commissions; it revives the demagogue; it rewakes the anti-corporation spirit of legislatures just beginning to slumber. Shot through it all is "politics" and the issues of personal or party vantage in a presidential campaign near at hand in which corporation questions promise to cut a wide swath; and, if the paradox may be allowed, not a few of the foremost party leaders on both sides vie in striving to prove which party is most like the other. To the railroad manager struggling to make ends meet when engines and empty cars are indefinitely side-tracked, it must be confessed that such a situation is more anomalous than cheering.

Of the final result there can, of course, be no real doubt The underlying forces of conservatism are too strong and the currents of an enlightened public and personal interest too deep not to prevail at last. But meanwhile the shadow remains and the strange situation presents itself of the great railroad interest of the country in a time of industrial stagnation and distress forced to battle with the law that should protect and with the public sentiment that should be sympathetic and helpful. Years hence, when with a broad and landscape view, the political economist or historian writes up the year 1908, in which the railroad faces the combination of hard times, acute politics, befogged law and federal antagonism, there will be a record to which, in uniqueness at least, the history of other fiscal crises in this country have no parallel In the story of the nation and its railroads, the year may also be an epoch.

THE WHEEL SITUATION

Probably no reader of the *Railroad Gazette* can recollect the time when the car wheel of the former day was not better in remembrance than that of the present, and yet the oldest inhabitant would not claim that the first wheel was the best wheel ever made; hence at some time there must have been an improvement of quality The difficulty is that there is no standard of quality with which to make comparisons, since the standard of life and wear becomes utterly worthless because of the changed conditions of service then and now.

In fact, it is only within the past few years that there has been a wheel question as we understand it to-day. It was about six years ago, when cars of 100,000 pounds capacity, had become plentiful enough to be a factor in railroad operation, that indefinite rumors floated into the office of the *Railroad Gazette* to the effect that there was trouble with the wheel. A representative was accordingly sent to enquire, and he found a condition of anxiety in the minds of thoughtful railroad men that would have been panicky with people of smaller caliber. Wheels were breaking in unprecedented numbers under high capacity cars, especially upon mountain divisions, where there were long and heavy brake applications, and users and makers found themselves face to face with the problem of improving the wheel or abandoning the high capacity car. By an increase of weight and a charge in material a better wheel was produced, and a year later these same officials were breathing easier, but they by no means considered that their troubles were at an end. Since that time, the increase in the relative number of high capacity cars has increased the actual number of failures in proportion, and the weakness of wheels, as evidenced in flange breakages, has become one of the vital questions of the hour.

Meanwhile, the wheelmakers are insistent that if the railroads would only pay more for their wheels, better work could be produced. The railroad replies to this, in substance: "You come here and offer a wheel of a certain weight at a given price and guarantee it to render a certain service. If you can make a better proposition, whereby, by paying more, a better wheel and a better guarantee can be obtained, accompanied by a lower cost per 1,000 miles, we will certainly be willing to entertain it." The burden of producing a better and more economical wheel is thus thrown upon the shoulders of the makers. The relations between them and the railroad companies is one that is purely commercial, and it is left to the seller to prove that he can make a cheaper wheel than the one now in use, the word cheaper being used in the sense of a lower ultimate, not of a lower first, cost. Whether this can be done or not remains to be seen, but an outsider would be led to infer that, in the opinion of the users, it cannot be done, if he based that opinion solely upon the external evidence of the action of the Master Car Builders' Association during the past two or three years. Apparently the members of that association have come to the conclusion that the cast iron wheel of the standard contour is insufficient to meet the requirements of the car of 100,000 pounds capacity, and so they have set themselves to work to improve the wheel, not by improving the material of which it is made, but by strengthening the finished article, by increasing its weight and thickness, using the existing grades of iron. In all the reports of the wheel committees and in all the discussion upon the floor of the conventions, there is not one word or hint that an attempt at improvement of material should be made or that it could successfully be made, as a means of strengthening the wheel. It is, apparently, resignedly accepted that the best that can be done along those lines has been done. Wheel users have accepted the metal as it stands and propose to make the best of it.

The result of this position has been the designing of wheels in which there is a progressive thickening of the metal and a corresponding increase of the weight of the wheel as the service rises from that of a 60,000 pound capacity car, through 80,000 pounds to 100,000 pounds.

This is official action, with no official comment other than the bare statement of the necessity that the wheel that has given satisfactory service under cars of 60,000 pounds capacity must be improved if it is to be used under those of 100,000 lbs. capacity.

The whole situation is not defined, however, in official action though it may be, in part, indicated. We have the private expressions of opinion of superintendents of motive power and master car builders, the so-called piazza talk of the conventions, the general gossip that is floating about from untraceable sources, and the discussions at the railroad clubs. As for the position of those men in charge of the rolling stock, it is well within bounds to say that it averages one of anxiety, especially where work has to be done on mountain divisions, while the feeling that there must be eternal watchfulness of the most wide-awake character is universal, in order that flange breakage—that dreaded result—arising from those insidious and non-detectable cracks that are apt to be set up in the interior of the wheel, may be avoided. The general gossip merely confirms this fear of cracks, and solidifies the current impression that the cast iron wheel is not just the thing—not quite safe for use under high capacity cars. As for the club discussions, the case seems to be merely emphasized by them. Two such discussions have taken place this winter, both marked by a practical unanimity of opinion upon the cast iron wheel question. At the Pittsburgh club, in November, there was an address in which the speaker opened with a well-deserved tribute to the cast iron wheel, and an acknowledgment of what American railroad development owed to it, but he followed this by a very vigorous and emphatic attack upon its use under high capacity cars, arguing that it was not safe. This in Pittsburgh, where the cast iron wheel is at home.

Yet, though the speaker was warned in advance that if he attacked the cast iron wheels he must expect a vigorous defense and counter-attack and be prepared therefor, he found himself in the midst of a love feast, and even the wheelmakers agreed with almost everything that he said.

Again, in January, at the Western Railway club, a paper was presented in which the causes of failure of the cast iron wheel were set forth with great elaboration. No excuses were offered, and the case was clearly and definitely stated. In the discussion that followed there was at least one vigorous attack upon the use of the wheel under high capacity cars, followed substantially by a corroboration, or at least, by no refutation of the arguments offered to show that the wheel was not safe. These straws are certainly very indicative of the opinions of men who know; for, in both cases, if railroad officers present had held any opinions contrary to those expressed, or if the wheel makers had any figures or arguments to offer to contradict or meet the opinions set forth, these opinions and arguments would undoubtedly have been brought to light.

Now, there must be a reason, or reasons, for all this, and it appears not unlikely that it is founded upon a mixture of knowledge and ignorance. We know that the cast iron wheel gave satisfactory service under cars of 60,000 lbs. capacity, and that when that capacity was raised to 80,000 lbs., the difference in efficiency was not enough to be noticeable, but when the load was made 100,000 lbs., the crash came. That much represents knowledge. Then came the talk about inferior wheels, brake action, stresses internal and external, soft and hard chills, and all manner of excuses and guesses, of the validity of which we know nothing. Who knows whether there is really any difference in the hardness of the chill of different wheels? We know that there is a difference in the depth of penetration. But how about actual hardness? How many tests have been made of the strength of the chilled metal cut from wheels? Who has ever measured the internal stresses that exist in the average cast iron wheel as it leaves the annealing pits? Has any one ever attempted to measure the effect of brakeshoe action on these internal stresses? Who knows, except in a general way, the effect of the temperature of the metal at the time of pouring, on the internal stresses of the wheel? In short, do we know one single item of what is going on inside that metal, to give us a clue about what should be done to improve conditions?

Who knows very much about external stresses either? With the exception of the investigations of last summer as recently published in the *Railroad Gazette*, nothing is known of lateral stresses, while of vertical stresses our knowledge is still more limited. It is, as the investigator asserts, a case where the merest scratching has been done on the surface of a field that stands inviting a thorough cultivation with the promise of a rich reward to the cultivator. We have no present opinions to express on this subject; we wish merely to record the apparent conditions; the state of the art. But it is quite proper to suggest to wheel makers and to railroad officers that before there is any further condemnation of the cast iron wheel and before there are any further attempts to improve it, it would be worth while to find out definitely what is the matter with it, and what effect brakeshoe and other actions have upon it. When we have learned this, we will all be in a better position to proceed intelligently with improvements, or at least to decide whether improvement is possible or not.

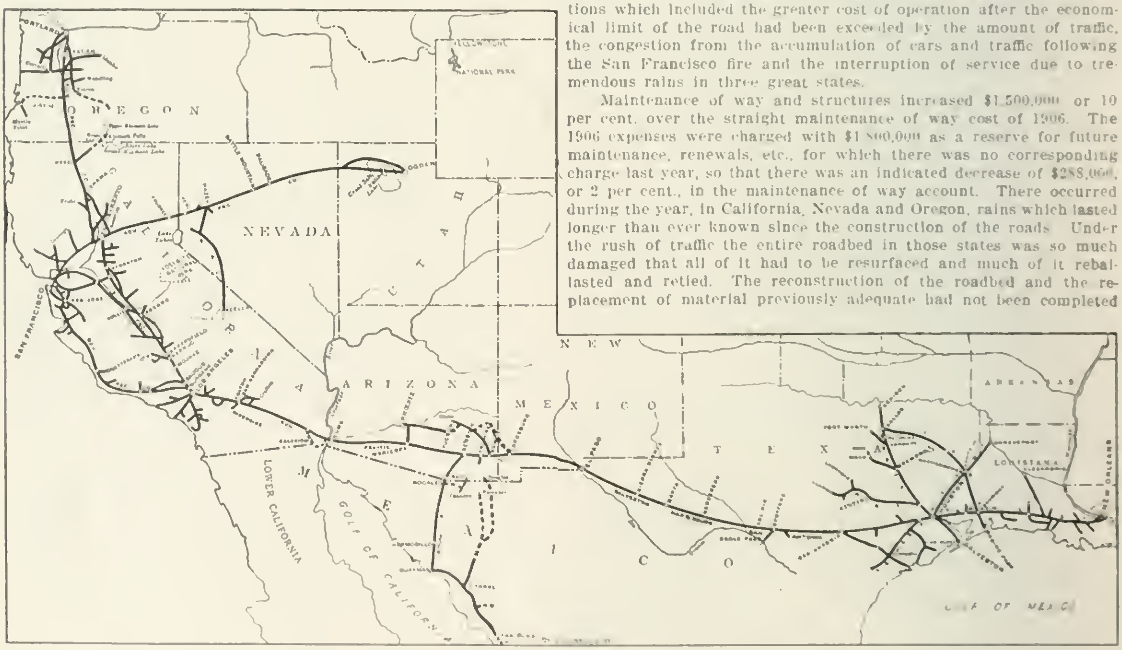
Probably nobody will deny that the case is serious. That a cure is not yet in sight, is evidenced by the large and increasing percentage of steel wheels that are being put under high capacity cars. It is not reasonable to suppose that railroad managers would buy steel wheels for this purpose, if, by an advance in price, they could obtain a cast iron wheel to meet their requirements. It is not a case of obtaining business through advertising the superiority of their equipment, nor would these same managers consider for a moment a proposition to put steel wheels under 60,000-lb. cars. They simply feel that traffic demands have outgrown the capacity of the cast iron wheel, and they are obliged to use steel just as they did years ago in passenger cars and engine truck wheels.

In this there can be no thought of condemnation of the cast iron wheel in itself. At present we know pretty well the extent to which it can be depended upon, but for high capacity service, in order to bring its quality up to the severe requirements, it is certainly better to pry into the present service condition of the wheel, external and internal, and the causes affecting it rather than proceed blindly with no definite idea of what ought to be done. What such an investigation will reveal, no one can say, but it is quite safe to predict that until the cast iron wheel is improved along the lines of positive information, the use of its rival, the steel wheel, will continue to increase and the steel wheel will be placed under a larger and larger proportion of the high capacity freight cars of the country.

For many years the Pullman Company has set the railroads of the country good examples in certain of the details of its dealings with its employees, but in nothing has it done better than in the action reported from Chicago in the following press despatch: "The Pullman Palace Car Company has distributed $171,850 among 5,770 employees of its car service department. The bonus amounts to one month's salary for every conductor and porter who continued on the payroll of the company throughout 1907 and who had no demerits charged against him. The maximum number of porters employed during the year was 4,400, and of conductors, 1,689. It is the intention of the company to grant the bonus of one month's pay each year hereafter to such conductors and porters as make a clean record throughout the year."

Southern Pacific Company.

The twenty-third annual report of the Southern Pacific Company and proprietary companies for the year ended June 30, 1907, was issued on February 6 under date of January 23, 1908. As usual it is a model of completeness; a standard for other companies to follow. Not only is full information given for the holding company, but



Southern Pacific.

most of the important facts are shown in detail for each of the 15 proprietary companies directly included in the system as well as information about four other proprietary companies which are not directly included.

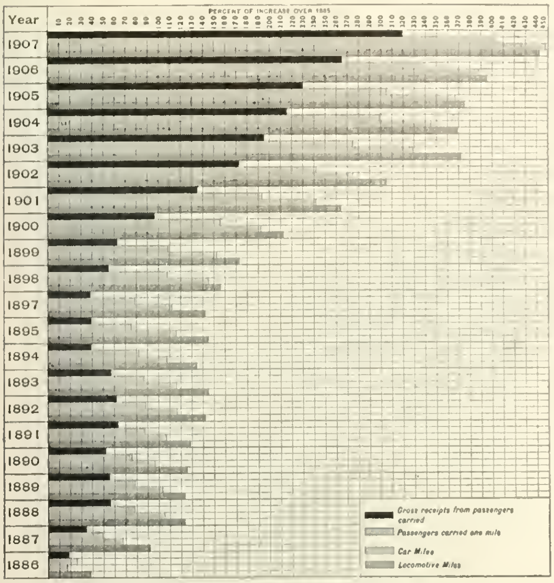
The average mileage of railroad directly operated has risen to 9,400 miles, and the gross transportation receipts from both rail and water lines to just under $125,000,000. The increase in transportation receipts over the year ended June 30, 1906, was $19,300,000, but operating expenses and taxes of all lines increased $12,500,000, leaving net earnings after taxes of $41,800,000 against $35,000,000 in 1906, an increase of $6,800,000. Increases in other income brought up the total amount available to pay fixed charges to $46,800,000, a gain of $8,400,000 over the previous year. Fixed and other charges were $700,000 less and net income $9,000,000 larger than in 1906. From the net income of $[illegible] there was paid in dividends $1[illegible]200,000 and appropriated for betterments and additions or reserved for depreciation of rolling stock $[illegible], leaving a surplus for the year after all charges and payments of $14,4[illegible]. This compares with $11,100,000 in 1906.

Gross railroad earnings were $117,[illegible] against $[illegible] in 1906, an increase of $1[illegible], or 18 per cent. No other railroad in the country except the Pennsylvania had gross earnings last year of as much as $100,000,000. Gross earnings were $12,[illegible] per mile. Railroad operating expenses increased 1[illegible] per cent, leaving net earnings of $43,700,000, an increase of $7,[illegible], or [illegible] per cent over 1906. Passenger earnings increased 15 per cent and freight earnings 19 per cent. Meanwhile the operating ratio was reduced from [illegible] in 1906 to 62.75 per cent. last year.

This was accomplished in a year of exceptional difficulties and rapidly increasing costs by spending a smaller proportion of gross earnings on maintenance than in the previous year. Considering maintenance of way and structures and maintenance of equipment as "maintenance," and conducting transportation and general expenses as "operation," there was a great change in the relation of these two groups to the gross receipts. In 1906 almost as large a percentage of gross was spent on one group as on the other, "maintenance" taking 30.88 per cent. of gross and "operation" 32.43 per cent. Last year, however, "maintenance" was reduced to 26.46 per cent. of gross earnings, while "operation" rose to 36.29 per cent.

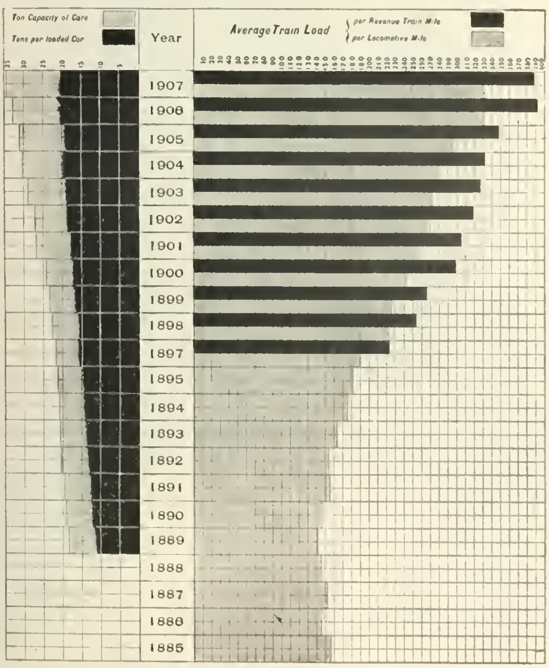
Operating expenses of all lines increased $12,100,000, or 18 per cent., but the actual increase in the cost of carrying on the business was greater than this, for the expenses of 1906 were charged with $2,100,000 which was credited to a reserve fund for future maintenance and renewals for which there was no necessity last year. The increase in actual operating expenses was, therefore $14,200,000, or 22 per cent. There were higher wage schedules, most of which went in effect in the fall of 1906; a larger amount of improvements; greater cost of material, principally of lumber and fuel, more traffic moved; and extra expense of moving traffic under exceptional conditions which included the greater cost of operation after the economical limit of the road had been exceeded by the amount of traffic, the congestion from the accumulation of cars and traffic following the San Francisco fire and the interruption of service due to tremendous rains in three great states.

Maintenance of way and structures increased $1,500,000 or 10 per cent. over the straight maintenance of way cost of 1906. The 1906 expenses were charged with $1,800,000 as a reserve for future maintenance, renewals, etc., for which there was no corresponding charge last year, so that there was an indicated decrease of $288,000, or 2 per cent., in the maintenance of way account. There occurred during the year, in California, Nevada and Oregon, rains which lasted longer than ever known since the construction of the roads. Under the rush of traffic the entire roadbed in those states was so much damaged that all of it had to be resurfaced and much of it reballasted and retied. The reconstruction of the roadbed and the replacement of material previously adequate had not been completed at the end of the fiscal year, but has been increasing the expenses of maintenance in the first six months of the current fiscal year. The cost of repairing damages caused by storms and floods on the lines of the Pacific system west of El Paso amounted to $565,000. Repairs of bridges, culverts and trestles increased $458,000, of which $102,000 represents flood damage and the remaining amount includes the cost of 6,900 ft. of steel and the wooden structures replaced. The average cost of ties during the year increased 23 per cent., from 47 cents to 58 cents, so that although there were over 600,000 less ties laid in track, there was an increase in the cost of tie renewals. Repairs of buildings other than docks and wharves increased $695,000, which includes the cost of repairing damages by fire and earthquake at San Francisco and of repairs to the passenger terminals at Oakland and at Alameda Moles. There is also included in maintenance of way under a separate account $218,000 spent by the Southern Pacific *Railroad* in finishing the work of moving its tracks and of building about 40 miles of new line higher up on the side of the Salton sink. The expenditures in 1906 for this work amounted to $537,000, making a total of $755,000 in the two years. There were 355 miles of new rails laid, a decrease of 64 miles from 1906. The unit cost of maintenance of way per mile of main and second track (including 175 miles of second track in 1907 and 164 miles in 1906) was $1,676, against $1,744 in 1906.



Passenger Service and Traffic.

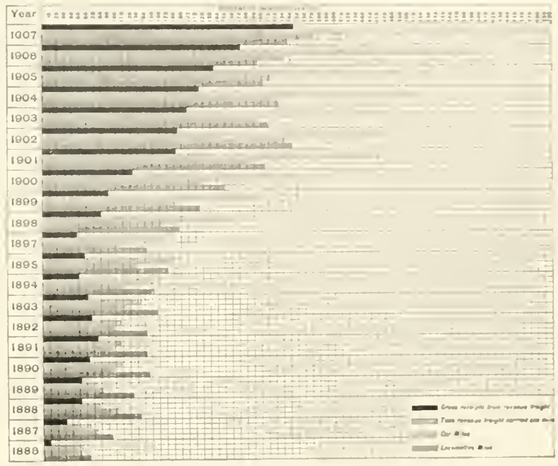
Locomotive miles include revenue passenger train miles, one-fourth of mixed train miles, and helping passenger train miles.



Average Train Load and Tons Per Loaded Car.

Revenue train miles include miles run with freight trains and three-fourths of mixed train miles. Locomotive miles include revenue freight train miles, three-fourths of mixed train miles, and helping freight train miles.

Maintenance of equipment increased 5 per cent. over the figure for 1906, which included $313,000 charged as reserve for future maintenance, renewals, etc., and 7 per cent. over the straight maintenance of equipment cost of that year. With an increase of 12 per cent. in the locomotive mileage, repairs and renewals of locomotives increased 3 per cent. These expenses include $202,000, the difference between the present cost of replacing 44 old light-weight locomotives and the price received for them, if sold, or the value of the old material, if dismantled. With an increase of 10 per cent. in the miles run by passenger cars, repairs and renewals of passenger-train cars increased 12 per cent. They include $140,000 similarly as with locomotives, on account of replacing 31 passenger-train cars. There was an increase of 11 per cent. in the mileage of cars in freight trains and in the cost of repairs and renewals of freight-train cars. These expenses include $1,137,000 for replacing, as above, 2,518 freight-train cars. Repairs and renewals of road service cars include $67,000 for replacing, as above, 139 cars. The unit maintenance of



Freight Service and Traffic.

Locomotive miles include revenue freight train miles, three-fourths of mixed train miles, and helping freight train miles.

YEAR	MILES OF RAILWAY	GROSS TRANSPORTATION RECEIPTS
1885	4,205.43	$30,351,272
1886	4,854.43	31,940,455
1887	5,520.22	38,845,611
1888	5,266.31	48,775,969
1889	5,898.32	48,467,962
1890	6,061.38	48,352,503
1891	6,325.53	50,449,815
1892	6,485.68	48,922,195
1893	6,598.83	48,049,548
1894	6,642.38	44,772,003
1895	6,724.05	46,529,200
1897	6,744.81	43,881,727
1898	6,758.26	52,112,876
1899	6,812.12	55,505,352
1900	7,964.22	63,920,414
1901	8,774.37	77,244,898
1902	8,808.21	83,543,821
1903	8,933.43	88,320,335
1904	9,135.49	92,933,230
1905	9,142.01	95,515,158
1906	9,218.83	105,632,550
1907	9,451.22	124,942,298

Mileage and Gross Transportation Receipts.

equipment costs and the average number of serviceable locomotives and cars owned per year are shown below:

	Average cost per year 1907.	Average cost per year 1906.	Av. serviceable No. 1907.	Av. serviceable No. 1906.
Locomotives:				
For repairs and renewals	$3,144	$3,067	....	....
For replacements	119	464	....	....
Total	$3,563	$3,531	1,692	1,655
Passenger train cars:				
For repairs and renewals	$790	$792	....	....
For replacements	82	90	....	....
Total	$872	$883	1,700	1,621
Freight train cars				
For repairs and renewals	$87	$76	....	....
For replacements	26	29	....	....
Total	$113	$104	43,562	44,172

The great increase in operating expenses came in conducting transportation, where the effect of the unfavorable causes which have already been mentioned was particularly felt. With an increase of 14 per cent. in passenger miles and of 11 per cent. in ton miles the cost of getting and moving the business increased $9,600,000, or 32 per cent. The "total locomotive mileage in service for which the attendant expenses are charged to conducting transportation," increased 12 per cent., while the cost of fuel for locomotives increased 43 per cent. and of locomotive service, other than fuel, 22 per cent. Train service increased 23 per cent. and station and terminal service 26 per cent. As a result of the 50-cent per diem charge and the unusual detention of cars caused by the congestion of traffic throughout the country, payments for car mileage and switching increased from $418,000 in 1906 to $2,156,000 last year, a rise of 415 per cent. The greater cost of handling the business may be briefly and accurately summed up by the statement that the expenses per locomotive mile were 13.353 cents for fuel for locomotives, against 10.475 cents in the preceding year, and for the entire expense of conducting transportation 71.035 cents, against 60.229 cents in 1906. These unfavorable results, it must be remembered, followed a year, in which, with an increase of 8 per cent. in passenger miles and 10 per cent. in ton miles, the cost of conducting transportation was less than in the year 1905.

There was an increase of 36 per cent. in general expenses. Expenses of water lines increased 23 per cent., largely as a result of two additional single trips between New York and New Orleans and 45 additional single trips between New York and Galveston, and the overcrowded dock facilities in New York City.

The trainload on the lines east of El Paso was 346 tons, a decrease of 17 tons, or 5 per cent. from the 1906 figure. West of El Paso the trainload increased 6 tons to 401 tons, making an average for all lines of 380 tons, a decrease of 3 tons. The average loading per loaded car was 20 tons, and the average train had 20 loaded cars. The freight density, including both revenue and company freight, increased from 784,590 tons per mile of road to 848,420, a rise of 8 per cent. The passenger-mile rate, excluding ferry and suburban passengers, was 2.287 cents, an increase of 2 per cent. over 1906, and the ton-mile rate 1.105 cents, an increase of 8 per cent. over 1906. Receipts of passenger trains per revenue train-mile were $1.81, an increase of 6 per cent., and freight trains per revenue train-mile $3.54, an increase of 8 per cent. The train-mileage figures on which each of these results is based include all mixed train miles, but exclude mileage of helping locomotives. Four diagrams, which are given herewith, show by years the growth in mileage, earnings and traffic of the rail and water lines over 1885 (calendar year), the year in which the Southern Pacific Company began operations. The mileage figures show the miles of road in operation at the end of each year.

Six per cent. of the Southern Pacific's tonnage is made up of fruits and vegetables and only 3 per cent. of bituminous coal. Agricultural products make up 20 per cent. of the total, animal products 3 per cent., mineral products 28 per cent., forest products 18 per cent., manufactures 16 per cent., merchandise 12 per cent. and miscellaneous 2 per cent. During the year the proportion of agricultural and mineral products and of manufactures and merchandise increased, while the tonnage of animal and forest products and miscellaneous decreased. The total tonnage of revenue freight was 25,500,000 tons and of company freight 5,300,000 tons.

As on the Union Pacific, separate accounts for betterments and for additions are now kept. The total expenditures last year amounted to $7,600,000, of which $600,000 was paid out of income. There was spent on the lines in Louisiana $927,000, in Texas $444,000 and for the lines west of El Paso and Ogden (Pacific system) $6,300,000, of which $66,000 was spent on the New Mexico & Arizona and the Sonora Railway. One of the most important expenditures, included under additions, is that for signals. On the Pacific system $970,000 was spent during the year. On June 30, 1907, 1,263 miles of these lines were protected by signals and work was in progress or contemplated on 860 miles more. On the eastern lines there was spent $121,000, and 355 miles of lines have, or are shortly to have, signal protection.

Construction work was under way on the date of the report on 15 different new lines. The most far-reaching of these are in Mexico, where a line is now under construction south along the west coast to Guadalajara, 720 miles, and two other lines are being built along the two branches of the Yaqui river, a territory long held in possession by the Yaqui Indians. These northern extensions are shown on the accompanying map; the Guadalajara extension is indicated.

The balance sheet of the Southern Pacific Company and proprietary companies, which excludes all offsetting accounts between the companies and the cost of stocks and bonds owned by the Southern Pacific Company, shows these large construction expenditures. From June 30, 1906, to June 30, 1907, the item "advances for construction and acquisition of new lines, including electric lines in California," increased from $19,200,000 to $39,900,000. This includes the cost of 718 miles of completed railroad and "of work on a part of about 1,700 miles of projected lines," besides 208 miles of finished road in Louisiana and Texas, for which most of the funds were advanced by the Southern Pacific. Cash and cash accounts during the same period decreased from $29,600,000 to $21,600,000, while loans and bills payable increased from $50,000 to $24,700,000. The need for new working capital was met by the issue of $36,000,000 preferred stock, under resolution of the directors of May 9, 1907. This was offered to the stockholders at par and $35,300,000 was subscribed, of which $16,100,000 was paid in by June 30, 1907, and the remaining $19,200,000 has been received since the close of the year. Judging by this showing, the cash assets on June 14, 1907, the day before the first subscription payment on the new issue of preferred stock was due, amounted to only about $5,500,000 against bills payable of probably $24,000,000.

President Harriman describes in some detail the great work which was done in closing the Colorado river crevasse and saving the Imperial valley. This can best be quoted:

> The Colorado river supplies the water for the irrigation of the lands in the Imperial valley. This valley, which is in the southern part of the Salton sink, comprises about 800,000 acres of land as fertile as any in the world, and has a population of about 10,000 persons. Its business is served by a branch line of railroad extending from Old Beach (now Imperial Junction) on the Southern Pacific Railroad, to Calexico, Cal., 41 miles. Work is progressing on an extension of this line from Calexico, through the northern part of Mexico to Yuma, 55 miles, of which 19 miles is completed.
>
> In the spring of 1905 there occurred an enlargement of a small artificial channel, connecting the Colorado river with the California Development Company's canal, which subsequently became the river's low water channel. During a flood stage in November, 1905, the Colorado river made this channel, parts of the Alamo and New rivers, and certain sections of the canal, its main channel. The river, thereupon, flowed inland and discharged into the Salton sink, intead of into the Gulf of California, where its waters had gone for centuries.
>
> The surface area of the Salton sink is about 1,950 square miles and is, at the lowest point, near Salton, about 278 ft. below sea level. The continuous inflow of the river filled up the sink, converting it into a saline lake over 45 miles long and about 15 miles broad, with an extreme depth of about 80 ft. This inflow, unless checked, would ultimately have ruined all improved lands in the Imperial valley as well as the lands along the lower sections of the Colorado river.
>
> After a number of attempts by the California Development Company to close the crevasse, it was successfully accomplished on Nov. 6, 1906. During the last days of November, and the early part of December, 1906, heavy rains on the headwaters of the Gila river sent a further flood, which reached its maximum at Yuma on Dec. 8, 1906, causing a break in the levee some distance below the original break. This rapidly enlarged to a width of 1,100 ft., with a depth in mid-channel of 34 ft., through which the water rushed with a flow of 22,000 seconds feet back again on its inland course and swept to destruction all before it.
>
> It was believed that the work of closing the new break should be undertaken by the United States Reclamation Service, but, failing in having this done, and having been requested by the President of the United States to close the break at once (provision for the equitable distribution of the burden to be made by Congress), the Southern Pacific Company vigorously commenced operations, and men, material, cars, and locomotives were assembled in order to do this work with the utmost expedition. On Feb. 11, 1907, a little over 15 days from the date of the dumping of the first rock, the break was successfully closed.
>
> In that time, there were put in place about 72,000 cu. yds. of rock and 5,000 cu. yds. of gravel and clay. In completing the closure and the necessary protection work, the Southern Pacific Company built 2,250 ft. of dam and put in place 80,000 cu. yds. of rock, 80,000 cu. yds. of gravel and 250,000 cu. yds. of earth, a total of 410,000 cu. yds. of material. It also built 15.6 miles of levee, handling in this work 920,000 cu. yds. of earth, and 215,000 cu. yds. of gravel. To handle and place this material 17 miles of standard gage railroad was built.
>
> The company incurred an outlay of $1,489,784 in aiding the California Development Company in its attempt to close the crevasse of the Colorado river, and $1,663,136 in undertaking the work it was requested to do by the President of the United States. The total outlay amounted to $3,152,920.

There was a notable increase in the number of stockholders during the year. On June 30, 1906, the holders of the preferred and common stock numbered 3,910; 18 months later the number was 14,830. With particular reference to the new stockholders a statement is made summarizing the operations of the company for the past 10 years, during which time the average mileage operated has increased from 7,723 miles to 9,401 miles; gross receipts and income from $58,000,000 to $129,900,000, net earnings after taxes from $21,400,000 to $46,800,000; fixed charges from $15,400,000 to $19,100,000, and surplus after fixed and other charges from $5,900,-000 to $27,700,000. Up to the fiscal year 1905 no dividends were paid, so that the surplus after charges was applicable to the improvement of the property.

The table shown at the end of this review sums up, with certain differences necessary to bring the figures in accord with our usual standards, the operations of the company since the payment of dividends has been begun. This shows that dividend payments have risen from $2,800,000 in 1905 to $13,200,000 in 1907. For the year ended June 30, 1908, based on the present amount of stock outstanding at the present rates, the total dividend requirement will be $17,100,000. In this connection it is interesting to observe that the surplus after fixed charges (including improvement appropriations) and preferred dividends amounted last year to 12.6 per cent. on the $198,849,258 common stock outstanding on June 30, 1907. The present annual rate of common dividends, which was begun in October, 1907, is 6 per cent.

The operating and income results of the Southern Pacific Company for the last three years, ended June 30, are shown in the following table:

	1907.	1906.	1905.
Mileage worked	9,401	9.192	9.138
Passenger earnings	$33,636,377	$29,224,510	$26,412,631
Freight earnings	76,506,135	64,122,439	57,902,855
Gross earnings	117,331,812	99,123,550	89,403,632
*Gross earnings	124,942,798	105,632,550	99,515,158
Maint. of way and structures	16,031,877	16,319,831†	13,731,801
Maint. of equipment	15,017,190	14,286,111‡	12,989,732
Conducting transportation	39,238,102	29,683,882	29,691,601
Operating expenses	73,631,374	62,752,771	58,530,015
*Operating expenses	86,220,800	68,120,893	63,664,235
Net earnings	43,700,438	36,370,779	30,873,617
*Net earnings	44,721,998	37,511,656	31,850,923
*Net income	28,911,816	19,913,371	13,124,415
Dividends	13,157,013	7,716,125	2,769,131
§Improvement appropriations	1,220,711	777,502	5,520,386
*Year's surplus	14,408,585	11,118,837	3,426,798

*Including water lines and the Southern Pacific Terminal Company, which owns the Galveston terminals.

†This includes $1,803,813 charged as reserve for future maintenance, renewals, etc.; no similar charge in 1907.

‡This includes $313,474 charged as reserve for future maintenance, renewals, etc.; no similar charge in 1907.

§Include the following amounts reserved for depreciation of rolling stock owned by Southern Pacific Company and leased to other companies: $609,251 in 1907; $483,793 in 1906; $540,996 in 1905.

NEW PUBLICATIONS.

Specifications and Contracts. By J. A. L. Waddell, C.E., D. Sc., LL. D., and John C. Wait, M.C.E., LL.B. New York: The *Engineering News* Publishing Co., 174 pages; 6 x 9 in. Price, cloth, $1.00.

This book is made up of two lectures, one on specifications and the other on contracts, delivered by Mr. Waddell before the senior class of the Rensselaer Polytechnic Institute, and supplemented with an appendix by Mr. Wait containing Notes on the Law of Contracts. The lecturer apologizes in his opening paragraph for the dryness of his subject and begs for the indulgence of his listeners, and then straightway proceeds to handle it in the most interesting manner and in a way that holds the attention from beginning to end. The whole text of both lectures is indexed by marginal references by which every point is made readily accessible, and the points thus referred to are clearly and concisely set forth. The burden throughout is, Be careful. Know first exactly what it is desired to accomplish and what the parties to the contract wish to agree to, and then express it so clearly that there is no possibility of a misunderstanding in a later interpretation of the document. This excellent advice is followed by driving home the idea that the engineer must above all things be honest with himself, his employer and the contractors with whom he is called upon to deal. But while due importance is put upon the ethical treatment of the subject, it by no means overshadows the purely engineering and commercial features. Then, after touching with clear incisiveness upon the many things that must be taken into consideration in the preparation of specifications, examples of model specifications are given, followed by examples for practice.

The same thoroughness marks the second lecture on contracts, and great attention is paid to the line of demarkation separating them from the specifications proper. There are a multitude of cautions as to what it is essential the contract should contain as well as what is useless and avoidable, and every precaution is taken to warn the unwary against the pitfalls that lie upon all sides of those who have such documents to prepare.

As for the appendix, it will be a remarkably well-informed engineer, or lawyer either, for that matter, who can read it through without finding many things of which he never dreamed, when the laws of liability are expounded. Many a phrase that has been a perfunctory part of contracts from time immemorial is shown to be useless and worthless for the purpose for which it was intended, as it serves, apparently, merely as a sort of bugaboo to those who do not know.

There is the same brief treatment of the headings that is to be found in the lectures, but nothing is slighted or treated cursorily. The book professes to have been prepared for students as a guide to them in the study of the subject, but it can well be made to serve a much broader purpose than that, for there are few engineers who would not find many suggestions in it of great value in the work of preparing specifications and contracts, together with hints about the view the courts will be likely to take of the agreements that they have drawn, as well as hints about the language of the documents themselves.

The Blacksmith's Guide. By J. T. Sallows. The Technical Press, Brattleboro, Vt. 157 pages; 5½ x 7 in.; 161 illustrations. Price, cloth, $1.50; leather, round corners, $2.00.

Once in a while a working book appears that shows all through it that it has been written by a practical man, thoroughly familiar with his subject. That is the case with the book at hand. In his preface the author modestly disclaims to be the only one who knows how to do blacksmithing, and then plunges at once into his work and to the end sticks closely to his text, which, for the most part, is that of telling how particular jobs should be done. He makes no attempts to explain the whys and the wherefores of any of his methods. These he ignores on the general ground that it is needless for the man to know the carbon content of the steel he is handling or the temperature in degrees Fahrenheit to which it should be raised for proper working. "There are books which give this information, which is very useful in its place, but if a spring is brought in for a blacksmith to temper, and he does as I have stated, he will have a position longer than he will by starting out to find the percentage of carbon in the steel and other points that properly concern the scientist."

While the book deals with the details of the manipulation of a multiplicity of jobs, no one of which may come exactly as it is described to the reader, there is an underlying principle in the whole range of the work that is valuable and suggestive and can be utilized by anyone engaged in the same line. The book deals especially with those more delicate branches of blacksmithing in which high grade steels are to be manipulated for tool making and include the forging, hardening and casehardening of the products. The book should be used not only as a reference for the repetition of a piece of work that has been described, but should be carefully read so as not to miss the unexpected suggestions that are frequently made. These suggestions are not grouped but are scattered throughout the work. His explanations for the hardening of tools is particularly explicit and throughout the whole of it the fundamental idea is to get a hard cutting edge backed by a soft, tenacious metal that will have the strength to resist shock, without the brittleness that usually accompanies hardness. Another lesson that is impressed upon the reader is the necessity for a close attention to details. Again and again he emphasizes the importance of points that are apt to be considered of minor importance to the average smith, and insists that success only attends the most careful attention to those details. It is the case of the emphasizing of the value of little things. The book makes no pretense to teach a trade but it cannot fail to be of great value to those who will read it understandingly. It is full of suggestions gleaned from the long practical experience of three generations of blacksmiths.

Bulletins of the Engineering Experiment Station of the University of Illinois.—Bulletin No. 16 briefly presents the results of several years' study of trussed roofs by N. Clifford Ricker, Professor of Architecture. About 50 trusses of a selected type and of different proportions and arrangement were designed in long leaf pine and steel, and were changed until the assumed and actual weights of the trusses agreed. Other trusses were likewise designed in white pine and steel, and a few made entirely of steel. To perform this work as conveniently and as rapidly and accurately as possible, it became necessary to devise simplified formulas, and tables, with a systematic method of treatment, all of which are fully explained in the pamphlet. The results illustrated are mostly shown in graphic tables for ready appreciation. The most important features are a new formula for the weights of trusses; per cent of weight to be added for connections; most economical ratio of depth to span of truss; distance between trusses; number of purlins per panel, and dimensions of panels. It was found that white pine and steel trusses are about 10 per cent. lighter than those of long leaf pine and steel; also, that if carefully designed, steel trusses from 100 to 200 ft. span have about the same weight as those of white pine and steel. It is believed that this bulletin will be valuable and suggestive to all persons interested in the design and construction of trussed roofs.

Bulletin No. 17 is on "The Weathering of Coal," by S. W. Parr and N. D. Hamilton. It relates to the weathering of coal and losses in fuel values which accompany storage under various conditions. The information heretofore available concerning the behavior of coal in storage is exceedingly meager. The results of tests as outlined in this bulletin, add materially to our information and open a way for a better understanding of matters pertaining to weathering, spontaneous combustion and other difficulties which attend the storage of coal in large masses. Deterioration has been studied with samples maintained in the open air, under cover at varying temperatures, in air-tight containers, and in submerged conditions.

Bulletin No. 19 is entitled "Comparative Tests of Carbon, Metallized Carbon and Tantalum Filament Lamps," by T. H. Amrine. It gives a comparative study of the electrical characteristics, life, candle-power maintenance, horizontal and vertical distribution and cost of operation of the three most widely used electric lamps under both good and poor conditions of operation. It is based upon a series of tests in which particular attention was paid to obtain exactly similar conditions for the three types of lamps in order to give a fair basis of comparison between types. Comparative rather than absolute results have been sought, though, in almost all cases, dependable quantitive values have been obtained. In an attempt to explain the reason for high efficiency of the newer lamps a study is made of curves plotted between "filament temperatures" and "candle power per square inch of filament area" and between "watts per candle-power" and "filament temperature." A consideration of these curves leads to the conclusion that the increase in efficiency of the metallized over the carbon filament is due almost equally to higher filament temperature and to selective radiation, while for the tantalum filament it is due almost wholly to higher temperatures.

CONTRIBUTIONS

Cast Iron Car Wheels.

Chicago, Ill., Feb. 8, 1908.

To the Editor of the Railroad Gazette:

It would seem that certain definite things need to be done before relief can be expected from present cast iron wheel troubles. The real difficulty underlying the whole matter is that not enough is known about the chilled cast iron wheel. In the first place there is no text-book or authoritative data on its manufacture, despite the length of time it has been in use on American railroads; therefore, outside of the experienced wheelmakers few have expert knowledge of the subject. But the really serious question is the ignorance regarding certain essential qualities of the finished wheel, and what the wheel must encounter in service. Not only are the nature and magnitude of the stresses imposed on it under a moving car unknown quantities, but much more needs to be known of its strength to withstand these stresses. The wheelmakers claim that the roads generally seem inclined to consider that the responsibilities for the solution of the chilled wheel problem rests with the makers. From the facts above stated it appears to be a two-part problem, on which each side has a special work to do.

With regard to the manufacturing end: The makers have contended all along that the chilled cast wheel, properly made, is fully equal to present service requirements; but that good wheels cannot be made for the price that the railroads, or many of them, will pay; that the price determines the quality, and for this the railroads solely are responsible. This attitude of the wheelmakers is open to criticism; for although what they allege is largely true, they themselves are not free from blame, since they continue to supply wheels that they know to be of inferior quality and therefore unable to stand the service. When manufacturers contract to supply wheels at a price equal to, or even less than, the price of pig iron, they cannot afford to put much new stock into their product. Cheap wheels presuppose the use of poor stock. But the use of good stock does not by any means assure wheels of corresponding quality, for not only can iron unfit for use be drawn from a cupola in which the best stock has been put, but good iron will make poor wheels if the foundry practice is bad. The liability of internal stresses is minimized only by the most careful foundry practice. The temperature in the cupola and of pouring, the temper of the mold, the time of "shaking out" and of "pitting" are all factors affecting the character of each individual wheel. This is the part of the problem that is the province of the wheelmakers to determine. A careful study of the effects of all of the different variations in cupola and foundry practice, and a determination of the limits for each within which the wheels will be of acceptable quality, should be a matter of record. Much, perhaps all, of this the experienced wheelmaker already knows, but it is not in a form to be of use to any one else.

The railroad's part of the work should be to determine as nearly as possible the service stresses of the wheel, the lowest factor of safety that reasonably can be allowed, and a fair price for wheels having this factor of safety. It doubtless will be said in regard to the first of these that the stresses are indeterminate, and there is no practical way to get at even a fair approximation to them. And, of course, this is unfortunately true at present, but ways may yet be found. Bridge engineers in the past have had to guess at the effect of the impact of moving loads on bridges and make liberal allowances for it, because they were only guessing; but they seem in a fair way now, after years of empirical formulas, of arriving at accurate determinations of these stresses by practical methods. This problem contained many and serious difficulties which finally were overcome. The other way may not be any harder to solve.

George L. Fowler said at the January meeting of the Western Railway Club, where certain phases of the cast iron wheel question were discussed (*Railroad Gazette*, Jan. 20), that he hoped to have some data on the stresses imposed on wheels on curves at different speeds for the next M. C. B. convention. As indicative of the excessive loads borne by the wheel when running some investigations of bolster stresses had revealed impact loads on that member of 25 to 30 per cent. of the static load, at speeds of 25 to 30 m.p.h. Whether the correspondence of impact and speed figures was only a coincidence he was unable to say. This impact occurs about three times a second on a track with staggered joints. As to what portion of the blow to the wheel is absorbed by the intervening bolster springs, Mr. Fowler did not hazard a guess. It is his opinion, though, based on his recent wheel investigations, that wheel flanges get their heaviest blows on tangents, when the car starts nosing rather than on curves, and this nosing is an important factor in flange breakages. The shorter the distance between truck centers the more severe the effect. It should therefore be the worst on locomotive tenders. It is studies such as Mr. Fowler is making that will finally solve the wheel problem, and the sooner the parties at interest get together to work it out along these lines the sooner their troubles will end.

WESTERNER.

Car Wheel Tests.

To the Editor of the Railroad Gazette:

New York, Feb. 10, 1908.

The communication in your issue of Feb. 7, from A. T. Perrin in criticism of the results of wheel investigations published under my name, fails at the outset to grasp the situation and the scope of the reports in question. The point is not whether the cast iron wheel is suited for service on the "ordinary freight rolling stock as in use in this country (England) and the Colonies, and especially for narrow-gage light stock of all type," but whether it is suited for use with the excessively heavy wheel loads obtaining with the cars of 100,000 lbs. capacity in use in the United States where the individual wheel may be called upon to carry a static load of more than 19,000 lbs., which may rise to nearly or quite 30,000 lbs. under the shock of running.

It is quite true that with the ordinary 12-ton wagon, and its insignificant wheel load of 11,200 lbs., no trouble will be experienced. This merely checks with the universal experience in the United States where with cars of 60,000 lbs. capacity and wheel loads of approximately 11,200 lbs., no noticeable trouble has been experienced, and it has been demonstrated beyond all peradventure that the cast-iron wheel is eminently well suited for such purposes. Even when the wheel loads have been raised to 14,500 lbs. as they are under cars of 80,000 lbs. capacity, no noticeable increase of wheel failures occurred, and it was only when these loads were again increased by raising the car capacity to 100,000 lbs. that serious trouble was experienced, and it was on the basis of use under such cars, and such cars only, that a doubt was expressed as to the advisability of using the cast-iron wheel.

In further explanation of the articles in question it may be repeated that they were reprinted from a book of reports of investigations that were not originally intended for publication, but were made, as said in the preface, "for the purpose of securing information regarding the standards of quality of metal and workmanship that must be met in the development of a new industry, the success of which depended on the production of a wheel that would at least meet the present requirements of railroad traffic." It was with the steel-tired wheel that the wheel comparisons were made, and the cast-iron wheel was only brought in incidentally and as an after thought. And it was not until the stresses put upon wheels under cars of 100,000 lbs. were measured that any actual data was obtained showing that the cast wheel was not suited for that service.

The position, taken by your correspondent is, therefore, unassailable, but it is doubtful if he would care to sign his own letter if "50-ton wagon" were to be written for "12-ton," and "19,500 lbs." for "11,200 lbs.," and "high capacity mineral wagons" for "ordinary freight and narrow-gage light stock." That would put an entirely different aspect on the matter, and one that is based on an experience in the United States that has caused no small amount of anxiety.

GEO. L. FOWLER.

There is an immense traffic in wine on the Italian railroads; but the consignees this year complain bitterly of the "evaporation" from the casks en route. In a single fortnight a Milan firm found one cask with a gimlet hole and 25 gallons short; another with bung out and also 25 gallons short, three broken open with 60 gallons missing, and another which lacked the bung and 20 gallons of wine. These calamities are doubtless due to the failure of the railroads to keep a supply of water on their freight trains. From time immemorial it has been the custom of wagoners hauling wine into Rome (and doubtless other places) over the Campagna in the heat of the day to take their siesta under the shade of the cask, provided with a gimlet. But they always delivered the casks full, which was easy to do because further on the evaporation could be made good from the aqueducts.

The Brotan Locomotive.

BY WILLIAM C. DREHER.

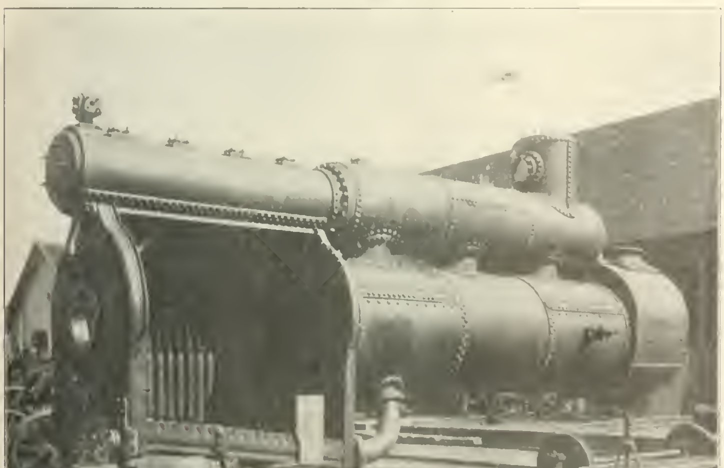
The Brotan locomotive boiler, with a water-tube firebox, has been mentioned occasionally during the last few years in the American technical press; but, so far as I am aware, American readers have not yet had a full description of it, with adequate illustrations, laid before them. It has been advertised to some extent among American locomotive builders and railroad managers, but as the former have been working at their utmost capacity for some years in meeting the demands for locomotives, and the latter have been overwhelmed with larger plans, no attempt has yet been made in America to test the worth of the new boiler.

On the Continent, on the other hand, its use is steadily increasing. Twenty-one are already in operation, and 29 more are building. Austria, where the invention originated, is far in the lead of other countries in introducing it. Of the 21 in use, not less than 14 are on Austrian and Hungarian roads, while 17 of the 29 building are for them. The Prussian State Railroads have had two in use for over a year; two are working on Russian roads, and one on the St. Gotthard Railroad in Switzerland. It will soon be practically tested in other countries; four machines are being built for French, two for Belgian, and one for Swedish roads. Switzerland is to take two more and Russia two.

The new boiler is the invention of the engineer, Brotan, of the Imperial Railroad Ministry of Austria, after long study and experiment. It was first put in operation in January 1901, on one of the Austrian roads, and it immediately established its superiority. In September of that year trial tests were made between the Brotan locomotive and two ordinary ones of about equal load capacity, and it was found that the new boiler consumed 35.8 lbs. of coal per locomotive-mile, as against an average of 49.3 for the other two. The saving of fuel was thus over 27 per cent., or 23.6 per cent. when reckoned on the basis of ton-mileage. In the following month there was a second competition between the Brotan and four other locomotives, including the two of the previous test. This trial showed a saving of 20.7 per cent. on locomotive-miles and 19.5 per cent. on ton-miles in favor of the Brotan locomotive.

Passenger Locomotive for Austrian State Railroads, Fitted with Brotan Boiler.

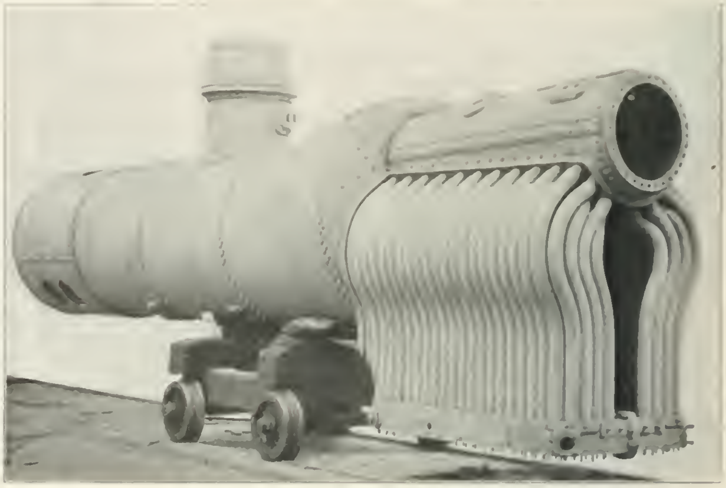
If any mechanical engineer were asked what part of the present locomotive boiler stands most in need of improvement, he would answer, without doubt, the water-chambers, or water-legs, that surround the firebox. These are built somewhat differently in Europe from the system in vogue in America, thick sheet copper being used abroad as casings for the firebox; but on both sides of the ocean these water-legs are the weakest and most troublesome part of the locomotive. Their two sides are held together by a great number of stay and anchor bolts to resist the expansive force of the steam and prevent explosions. For all that, it is precisely here that most of the bad boiler explosions occur. The inner heads of the copper bolts are in time consumed by the fire-gases and leaks develop that are difficult to stop. Repairs are usually made by hammering the heads, but this cannot be continued indefinitely; the sheets must in time be completely overhauled or replaced by new ones. Another great trouble with the bolts is that they become centers for the collecting scale; heavy deposits also accumulate in the corners. This not only causes a serious waste of fuel, but a great loss of time and money while the locomotive is undergoing repairs and cleaning at the shops, the entire machine being dead capital pending repairs and cleaning on a small part.



Brotan Boiler with Water-Tubes on One Side of Firebox Removed.

In the Brotan boiler these troublesome water-legs are done away with, and in their stead a system of water-tubes forms the sides and roof of the firebox. These can be made very thin ([illegible] in.), so that the water passing through them is exposed immediately to the heat of the firebox. They are of the weldless (Mannesmann) type, are made of mild steel, and have an exterior diameter of about $3\frac{3}{4}$ in. They are thoroughly annealed and tested to a pressure of 750 to 900 lbs. per sq. in. They are set up in four rows on each side of the firebox and converge in a Gothic arch at the top where they enter the steam-collector. Strips of copper or asbestos are hammered into the spaces between them, so that each row presents an impervious wall to the fire-gases. Between each pair of tubes in the same row a space of only ¼ in. is left to be thus filled, except at their ends, the tubes being reduced at the top and bottom to about 3 in. diameter, and so leave more space between them. They are made smaller there so as not to weaken too greatly the bottom pipe and the steam collector.

The bottom-pipe is of cast-steel, and, except in small locomotives, is cast in two or three sections, because of the difficulty of making perfect castings in a single piece. An American locomotive builder, however, has expressed the opinion that the best American shops can make these pipes of any desired size in a single casting. The ends of each section are flanged so that they can be screwed together steam-tight. Their cross-section has the shape of a broadened letter D, the flat surface of which is set upright and turned away from the firebox. Their round surface is provided with bosses for receiving the fire-bars and ash-pan. The bottom-pipes have an interior diameter of over 6 in. and are connected with the longitudinal boiler by bent pipes. The bottom-pipes and the grate usually slope upward somewhat from the boiler-head, but sometimes they are set horizontal.



Brotan Boiler, Adapted to American Locomotive, Showing Arrangement of Tubes.

As steam is generated in the upright water-tubes, it rises rapidly to the steam-collector, forcing the water along with it. The collector, which is 28 to 30 in. in diameter, extends the entire length of the boiler and is connected with it by three openings. Through these the non-vaporized water returns to the boiler, and the steam generated in the latter gets into the steam-collector through the same openings. These connections can be seen in the illustrations. The under part of the collector, just above the firebox, is strengthened by a plate of soft steel, making it 1 in. thick. The holes for receiving the water-tubes are cut in this plate on a zig-zag line. The tubes are expanded into the bottom-pipe and the collector, so as to make them water-tight; their projecting ends are then conically enlarged, or bell-mouthed. From three to five holes are cut in the upper surface of the collector, and several in the bottom pipes

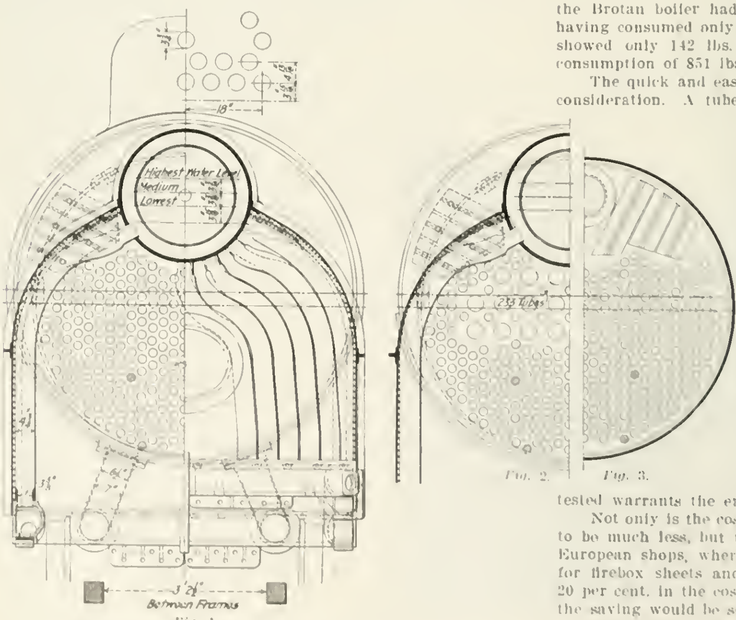


Fig. 1

Fig. 2.

Fig. 3.

Cross Sections of Firebox; Brotan Boiler.

Fig. 1 without superheater. Fig. 2, with superheater. Fig. 3, smokebox flue sheet.

for fitting in the tubes and cleaning them. A steel casing encloses the banks of tubes and the space between it and the outer row is filled with a composition of asbestos scraps and other non-conducting material. Fire-bricks fill the space under the firebox door.

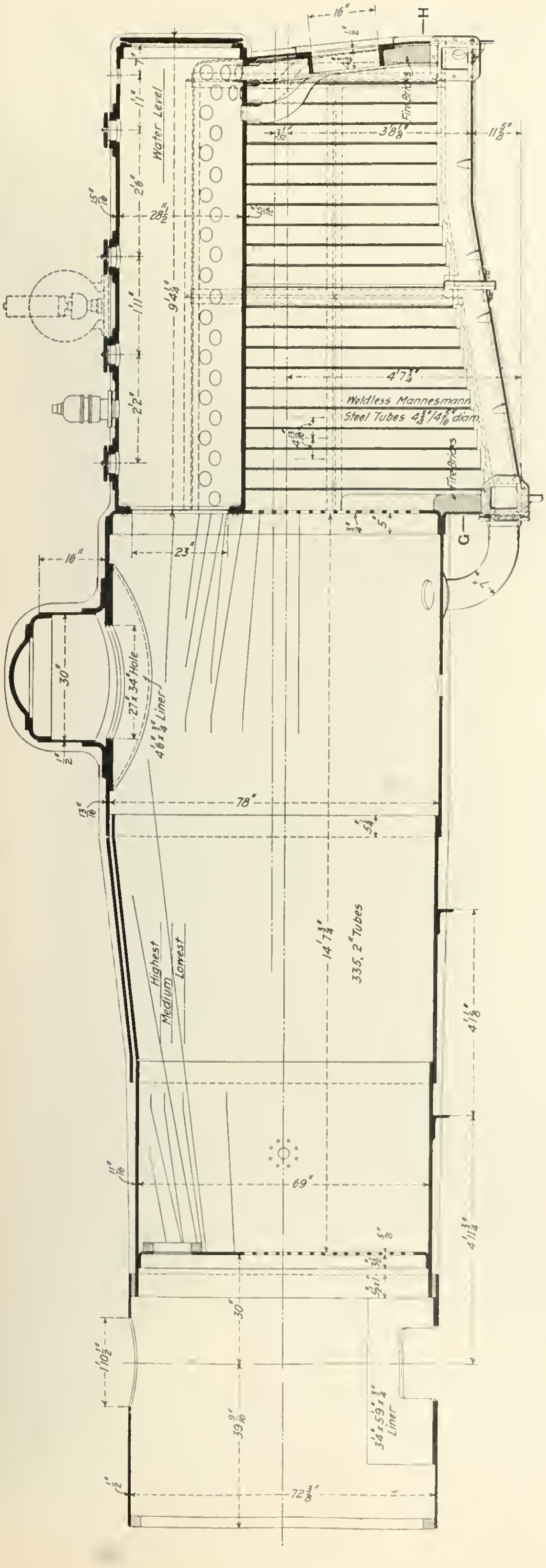
The advantage claimed for the Brotan boiler is that since the water-level is no longer in the longitudinal boiler, but about in the middle of the steam-collector, the former can be completely filled with fire-tubes. Hence the Brotan boiler is usually made considerably smaller than that of the ordinary locomotive, and even then it has about 10 per cent. more fire-tubes than the latter. The upright position of the water-tubes ensures a most active water circulation. As the tubes are very thin and as the heating surface of the firebox is about 50 per cent. greater than that of the common type, steam is generated much more easily and carries the water very rapidly up into the collector. A test made of the first Brotan locomotive put in service in Austria and an ordinary locomotive gave striking proof of the steam-producing capacity of the former. The two boilers were filled with cold water and fired up simultaneously with brown coal, or lignite. After 2 hrs. 34 min. the Brotan boiler had developed a pressure of 171 lbs. per sq. in. having consumed only 624 lbs. of fuel, while the competing machine showed only 142 lbs. pressure after 3 hrs. 24 min., with a fuel consumption of 851 lbs.

The quick and easy repairing of the new firebox is also a great consideration. A tube can be removed and replaced within a few hours. Each one can be cut out with a chisel from the inside of the firebox, and a new one fitted in without disturbing the adjacent row. The holders of the Brotan patent claim that, where proper tubes are kept in stock, the entire system can be taken out and renewed within 14 days, while European shops generally take about four months to renew completely a firebox of the ordinary type. The technical bureau of the Prussian Railroad Ministry has said that the saving in repairs and cleaning is regarded by the Prussian authorities as the chief merit of the new boiler.

The boiler is also claimed to be much safer than that of the ordinary locomotive. The danger from explosions in the firebox is reduced to the danger from the bursting of a tube. There are no rivets or staybolts to "lose their heads"; and the high pressure to which the water-tubes have been tested warrants the engineman's feeling of security.

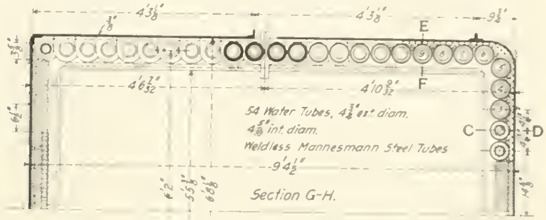
Not only is the cost of maintenance of the Brotan boiler claimed to be much less, but the original cost is also said to be lower. In European shops, where, as already mentioned, thick copper is used for firebox sheets and the staybolts are also made of that metal, 20 per cent. in the cost of construction is saved; in American shops the saving would be somewhat less.

The foregoing description applies to the usual method of construction. It may be worth while for American railroad managers and locomotive builders to know that a different type of boiler has been introduced so that an existing locomotive can be equipped with the new firebox. Any locomotive with a boiler 4½ ft. or more in diameter can be thus converted, and a number of these are already in use in Europe, or in process of transformation. In this form the steam-collector is connected with the longitudinal boiler at the boiler-head. To get sufficient space in the front tube-plate for the connection, the last ring of the boiler-barrel, if necessary, is en-



Longitudinal Section of Brotan Boiler Adapted to American Locomotive.

larged conically at the top, as shown in the cross section taken at the boiler-head. The diagram shows such a locomotive. It was designed for one of the best-known American railroads, but, owing to causes already explained, has not yet been built. A reference to the diagram shows that such a locomotive, from the boiler-head forward, presents no outward difference whatever from the present type. Everything in the machine, indeed, will remain unchanged except the firebox; it is important to note that any ordinary firebox that needs considerable repairs can easily be replaced by the Brotan invention. Such a transformed boiler has a much greater



Section of Firebox on Line G-H.

heating surface, especially in the firebox, and is claimed to be more effective than present boilers.

The following table gives a summary of the principal dimensions of the Brotan boiler both with and without a superheater, as compared with those of an ordinary boiler:

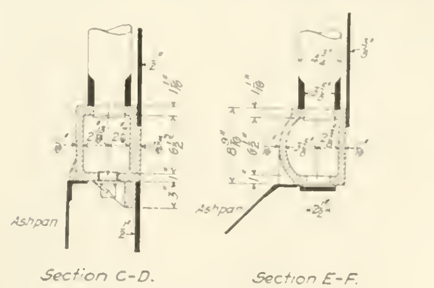
	Brotan boiler — With superheater.	Brotan boiler — Without superheater	Ordinary boiler
Working pressure	200 lbs.	200 lbs.	200 lbs.
No. of fire tubes, 2-in., O. D.	233	335	244
" fire tubes, 5-in., O. D.	22		22
" water tubes	54	54	
Grate area	50.8 sq. ft	50.8 sq. ft.	50.2 sq. ft
Heating surface, firebox	215 "	215 "	180 "
" " of 2-in. tubes	1,785 "	2,577 "	1,820 "
" " of 5-in. tubes	424	"	413 "
" " total	2,424 "	2,782 "	2,113 "
Steam space at medium water level	80 cu. ft	80 cu. ft	80 cu. ft
Water space at medium water level	330 "	320 "	330 "
Total capacity of boiler	410 "	400 "	410 "
Weight of empty boiler	42,250 lbs.	42,000 lbs.	42,550 lbs
Do. boiler filled to med. water level	62,850 "	62,000 "	62,500 "

The following table gives the complete results of the trial competitions instituted by the Austrian railroad authorities:

WORK DONE AND FUEL CONSUMED.

No. of locomotive.	Work — Red. locomotive-miles.	Work — Effect. miles.	Work — 1,000-ton miles.	Load, tons per 1 eff. mile.	Total consumpt'n in lbs.	Standard coal — Per Loco.-mile — Consumption, lbs.	Per Loco.-mile — Saving, %	Per 1,000 ton-miles — Consumption, lbs.	Per 1,000 ton-miles — Saving, %	Boiler
September.										
4752	1,611	1,136	131	115	82,430	51.1	...	629	.	Standard Type Boiler.
4756	1,657	1,091	140	128	78,980	47.6	....	564	...	
Total.....	3,268	2,227	271	...	161,410	...	...	...	...	
Ave.......	1,634	1,113	135	122	80,705	49.3	...	595	...	
4754	1,737	1,264	137	108	62,222	35.8	27.0	454	23.6	Brotan
October.										
4743	1,316	926	105	114	74,778	56.8	...	712	.	Standard Type Boiler
4752	1,290	914	103	113	67,602	52.4	...	656		
4753	1,389	932	109	117	76,830	55.3	...	705	..	
4756	1,856	1,257	140	111	101,028	54.4	...	722	.	
Total.....	5,851	4,029	457	...	320,238	....	..	...		
Ave.......	2,925	1,007	115	114	80,059	54.7	..	699		
4754	1,582	1,126	122	108	68,687	43.4	20.7	563	19.5	Brotan

The Brotan patent is held by the Deutsch-Oesterreichische-Mannesmann-Rohren-Werke of Dusseldorf, Germany. It supplies the designs for the firebox and sells the rights to use the patent. The machines themselves have been built by various locomotive shops on the Continent. Owing to the high duty on steel tubing in the



Expansion of Tubes Into Bottom Pipe and Collector.

Dingley tariff law it would not perhaps be profitable for prospective American builders of the new boiler to import their tubes from Germany.

Consumption of Poles in 1906.

The following information is taken from Circular 137, United States Department of Agriculture, Forest Service.

The information in this circular concerning the consumption of poles during 1906 is based upon the number of poles purchased rather than the actual number produced during the year. It seems safe to assume, however, that the two were practically identical. Inquiries were sent out to more than 6,000 companies operating telegraph and telephone lines, electric light and power systems, trolley and street railway lines, and to railroad companies which operate their own telegraph or telephone lines. Practically all replied. The number of poles purchased during the year, as shown by these statistics, was 3,574,666, valued at $9,471,171 at the point of purchase. These figures do not include poles less than 20 ft. long. Shorter poles are used for local lines and for temporary work, but they constitute only a small percentage of the total.

Table 1 shows, by kinds of woods, the quantity and value of round and sawed poles purchased in 1906. In both classes cedar ranks first and chestnut second. These two together furnish nearly nine-tenths of all the poles used, cedar supplying about three-fifths and chestnut over one-fourth.

The telegraph and telephone companies purchased about two-thirds of the total number reported and the street railway, light and power companies about one-fourth. The remainder is credited to railroad companies which own and operate their own telegraph or telephone lines.

SUPPLY.

The regions of supply of the two principal pole timbers—cedar and chestnut—are fairly well defined, and are, unfortunately, extremely limited. The present source of supply of cedar poles in the United States is confined almost entirely to the Lake states. The total purchase of cedar poles reported for the United States in 1906 was 2,174,279. The production of the Northwestern Cedarman's Association, which operates in the Lake States, as shown by the association statistics, was more than 1,700,000. The greater part of the production outside the Lake states can be credited to two sources—Maine and the adjoining states, including the Adirondacks in New York and the Idaho cedar territory. From these districts cedar poles are shipped to practically every state in the Union.

The regions from which the supply of chestnut poles is drawn are even narrower. A small territory—embracing parts of Pennsylvania, Maryland, Virginia and West Virginia—furnishes nearly all of these poles. Cypress poles necessarily come from the South, probably the greater part from the Gulf states; juniper, from Virginia, the Carolinas and other South Atlantic states. Redwood comes wholly from California.

With the regions of supply so restricted, transportation becomes an important factor. The cost of the pole is sometimes doubled by freight charges. This difficulty is obviated, in a measure, by the use of local woods, cypress and pine in the Southern states, for instance, and chestnut and juniper in the Atlantic states. On the Pacific coast cedar is supplemented to a considerable extent by pine and redwood. Both such local supplies are insufficient, and cedar and pine are found everywhere.

There are no data available which show even approximately the quantity of cedar still standing in this country or Canada to meet the enormous demand of 2,000,000 poles each year. It is certain, however, that when the present supply is exhausted it will be gone forever, since the cedar, though it reproduces fairly well, grows so slowly that other kinds of trees, chestnut for instance, will be more profitable to produce by systematic management.

SUITABILITY OF VARIOUS WOODS.

There are several qualities which timber must possess to adapt it to use for poles. The most important of these are durability in contact with the soil, minimum weight, straightness coupled with relatively small size and little taper. The wood must be soft, so that the spikes of a climber may enter readily, and at the same time it must have strength to support considerable weight. These qualities are admirably combined in cedar and in juniper, which commercially is a cedar. No other woods possess so many.

Chestnut and cypress are both durable. Chestnut is not so straight as cedar and is liable to be knotty. The wood, though soft, is not as soft as cedar. It has greater strength, but this advantage is more than counterbalanced by its greater weight, which prohibits long shipments. Cypress frequently is too large for use as a pole and has greater value for lumber. Even when its general diameter is small enough the butt will often be so big that it adds too much weight. Pine, besides being heavier than cedar, is so much less durable that it cannot compete as pole wood without preservative treatment. Redwood possesses durability, lightness and softness, but its size necessitates sawing, which adds to the cost.

PRESERVATIVE TREATMENT.

One of the results of the increased cost of poles and the difficulty of obtaining a sufficient quantity of satisfactory stock has been an effort to increase the period of service of poles by preservatives, generally by applying a liquid to the whole of the pole or, more generally, to the butt, which is most liable to decay. Poles which have not been treated with preservatives may be expected to give from ten to fifteen years of service, roughly speaking.

Creosote is probably more extensively used than any other preservative, though ordinary paint is a common agent. For the butt tar is often employed, and charring by fire is found useful. The American Telephone & Telegraph Company is carrying on extensive experiments in co-operation with the Forest Service to determine the best methods and materials. Several experimental lines of variously treated poles have been erected and careful records of the behavior of each pole is being kept. By the comparatively new open-tank treatment the preservative is forced into the wood of the butt by a much simpler and more inexpensive method than was formerly used.

Successful preservatives make possible the use for poles of a great number of otherwise unsuitable timbers, many of them among the cheaper and more abundant woods.

TABLE 1. *Number and Value of Round and Sawed Poles Purchased in 1906.*

Kind	Total. Quantity number.	Total. Value at point of purchase.	Total. Average value per pole.	Round poles. Quantity, number.	Round poles. Value at point of purchase.	Round poles. Average value per pole.	Sawed poles. Quantity, number.	Sawed poles. Value at point of purchase.	Sawed poles. Average value per pole.
Cedar	2,174,279	$5,579,891	$2.57	2,169,869	$5,571,312	$2.57	4,410	$8,579	$1.95
Chestnut	988,081	2,625,568	2.66	987,303	2,619,314	2.65	781	6,254	8.00
Pine	177,809	686,803	3.86	162,601	590,736	3.63	15,208	96,067	6.32
Cypress	111,657	256,950	2.30	111,292	255,867	2.30	365	1,083	2.97
Juniper	57,064	163,437	2.86	57,064	163,437	2.86	....	....	....
Redwood	24,760	87,189	3.56	480	3,253	6.78	24,280	83,936	3.46
Oak	9,924	13,951	1.41	8,624	10,831	1.26	1,300	3,120	2.40
Fir	9,601	21,637	2.25	8,741	19,915	2.28	860	1,722	2.00
All other	21,488	35,485	1.68	20,901	35,025	1.68	587	720	1.23
Total	3,574,666	$9,471,171	$2.65	3,526,875	$9,269,690	$2.63	47,791	$201,481	$4.22

TABLE 2. *Poles Purchased by Various Classes of Consumers in 1906.*

Kind.	Total. Quantity, number	Total. Value at point of purchase.	Total. Average value per pole.	Telephone and telegraph companies. Quantity, number.	Telephone and telegraph companies. Value at point of purchase.	Telephone and telegraph companies. Average value per pole.	Steam railroad companies. Quantity, number	Steam railroad companies. Value at point of purchase	Steam railroad companies. Average value per pole.	Street railroads, electric light and power companies. Quantity, number.	Street railroads, electric light and power companies. Value at point of purchase.	Street railroads, electric light and power companies. Average value per pole
Cedar	2,174,279	$5,579,891	$2.57	1,532,906	$3,079,852	$2.01	141,359	$371,246	$2.57	497,014	$2,128,793	$4.28
Chestnut	988,081	2,625,568	2.66	661,898	1,510,484	2.28	63,151	139,579	2.21	263,035	975,505	3.71
Cypress	111,657	256,950	2.30	21,395	36,559	1.71	11,976	20,271	1.69	78,286	200,120	2.56
Juniper	57,064	163,137	2.86	38,331	91,854	2.40	465	638	1.37	18,268	70,945	3.88
Pine	177,809	686,803	3.86	121,609	478,427	3.93	16,826	22,866	1.36	39,374	185,510	4.71
Oak	9,924	13,951	1.41	2,980	1,500	0.50	2,736	2,549	0.92	4,208	9,902	2.35
Fir	9,601	21,637	2.25	9	94	10.44	1,284	2,533	1.97	8,308	19,010	2.29
Redwood	24,760	87,189	3.56	7,140	24,390	3.42	9,871	21,920	2.22	7,749	40,879	5.28
All other	21,188	35,745	1.68	9,454	11,789	1.25	3,600	4,225	1.17	8,434	19,731	2.34
Total	3,574,666	$9,471,171	$2.65	2,395,722	$5,234,949	$2.19	254,268	$585,827	$2.30	924,676	$3,650,395	$3.95

Cab Signals.

The following discussion of the subject of signaling to and from the cabs of moving locomotives by means of electrical or mechanical contacts between the engine and roadway or roadside fixtures, is taken from the introduction to a paper by Mr. J. Pigg, recently read before the Institution of Electrical Engineers, London, describing the apparatus of Mr. V. L. Raven, in use on the North Eastern Railway. Mr. Raven's apparatus will be described in a future issue.

Of late years the subject of the signaling of railroads has received a good deal of attention, and the difficulties under which drivers labor under exceptional conditions of weather have been officially recognized by references and recommendations from the inspecting officers of the Board of Trade. A number of systems have been devised and put forward during the last 10 or 12 years for supplementing the ordinary outdoor mechanical signals but, practically, no progress has been made in their application. Whatever the merits of the various proposals, not one has made any headway towards adoption, and railroads still continue to use the system of visual signaling—during clear weather—supplemented by the audible, explosive signal during fogs. This delay cannot, however, be laid to the charge of the railroad companies, who have on many occasions furnished opportunities for the trial of apparatus, but whose officers have, necessarily, to gage carefully the merits of proposals from every standpoint.

The problem to be faced is not a simple one.

At high speed the time allowable for the collection of a signal, by any reasonable design or apparatus, is very short, and the apparatus must be exceedingly prompt in operation. Where mechanical impact is relied upon for the operations, the stresses to which the parts brought into contact are subjected are tremendous, and in all forms of actuation involving mechanical contact between parts on the engine and parts on the line, the greatest possible care must be taken to minimize the blow experienced.

The financial difficulties are no less evident. Any system of supplementing the present signaling which does not take into account the cost factor will fail in a most important point. If the proposals hold out any prospect of relief in this respect so much the better. The engineer's object should be the keeping of the cost within the value of the service given, but certain things must be provided for railroad operations, regardless of cost, and signaling is one of these. It is much more difficult to prove that an accident has been averted by some means, than to point out, after the accident has taken place and the circumstances become known, how it might have been avoided by the means referred to.

If we carefully consider the operations involved in that mass of conventions known as the block system (in which term is included all apparatus used for signaling), we find that it implies implicit observance of the signals exhibited. We further find that while the signalmen are provided with reminders to a certain extent, and hedged about more or less completely with restrictions on their actions, the driver must rely upon his physical powers—sometimes under most difficult conditions—to enable him to observe and obey the signals by which he is to be guided * * * Man has many more interests than those appertaining to any one task he may undertake, and to carry out any work requires more or less exclusive concentration of the mind upon its details. Probably nothing is more difficult for the average man to accomplish than to concentrate his attention exclusively upon one subject for any length of time; his other interests will rise in his mind, and engage his attention unbidden, especially if his other duties are monotonous.

During the last two years the author has been associated, in a minor part, in experiments with apparatus which has been designed by Mr. Vincent Raven, the Chief Assistant Mechanical Engineer of the North Eastern Railway. The system is essentially an electrical one, which aims at reproducing in the cab of the locomotive, all the information that the driver now obtains from the present mechanical signals, but is not intended as a substitute for those signals.

The time when the driver most urgently requires supplementary indications is undoubtedly during fogs and snowstorms, but it by no means follows that it is only during such exceptional conditions of weather that supplementary indications are of value. Absence of mind is common. * * * No more strenuous duty can be imposed on a man than the driving of a 100-ton engine, with from 250 to 350 tons behind him, at a speed of 60 or 70 miles per hour, through a gray wall which never seems to end, where sight is useless, and the driver must endeavor to keep track of his position by the "feel" of the road and by the explosive signal which means for him the danger signal—the only practicable signal given to him.

Many suggestions for providing supplementary indications have been made during the last twelve or fourteen years, most of which have had as their object the giving of the indications directly on the engine, in the cab where they are most easily observed. Others, however, have aimed at producing a signal, ordinarily an audible signal, on the line.

The latter are merely variations of the present supplementary explosive signal, with the added disadvantage that they are not so readily heard. Much of the efficiency of the explosive signal is due to transmission through the body of the engine. The difficulty of conveying sounds from the line to the cab of an engine, running at a high speed, under ordinary circumstances is so great as to render such systems totally useless. Cab signaling is undoubtedly the only method worth consideration.

Purely audible signals leave no record; and purely visual signals need more attention than the driver can give. With the first he may forget which indication he obtained after it has ceased, either automatically or by his own action; with the second he may forget to observe it. From these considerations alone it seems imperative that both classes of signals should be employed, the audible signal being of the nature of an alarm, or "call attention" signal, and the visual signals giving the "condition of line" signals, and route indications.

Choice of Design of Apparatus.—The design of the apparatus divides naturally into two parts—that of the indicating apparatus, and that by which the indications are to be produced. The indicating apparatus will be subject to violent vibration whatever arrangements are made, and must be capable of withstanding it. The means by which the indications are produced, if a contact system is used, will necessarily be subject to severe shocks, and must be strong. Purely mechanical apparatus for producing the indications, depending as it does upon impact, involving movement of some part against a resistance, has small chance of adoption on account of liability to failure under the stresses sustained, and the difficulty of operating such devices at the distances rendered necessary by the high speeds of trains. Where off signals are to be given the cumulative effects of the multiplied blows would render such apparatus liable to constant failure. Moreover, mechanical systems, at their best, can never hope to reproduce in the cab, under the driver's immediate notice, all the information he obtains from the line signal.

The use of electricity offers much greater advantages, and enables the effects to be produced at any required distance from the operator without effort. The combinations that may be made with a given apparatus are more numerous, and the methods in which electricity can be utilized preclude the necessity for the violent shocks which are almost inseparable from purely mechanical operation. Nevertheless mechanical means may, if designed with a knowledge of the conditions to be met, be made to form a valuable auxiliary to electrical systems.

The collection of signals on the engine is a matter of the highest importance in any system of cab signaling. In purely mechanical systems, as has already been stated, this is done by contact of apparatus carried on the engine and apparatus fixed on the line which partakes more or less of an impact or blow. This blow may be minimized to some extent by the adoption of yielding devices on the engine or track, or by applying the contact more or less gradually by sloping devices, but the effects are but slightly reduced.

Electrical systems have generally to provide some form of mechanical contact between the circuits on the engine and those on the track, but as they do not necessarily involve the movement of the apparatus, their design need not follow the same lines. If efficient contact is established, that is sufficient. Metallic contact is necessary, and it has been thought that under the conditions of use snow and ice, or dirt, might form an objection by causing failure to make efficient contact. In any system whatever the design is the most important point. If the apparatus brought into contact is not such as will tend to clean, but rather to press and consolidate whatever the bar may be covered with, failure is sure to result.

Considerations like these have given rise to suggestions for contactless systems of collecting indications, of which Mr. W. S. Boult's system is perhaps the best known. These systems depend upon magnetic influence for the operation of the signaling apparatus on the engine, and are therefore independent of such conditions as have to be provided for in contact systems.

Requirements to be Satisfied by Supplementary Apparatus.—The distant signal is the one of greatest importance, since at that signal the driver gains information by which he is guided in his immediate subsequent actions. At that point he is informed of his position relatively to the stopping place of that signaling point, and he there obtains the "condition of line" and route indications if the line has been prepared for his further passage. What is required, therefore, in any supplementary apparatus is that it shall advise the driver, when he is passing a position corresponding to that fixed upon as the distant signaling point, of the condition of the stop signals in advance. If this is done, the driver is informed on all the points which it is necessary for him to know. The following points should be provided for:

1. The first useful operation is to inform the driver, by way of warning, of his position relatively to the signaling point he is approaching, at such a distance as will enable him to carry out any steps that may be necessary.

2. To advise him immediately afterwards of the condition of the stop signals he is approaching.

3. If the off signal is obtained it should be accompanied by a route indication, which will enable him to judge whether the right road has been prepared at a diverging junction. It should be possible to reverse this indication at some point or points before the train passes the home signal, in case of emergency, just as it is possible to reverse an indication with the mechanical signals by throwing them to danger before they have been passed.

4. If the on signal is obtained, the indications on the engine should be maintained until the off signal is received. It should be possible to receive the off signal at some point or points between

the distant signaling point and the home signal to prevent unnecessary delay. It should be possible for the apparatus to indicate to the driver at some point or points how far he has traveled between the distant signaling point and the stop signal when the indication continues at on. It should be possible for the driver to obtain the off indication when standing at the home signal. It should also be possible to give a signal to a train standing at the home signal which would be of a cautionary character and distinguishable from the ordinary authority to proceed.

As corollaries, the following conditions should also be provided for:

(*a*) The warning signal should be given by the natural operations of the apparatus, and should require no action on the part of the driver or signalman to bring it into operation.

(*b*) The "condition of line" and the route signals should be under the sole control of the signalman, should be subject to the control imposed by the interlocking, and must be such that failure shall not be liable to give a dangerous false indication.

(*c*) The signalman shall be provided with indicators which will show him that the apparatus on the line, for giving the signals on the engine is in order, and that the apparatus prepared is in accordance with the positions of the signal levers.

(*d*) The apparatus on the engine should be of a reliable character, easily seen and heard, and such that the indications shall, as far as possible, correspond with the apparatus it is intended to supplement. It should be self-testing and be continually in use, so that failure may be instantly indicated, and it should be so arranged that attention can be readily given and defective apparatus easily removed and replaced.

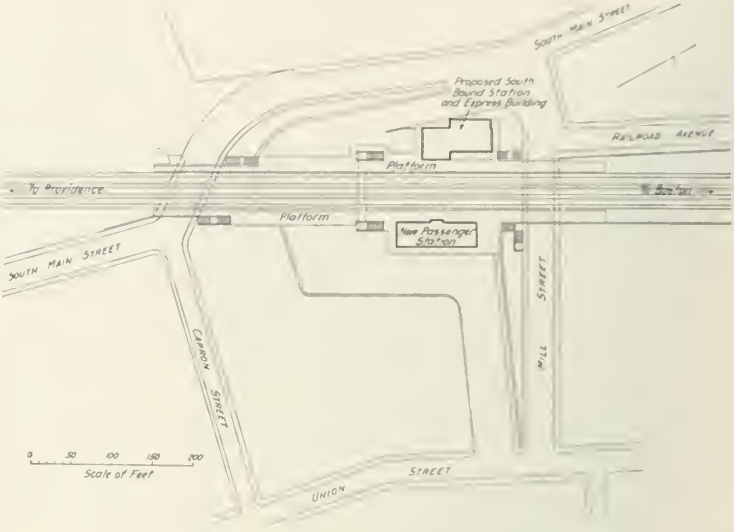
(*e*) The apparatus should be capable of easy adaptation to single or double line working.

Conservative Socialism in Belgium.

Belgium has a new Railroad Minister, by name Helleputte, who as deputy belonged to that section of the clerical majority of the Parliament known as Christian Socialists, especially devoted to the interests of the working man. But like many others who, radical as critics, become conservative when in authority, he finds that there is a limit to what the state can pay the working man; and when his fellow Christian Socialist, the Abbé Daens, moved that the minimum daily pay of an employee in the state railroad, postoffice and telegraph service should not be less than 3 francs (58 cents), he objected, affirming that the working expenses of the railroads had already increased seriously. The mover of the resolution said that at one station laborers were offered only 47 cents a day, and another deputy affirmed that there were employees receiving only 58 cents a day after 23 years service.

New Passenger Stations at Attleboro.

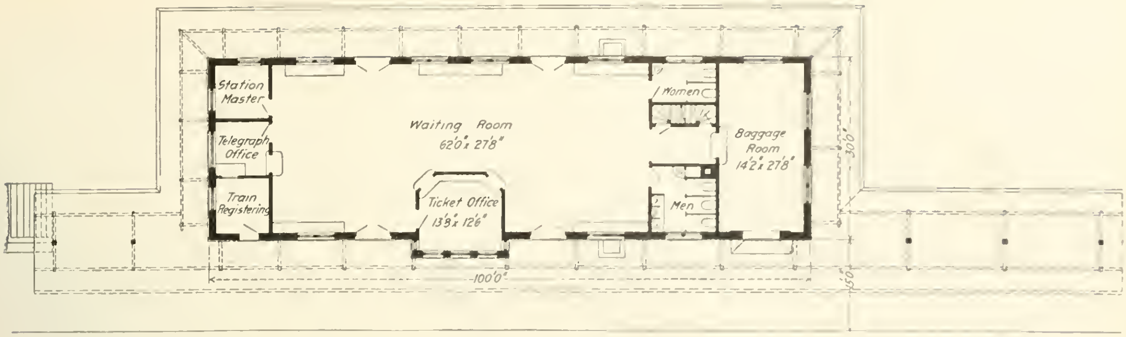
The New York, New Haven & Hartford has built new passenger stations at Attleboro, Mass., which is on the main line of the Providence division, 12 miles northeast of Providence, R. I. Elimination of grade crossings made new stations necessary and the northbound station, shown in the photograph, was built



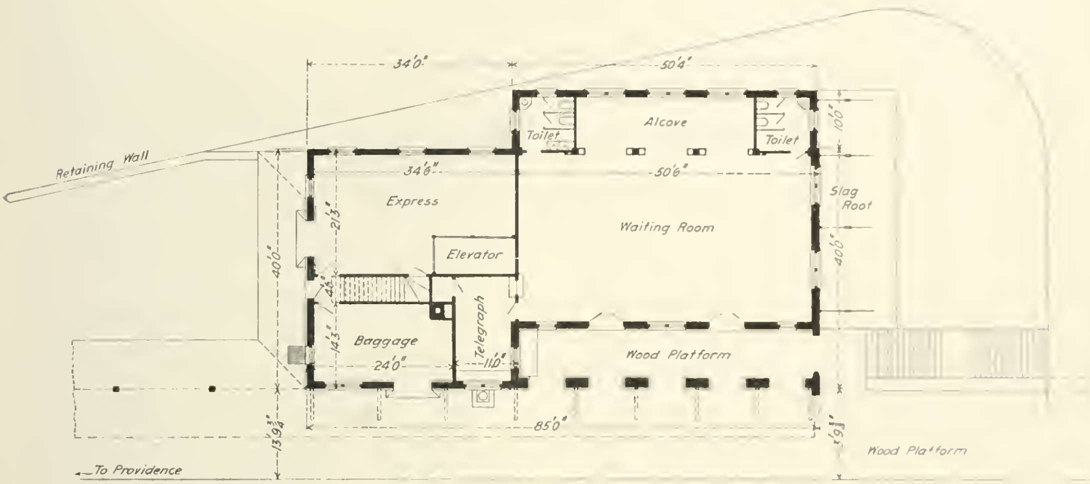
Stations, Express Building and Passenger Subway at Attleboro.

last year. The stations are between Mill and South Main streets, which the railroad crosses on granite arch bridges. The two stations will be connected by a concrete passenger tunnel under the tracks. At this point the road is on an earth fill so deep that concrete foundations for the stations were necessary, and in the southbound station advantage is taken of this situation to make a lower story, which is to be used for express. An elevator is to be installed to handle loaded trucks of express matter between the delivery floor and the track level. Temporary wooden platforms were laid, as it was not thought best to build concrete platforms until the earth had entirely settled. The lower walls of the southbound station are of granite masonry, harmonizing with the stone arch bridges and the retaining walls. The upper walls of this station and of the northbound station are of red brick with white joints and trimmings of granite and concrete. Both stations and sheds are roofed with red Spanish tile. The interior of the waiting rooms, toilet rooms and ticket offices are plastered, and finished in chestnut, stained dark brown. The other rooms are sheathed with varnished North Carolina yellow pine. An unusual feature

North Bound Station at Attleboro, Mass.; New York, New Haven & Hartford.

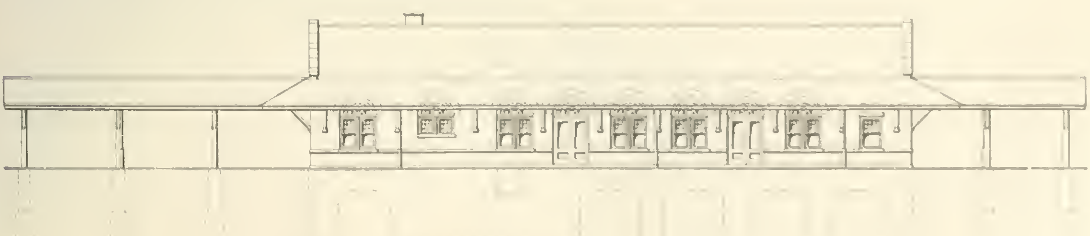


Plan of North Bound Station at Attleboro.



Plan of Main Floor; South Bound Station at Attleboro.

Street Elevation of South Bound Attleboro Station; New York, New Haven & Hartford.



Front Elevation of South Bound Station.

in the waiting room of the southbound station in the alcove, shown in the plan. The southbound station is now heated by a direct hot water system, but it is intended ultimately to heat both buildings by the direct steam system planned for the southbound station.

Picked Up on the Road.

BY GULF.

In these days when railroad managers are vying with each other in fast schedules on paper, and the dear public is left guessing as to the time of arrival and departure of trains, it would be a gracious act on the part of superintendents and general ticket agents to issue instructions to ticket sellers, gatemen and ushers to give such full and complete information to travelers, as to mitigate as far as possible, the irritation felt against their superiors because of the aforesaid paper schedules, and not withhold matters the knowledge of which would serve to allay the hostile feeling that unfortunately exists. To take a concrete case from experience, I was going from X to Z on the A. B. C. through line. There were two trains scheduled to run 15 minutes apart, and I, being somewhat experienced, and knowing that the A. B. C. trains were likely to keep in the fashion and run late, went to the ticket office at X at my convenience and asked, "How late is No. 17?" the first of the two trains. I was told that it was one hour behind. I bought my ticket and went away. Coming back in an hour or more and asking for a Pullman ticket I was informed that the parlor car had gone on No. 13 which had left only 30 minutes late. I really am afraid I said things to that agent for not telling me that 13 would lead 17, when he knew that it would when he sold me the ticket and answered my inquiries. But then, what's the use? No amount of instructions will put common sense into indifferent employees. And then, what could be expected on a line, in one of whose principal depots, I was once unable to find or procure or get access to a time-table?

I sometimes think, oh well! we are all agreed that centralization and consolidation is the order of the day, and also that it is demoralizing to the personnel. Those of us who travel, and have to do with the ticket agents and conductors and baggagemen, sigh for the time when the ear-marks of the superintendent were apparent in the land; when there was some sort of *esprit de corps* due to contact with superiors who could issue an order, and not have it referred up and up until it finally disappeared in the hazy proceedings of the Board. If you want to do business with a man, you go and see him. If you want to have your cavalry charge a success, you don't send a telegram to your men, but you order boots and saddles sounded and head the line yourself. If your ship is in a storm and the seas are boarding her, you are upon the bridge and not asleep in the cabin. But if you are a railroad magnate you expect to reach success through a series of letters and telegrams and reports. Everyone of you appreciates the value of personal contact, but how many of you ever take a trip over your own road in a day coach? How many of your men know you and how many do you know? How often, too, do you ask the conductor of your train to come back into your car for a talk? How much do you know of the ideas held by your men? How often have you consulted them personally before an order was issued? When did you ever sit in a day coach or even in a Pullman and talk to a passenger about your road? And finally, how much can you tell your masters in Wall street of all these things? A certain ruler knows their value. You give him a special train and pay the engineer and fireman and conductor and trainman for the service they give him, but when he reaches his destination, he shakes hands with the whole crew and asks after their babies—and they would vote for him and follow him and back up his policies to the utter damnation of you and your road and their own welfare! He doesn't send an *aide-de-camp* to express his good will, he goes himself. And really, you would be surprised to learn how little of his time it takes, and how little it would take of yours to follow suit. None at all, in comparison with the dividend it would pay.

I wonder how much of the popular hostility to railroad interests is due to the work of politicians and to inflammatory writings that are published to sell, and how much to unfortunate personal experiences? How many commuters have got it in for the road they use every day because of what they read in their morning paper, and how many because of the failure to keep the promise of the guessing sheets, formerly known as time-tables? How many casuals believe in government control with a big C, because of the insolence or indifference of a ticket agent, forgetful of the fact that for supremacy in indifference, insolence and all other aggravating qualities one must go to a government employee? How many women lend their influence to the movement to down the railroads because their trunks came out of a baggage car rather too rapidly, and the corners were not as strong as the conditions demanded? How many regular travelers think "something ought to be done," because they don't make connections and are always late at destination, and yet being regular travelers realize that it's pretty difficult to draw up an exact specification of what that "something" should be? How many employees follow the teachings of the demagogue and the politician one grade removed, because the demagogue and the politician shake hands with them and call them by name and ask after the wife and babies and the general manager doesn't? Every month there is a frantic appeal from some general ticket or freight agent to his men to be polite and to make the public think they are interested in their welfare. They realize that sweet oil is a better lubricant than vinegar, but I doubt if any of them have the time to come into any very close personal contact with their representatives, and so the work of betterment lags.

This placing of blame on the superintendent and general manager to which I plead guilty may, however, partake of the nature of the story of the office boy who when asked who was the responsible party there replied, "I don't know who's responsible, but I'm always to blame." Perhaps, you see I'm repentant now for all the things I've said—perhaps the responsibility lies higher up, while we the public blame the department heads. When locomotives are bought by men who don't know a mogul from an Atlantic, and superintendents of motive power and traffic officers are ignored, and Wall street is all sufficient unto itself, it is quite natural that some things should be as they are. When men get control of a road and do not realize that there are things to be learned beyond the pale of high finance, and pleasure, and the clipping of coupons, the men represented on the Board are apt to be those whose skill in brightening the executive lunch, in percentage calculations, in getting speed out of automobiles, is acknowledged; balanced, perhaps, by some silent men of substance who can clip a coupon with all the dexterity that Louis XVI showed in the opening of an egg, and who have about as much value to the road as he had to the state. Then if there happens to be a busybody in the crowd, a man who takes interest enough to meddle, why, then—ye gods and little fishes!—we have a condition to make the economist weep and the stockholders gnash their teeth. Blame and responsibility then become separate and distinct and we follow the motto of Donnybrook Fair and hit the visible head regardless of its degree of offensiveness. Possibly, quite possibly, we have swung through the whole circle only to locate the seat of public hostility to railroads, of the wariness in taking up railroad securities, of the indifference of employees, of the clerical positions occupied by departmental heads, of the indifference to contract agreements as shown in the issuance of the guessing-sheets, and of the general demoralization that sometimes seems to pervade the service, in the magnates of high finance who do not know that they do not know, and so have not the wisdom to direct what they want accomplished in operation and management and then leave it to the competent men in the service to bring about this result in their own way without let or hindrance or dictation as to details.

People who have traveled and noticed, frequently remark upon the rapidity with which the crowds of the New York Elevated and Subway trains are handled. Away back in 1878, when the Sixth Avenue or Gilbert Elevated Railroad was opened, the guards began urging the passengers to "step lively," and have kept it up ever since, with the result that they do step lively and station stops are materially shortened. Suppose, now, there were to be someone in authority all along the line of—well say the A. B. C. Railroad—or to accompany trains that are late—say all trains, to avoid controversy, and to be on hand at the baggage, express and mail cars to shout a "step lively" to the men at work and thus hasten the movement of the Saratogas and Innovations, thereby cutting down station stop delays? It would help matters somewhat, and serve to put the running time a little more on a par with the representations of the guessing-sheet. It's rather discouraging to the driver who has succeeded in scaling three or four minutes off a run of 40 miles, or made up some time, to lose five minutes of it through the station baggageman's desire to tell the train baggageman about his wife's sister's boy; or through the general indolent handling of baggage and express. He sympathizes with the foreman of a gang of chattering Italians, who, disgusted with their volubility, shouted—"There yez, jist sthop yer dagoing an lift!"

The Bologna Chamber of Commerce recently sent a circular of inquiry to the chambers of commerce of all the other cities and towns of Italy, asking for opinions as to the present handling of traffic on the State Railroads. From one solitary place, Turin, came the answer that it is generally satisfactory. Many said that it is better than formerly, but a large number declared that it continued to be very bad. A summary of the answers is that most of the chambers of commerce find the railroad service unsatisfactory from causes due both to equipment and to the staff of employees. There is negligence in maintenance, delay in making repairs, and indifference in operation. The lower employees are deficient in sense of duty and honor. Complaints bring nothing better than promises. One chamber complains especially that nothing can be done without tips.

Ship Building During 1907.

The world's output of ships in 1907, according to *The Marine Review*, was 3,330 vessels with a tonnage of 3,220,399 tons. In 1906 the world's output was 2,941 ships of 3,323,250 tons.

In point of tonnage the American Ship Building Company, of Cleveland, Ohio, leads the ship builders of the world, having built 34 vessels of 191,602 tons. The next is the corporation of William Doxford & Sons, Sunderland, England, which built 22 vessels of 91,254 tons at one ship yard. The American Ship Building Company has seven yards, so that it is not altogether fair to put it at the head of the list, but it built a greater tonnage than any other company. The following table shows the first nine companies in output of tonnage during 1907:

	Vessels.	Tons.
American Ship Building Co.	34	191,602
William Doxford & Sons	22	91,254
Swan, Hunter & Wigham Richardson	19	75,818
Harland & Wolff	8	74,115
Russell & Company	14	71,705
Workman, Clark & Co.	21	63,245
The Great Lakes Works	10	58,051
The Bremer Vulcan Works	11	49,431
The Fairfield Company	6	48,027

Comparing the different countries of the world, the United Kingdom is not only far and away the leader, but built more ships of a greater tonnage than all the other countries of the world put together. Great Britain and Ireland produced 1,571 ships of 1,724,921 tons during the year; including the colonies, the total output of the British Empire was 1,764 vessels of 1,758,601 tons. As against this, the output of all other countries was 1,566 ships with a tonnage of 1,462,798. The United States comes second with 189 vessels of 488,340 tons. Germany is third with 513 vessels, whose aggregate tonnage however was only 315,518 tons. In this comparison between Germany and the United States is clearly shown the great size of the bulk freighters on the Great Lakes which constituted nearly all of the American output. The following table shows the world's output by nations during 1907:

	No.	1907. Board of Trade, tons.
Great Britain and Ireland	1,571	1,724,921*
The Colonies and dependencies	193	33,680
Total of British Empire	1,764	1,758,601
United States	189	488,340
Germany	513	315,584
France	51	113,345
Belgium	42	17,630
Holland	344	152,371
Denmark	39	24,488
Norway	75	51,523
Sweden	34	15,646
Spain	4	4,341
Italy	26	86,370
Austria-Hungary	48	41,960
Greece	1	150
Russia	13	20,700
Japan	157	126,068
China	30	4,282
Total output	3,330	3,221,399

*51,800 tons warship displacement.

A Comparison of Earnings and Operation of Nine Western Railroads.

The *Wall Street Journal* has made an elaborate analysis of the earnings and operating results for the year ended June 30, 1907, of the four big granger railroads, the four transcontinental lines in the United States north of the Southern Pacific, and the Canadian Pacific. Every one of the roads is an important grain carrier.

The comparisons are made in percentages, using the results on the Chicago North-Western as a standard, the results on that road being taken as 100 per cent. in each case. By this means the other roads can be compared not only with the North-Western but with each other.

The first table gives average mileage operated, gross earnings, operating expenses (not including taxes) and net earnings:

Mileage and Earnings.

Railroad.	Mileage worked.	Gross earnings.	Operating expenses.	Net earnings.
Chicago & North Western	7,550.64	$68,878,931	$44,789,025	$24,089,906
Per cent	100	100	100	100
Chic., Mil. & St. Paul	7,049.46	60,548,554	39,400,410	21,148,144
Per cent.	93	87	88	88
Chic., Burl. & Quincy	8,863.40	82,473,250	58,904,987	23,568,263
Per cent.	117	119	131	98
Chic., Rock Island & Pacific	7,780.26	60,238,419	41,044,142	19,194,277
Per cent.	103	87	90	79
Canadian Pacific	9,153.90	72,217,527	46,914,218	25,303,308
Per cent.	121	105	105	105
Atch., Top. & Santa Fe	9,273.15	93,683,406	58,867,901	34,815,505
Per cent.	123	136	131	144
Great Northern	5,982.31	55,144,402	32,562,775	22,581,626
Per cent.	79	80	73	94
Northern Pacific	5,443.67	68,534,832	37,664,316	30,870,515
Per cent.	72	99	84	128
Union Pacific	5,344.55	76,040,726	40,574,889	35,465,857
Per cent.	71	110	91	147

This table shows that the Burlington, with 117 per cent. of the North-Western's mileage, has about the same ratio of gross earnings. Its operating expenses, however, are 131 per cent. of the other road's and its net earnings in consequence only 98 per cent. of the North-Western's. In the same way, the Rock Island, with 103 per cent. of the mileage, has only 87 per cent. of the North-Western's gross and only 79 per cent. of its net.

On the other hand, the Atchison, with mileage of 123 per cent. and expenses of 131 per cent., has 144 per cent. of the net. By far the best showing is that of the Union Pacific. With but 74 per cent. of the North-Western's mileage it earned 110 per cent. as much in gross, and by keeping operating charges down to 91 per cent. manages to show 147 per cent. for net. The Northern Pacific makes almost as good an exhibit. While the Chicago & North-Western spent 65 per cent. of its total earnings for operation, this road, with almost exactly the same amount of gross earnings, used only 55 per cent. of gross for this purpose.

The following table gives the ton miles, the freight density (tons one mile per mile of road), and the mileage of freight and mixed trains, which in one way expresses the amount of energy used in moving the freight:

Ton Mileage, Freight Density and Train Mileage.

Railroad.	Tons 1 mile revenue freight.	Tons 1 mile per mile road.	Miles of frt & mixed trains
Chicago & North-Western	5,428,771,597	719,042	20,591,011
Per cent.	100	100	100
Chic., Mil. & St. Paul	5,155,662,231	731,403	17,805,620
Per cent.	95	102	86
Chic., Burl. & Quincy	7,169,879,492	808,966	18,410,855
Per cent.	132	111	89
Chic., Rock Island & Pacific	4,281,228,365	550,286	16,084,714
Per cent.	79	76	78
Canadian Pacific	5,789,191,940	632,422	19,599,133
Per cent.	107	88	95
Atch., Topeka & Santa Fe	6,842,669,206	738,021	24,058,639
Per cent.	124	103	117
Great Northern	5,370,157,882	897,719	9,788,355
Per cent.	99	125	48
Northern Pacific	5,504,444,098	1,011,102	13,532,148
Per cent.	101	140	66
Union Pacific	5,704,061,535	1,010,641	14,086,856
Per cent.	105	141	68

The St. Paul, with 95 per cent. of the North-Western's ton mileage, handles it with 86 per cent. of the number of trains, while the Burlington makes a better showing with 132 per cent. of the tonnage and only 89 per cent. of the train mileage. The Rock Island has practically the same ratio as the standard taken. The Northern Pacific and the Union Pacific again make an economical showing in carrying a little more freight than the North-Western with two-thirds as much effort. But the Great Northern easily takes off the palm for economical handling of freight. With about the same amount of tonnage as the North-Western it used only 48 per cent. of the train mileage to move it.

In the next table the revenue trainload, the number of cars per freight train and the average load in each loaded car are shown:

Trainload and Carload.

Railroad.	Av. No. tons rev. frt. per train.	P'r cent.	Av. No. of cars per frt. train.	P'r cent	Av. No. tons loaded frt. car.	P'r cent
Chic. & Nor. West'n	262.65	100	25.5*	100	15.33	100
Chic., Mil. & St. P.	289.55	109	27.1	106	14.72	96
Chic., Bur. & Q.	389.45	147	30.21	119	17.56	115
Chic. R. I. & Pac.	266.17	101	23.07	90	15.27	100
Canadian Pacific	295.38	112	22.96	90	16.67	109
Atch. Top. & S. Fe.	284.42	108	28.61	112	15.46	101
Great Northern	548.68	208	35.54	139	20.44	133
Northern Pacific	406.77	154	28.98	114	17.78	116
Union Pacific	404.92	153	30.02	118	18.2	118

*1906.

The most striking feature of these figures is again the economical handling of freight by the Great Northern. Carrying on an average 20.44 tons per mile in each loaded freight car it makes a showing of 133 per cent. as compared with the Union Pacific's good record of 18.2 tons and 118 per cent. The Northern Pacific is close behind with nearly 18 tons.

The last table shows the average gross revenue received by each road per freight train mile and average ton mile rate.

Train Mile and Ton Mile Revenue.

Railroad.	Av. rev. per frt. train mile.	Per cent.	Av. rev. pr ton pr mile.	Per cent
Chicago & North-Western	$2.40	100	$0.90	100
Chicago, Mil. & St. Paul	2.47	103	.85	94
Chicago, Burl. & Quincy	3.07	128	.79	88
Chicago, Rock Island & Pacific	2.53	105	.95	105
Canadian Pacific	2.29	95	.77	85
Atchison, Topeka & Santa Fe	3.07	128	.95	105
Great Northern	4.27	178	.77	85
Northern Pacific	3.57	149	.87	97
Union Pacific	3.89	162	.96	108

The Great Northern again shows the lowest average rate of the American roads, .77 of 1 cent, which is as low as the Canadian Pacific's, while at the same time it earns the most per train mile. Only the Canadian Pacific earned less per train mile than the North-Western, although five of the other seven roads received a lower ton mile rate. The Union Pacific received the highest ton mile rate, .96, while the Rock Island and the Atchison got .95 of 1 cent each, from which the latter realizes $3.07 per train mile compared with $2.53 for the Rock Island. The Atchison's ton mileage explains this, for it is almost 160 per cent. of that of the other road.

A Locomotive Sled.

The accompanying photographs show a new type of traction engine for hauling logs over snow and ice roads. The boiler is mounted on a heavy channel iron frame. These channels are reinforced and extend from the extreme front end to the rear of the machine, supporting the cab and the coal bin. The water tank is carried under the boiler on the same frame and has a capacity of about 10 barrels (315 gallons) of water, which is enough for a run of five miles. The frame rests on heavy traction wheels in the rear and on a sled in front. The boiler is 30 ft. long and 2 ft. 11 in. in diameter; the working pressure is 200 lbs. The boilers are jacketed with a 2-in. covering of moulded magnesia, outside of which is a heavy iron jacket. The flues are 1½ in. in diameter. There are four upright cylinders bolted in pairs, two on each side, to the frame and the boiler. They are 6½ in. in diameter, with 8 in. stroke, and are heavily jacketed with magnesia and planished iron. The valve gear is a reversing link motion.

That part of the weight of the engine which in an ordinary locomotive would be carried on the drivers, is in this machine carried on a transverse 5½-in. shaft. This shaft in turn rests on steel castings which act in the same way as the runners on a sled, although, as will be seen, they do not touch the ground. These runners carry on each end journals in which auxiliary transverse hammered iron shafts run. On each of these shafts there is a sprocket wheel carrying a tread or lag chain, which is 12 in. wide and about 14 ft. long. Inside of these sprockets are other sprockets carrying steel roller chains. The runners bear on these rollers, which in turn rest on the tread chains when the machine is in operation. Power is transmitted from the crankshaft to the longitudinal driving shafts by spur pinions. The rear ends of the driving shafts are geared to large beveled gears on the single transverse shaft first mentioned. From this shaft the power is transmitted to the rear sprocket by intermediate gears. All gears are cut from solid steel; they are pressed on the shafts under heavy hydraulic pressure. The runner castings, sprockets, tread chains and all parts subject to strains are made from a high grade of cast steel and built for severe work.

In their other fittings these engines in general follow standard locomotive practice. The cabs are fitted up like a locomotive cab, with quadrant, reversing lever and regular locomotive throttle. Each engine is fitted with a double sight feed lubricator and two injectors. Twenty feet of suction hose and 30 ft. of steam hose are also part of the equipment.

Traction Engine for Ice Roads Hauling String of Log Sleds.

Locomotive Sled for Hauling Logs on Ice Roads.

One of these engines weighs 15 tons without water and about 18 tons ready for the road. At 200 lbs. pressure it develops 100 h.p., and has a speed of from four to five miles an hour. While it can be used in rough country, it needs easy grades for satisfactory working. Water must be supplied every four or five miles. On well graded and icy roads it will handle from seven to 15 heavy logging sleds with 5,000 to 7,000 board feet of logs to the sled. Twenty-nine of these engines are now being used in Minnesota, Wisconsin, Michigan and Saskatchewan by 20 lumber companies. Some of these are making 50 miles a day and doing the work of from 12 to 18 four-horse teams. There are three men in an engine crew: the engineman, the fireman and the pilot, who steers the front sled by the wheel shown in the photograph. The engines are built by the Phoenix Manufacturing Co., of Eau Claire, Wis.

The Railroad from the Red Sea to the Soudan.*

The new railroad which the British have built from Atbara to the Red sea begins 200 miles north of Khartum in the heart of the Nubian desert, and runs to Port Soudan, 332 miles. It crosses one of the bleakest deserts on earth. There is no vegetation at all between Atbara and the Red Sea until within about nine miles of the coast, where there is a scanty growth of thorn bush and scrub, which feeds small flocks of camels and sheep. The only inhabitants of the desert are Nubian tribes, who go about from place to place living in tents of matting seeking pasture for their flocks and camping by the occasional wells.

This road was opened in 1906 and now has more freight than cars. All the trade of the Soudan will probably go over it and, it is believed, much of the tourist travel as well. Already the Mohammedan pilgrims from central Africa and the whole Upper Nile valley are taking this railroad on their way to and from Mecca. Some of the tourists who go up the Nile are returning by the Red sea and ships are now sailing regularly from Port Soudan to Suez.

In the past all freight for the Soudan has been landed at Alexandria and carried by rail or boat up the Nile to Shellal, a distance almost as great as from New York to Chicago. There it has been taken by steamers to Wady Halfa and thence on trains to Khartum. On the way to Shellal the railroad freight had to be transferred from the broad-gage cars at Luxor to the narrow-gage from Luxor to Assouan. All of these transfers were costly, the freight rates were high and the time slow. Now ships go right through the Suez canal to Port Soudan, on the Red sea, and there land their goods for the Soudan. The freight is transferred almost direct to the cars, which by one continuous 500-mile haul land them in Khartum. In the past, wheat could be sent from Chicago to Liverpool at a lower rate than that which formerly prevailed between

*From a letter written by Frank G. Carpenter to the *Deseret News* (Salt Lake City).

Khartum and Wady Halfa. The cause for this was the high price of coal, all of which had to be brought up the Nile from Alexandria. The coal is now coming in direct from the Red Sea.

Atbara, the station which forms the terminus of the Red Sea railroad, is in the heart of the Libyan desert. It is about 200 miles north of Khartum, at the junction of the Atbara river and the Nile. It is also at the junction of the Red Sea railroad with the great trunk line which may some time go from Cairo to the Cape. The northern section of the latter starts at Alexandria and runs northward through here to Khartum, where the Blue and White Niles come together and form the main stream.

The Atbara river, which can be plainly seen from this station, is the last branch that the Nile has between this point and the sea. The Atbara rises in the Abyssinian mountains and it carries down to the Nile every year millions of tons of the rich Abyssinian mud which makes so fertile the Lower Nile valley. During a part of the year this river has a volume which compares with that of the greatest rivers of the world and at other times much of it is as dry as a bone. From March until June for about 150 miles above Atbara you can walk across it in most places without wetting your feet and there is water only here and there in the depressions and pools. These contain hippopotami, crocodiles, turtles and fish.

The great floods begin in July and last till October. Then the waters are about 30 ft. deep and they roll down in a great river from a quarter to a half a mile wide. They are of a reddish color and are loaded with the volcanic dust of which the Abyssinian highlands are made. When the floods come they bring down masses of driftwood, on which are sometimes the dead bodies of elephants and buffaloes. The waters come with great force. The Atbara bridge, over which the railroad crosses the river, was built by an American bridge-building company, and was sent here in sections. It consists of six great steel spans of 200 ft. each, built on piers which extend 30 ft. down under the river to the bed rock.

Atbara, lying as it does at the junction of the two chief lines of the Soudan, is an important railroad center. The railroad shops, which lie here in the sands of the desert, cover two or three acres of the bleakest part of the earth. They are great sheds, with walls of galvanized iron and roofs of iron and plate glass. The machinists are a mixture of whites, blacks and yellows, representing a half dozen different nations and tribes. There are British overseers, Greek and Italian mechanics, Nubian blacksmiths, and many Nubian boys taking a manual training course in order that they may serve as locomotive engineers, under-machinists and trackmen.

The desert is a great wear and tear on the equipment. The sands ruin the car wheels. The desert is covered with grains as hard as flint. They blow over the rails, and as the cars move they grind out the steel as though they were emery powder. Deep grooves are cut out. As a result a wheel's life is short, and the tires have to be cut down every few months. Moreover, the sand gets in the bearings, and there is continuous wearing which necessitates almost constant repair.

Sandstorms are serious obstacles to traffic. At times they come with such violence that they cover the tracks; they darken the sun so that when you are in one you cannot see your hand before your face. They often spring up afar off, and you can watch them coming. At such times the sand gets in everything and grinds its way through all parts of the machinery.

Another thing to contend with is the extraordinary dryness of the air, which shrinks everything connected with the road. The rolling stock has to be tightened up again and again. One of the passenger cars will shrink as much as 18 in. in one wall alone, and extra boards have to be put in to fill up. This is so with all sorts of woodwork.

Another trouble is the white ant, which eats anything wooden. It chews up the insides of the cars and even attacks the furniture. Where there is any least moisture the ants go for the railroad ties, and they will also chew out the insides of the wood telegraph poles. They always work in the dark, leaving a thin shell of wood outside. The result is that a tie or pole may look sound, but all at once it crumbles to pieces. The road has to be inspected very carefully at regular intervals. Steel shells are now being used as ties. They do not make as smooth a road as the wooden ties, but the ants cannot eat them. Steel telegraph poles are also used.

American locomotives, according to the manager of the road, do not compare well with those from Great Britain. Some American engines were bought seven years ago, and are still in use, but most of them have been repaired and made over. American builders make locomotives, expecting to be run to their full capacity for four or five years and then thrown on the scrap heap. This is not advisable in the desert, where freight costs so much and the trouble of getting rolling stock is so great. What is wanted is machinery that will stand all sorts of trials, including the climate; rustproof and rotproof and heavily made all around. There is not only the dry air and the sand to contend with, but in the neighborhood of the Red sea, also the salt air and the alkali water. The latter ruins boilers, more so, in some respects, than the sand.

The lack of water is one of the chief difficulties. The railroad is over 300 miles long and the track is laid through the sand. For about one-third of the distance inland from the Red sea the country is mountainous, but the rest is flat. There are no streams, and artesian wells furnish the water supply. The water in them in many places is salt. One well had 3 per cent. salt in it, and another 1 per cent. salt. Of course such water is useless for locomotives.

There is also trouble in getting a good water supply at Port Soudan. One well was sunk to a depth of 800 ft. and struck a good flow of fresh water. It was hardly completed, however, before the salt water from the Red sea began to seep in. There are some stretches along the route where there is no water whatever. In such places water has to be carried. For this tanks of galvanized iron, each of which will hold about 1,500 gallons, are used.

This road is the short cut to the Soudan and Central Africa, and it is likely to have the most of the carrying trade of that region. The country is vast, and it is just now on the edge of its development. Goods will be brought over the Red sea road to Khartum and thence sent up the White and Blue Niles. There will be new roads going out from Khartum connecting the Nile with all parts of the country, and both the rivers and the road will be feeders of the Red sea line. A bridge is being built across the Blue Nile, which will carry the road directly into Khartum, and in the near future a bridge will probably be built across the White Nile, which will take the road to Omdurman.

The railroad terminus on the Red sea is known as Port Soudan. The original intention was to end the road at Suakim, but the British surveyors found a much better port a little farther north and located the terminus of the railroad there. This is Port Soudan. It lies about half way down the west coast of the Red sea and just opposite Jeddah, about 500 miles south of Suez. The harbor there is the mouth of a creek shaped like a leaf, with the point inland. The water is 200 ft. deep in places, and there is deep water close to the shore. Just outside is a coral reef, which protects the harbor. The British are now dredging the edge of the harbor, and they will have it so that the biggest ocean steamers can come right up to the quays. They are building a quay wall of granite blocks nearly a mile long, with electric traction cranes running on it. The railroad tracks will come out on the wall and the freight will be loaded and unloaded by the cranes into the ships and the cars. The harbor will be lighted by electricity and the best of coaling arrangements supplied. The government has already planned an expenditure of $4,000,000. Most of the improvements are well under way. Six or seven lines of steamers now make regular callings there, and the prospect is that Port Soudan will be the chief port of the Red sea and the principal place of import and export for lower Nubia, and a large part of central Africa.

Foreign Railroad Notes.

The Austrian State Railroads are to renew the tracks of lines on which express trains run, where 70-lb. rails are the rule now, with 85 and 90-lb. rails.

The German Dining-Car Co. in its last fiscal year had cars on 25 different routes, 15 of which yielded a profit and the other 10 a loss; but the net result made a dividend of 10 per cent. possible. Since June smoking has been prohibited in these cars. The receipts for food have increased since; but there has been a material falling off in the money taken in for drinks.

The French Minister of Public Works recently announced to the Chamber of Deputies that he should soon lay before the Senate what he considered uncontrovertible evidence that the state should immediately acquire the Western Railroad system. The Chamber had already voted in favor of this; but the Senate has delayed action. It is doubtful if it can delay much longer.

There is talk of putting on a limited train between Paris and Munich. The latter city is on the route of the "Orient Express," which, however, adapts its time more to Vienna and the East than to the Bavarian city, and, moreover, is likely to be so crowded that Munich passengers haven't a fair chance. The proposed train would be a sort of through-by-daylight Empire State Express, leaving Paris at 8 a.m. and arriving in Munich at 10.25 p.m. (565 miles), and leaving Munich also at 8 a.m. and arriving in Paris at 9.15. On the route are such important places as Strassburg, Karlsruhe and Stuttgart. This will make a neat little 40 miles-an-hour run.

Russian Turkestan, since the opening of the Orenburg & Tashkend Railroad, may become for Russia what California has become for a large part of this country and some other parts of the world—that is, its fruit garden. It produces very fine fruit, and when it has more skilled fruit growers, and co-operation among them, and cold storage, and refrigerator trains, and reasonable railroad speed, and low freight for Turkestan, like California, is very far from its market it may blossom like San Jose and Riverside.

On suburban lines out of Mayence a trial has been made since last spring of five passenger cars driven by accumulator batteries which for such service had dropped out of sight for some years. These cars are interspersed among the regular steam suburban trains. They make round trips over lines 7.6, 12.7 and 13.2 miles long, respectively, and their batteries must be charged after each round trip, requiring 40 minutes after the two longer runs and 25 minutes for the shorter one. By the end of September these cars had run 60,737 miles, and there had been no irregularities in traffic due to them. The builder of the cars undertook their maintenance, and no data as to their economy are given.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

VI.

The Normal Type of Steamship Line Organization.

It has been stated that nothing will so prolong the life of a person advanced in years as an annuity. The even and absolutely dependable income gives a certainty, repose and peace that produce a new lease of life. A similar dependable income is about as wholesome and as important for the healthy development of a business corporation as for the individual. The transportation business is uncertain in the amount of its business and its income, so much so that any change tending toward steadiness of business is eagerly sought by the managers of these enterprises. In this fact lies the explanation of much of the recent growth and development of these enterprises.

It is evident that a short railroad serving a small territory, sharing the plenty resulting from good harvest and want of the meager harvests, has much less prospect of steady business than a larger road, serving more territory where local variations tend to be equalized. The strife for regular freights has another phase in the terminal connections which can be made by the company. It is again fortunate, if some other company will promptly carry the freight away from its terminal and pass it on to other territories. It is better yet if some second company delivers goods at its termini for carriage over its lines.

In obedience of these economic forces, transportation corporations may be said to have a law of expansion. Within limits of easy control, the larger they are and the wider their territory, the safer and more reliable is their business. This expansion tends to go on until the carrying unit embraces an economic unit so that there are no commercial wants of the people along the lines that cannot easily be supplied by the great carrier. The people want the ship, and desire to receive goods on through bill of lading with prompt service. The carrier strives to furnish these opportunities. In response to this law the past 40 years have been a period of astounding consolidation and enlargement of the units of management in transportation by land and by sea. Single steamship companies regularly circumnavigate the globe. This has been far eclipsed by the actual labor and capital involved in the operations of railroads which have performed the greater work of crossing an entire continent and establishing subsidiary steamship lines. Connecting railroad lines have been brought closer by through freight agreements, by the leases of long term, 99 or 999 years, and by outright purchase. Great trunk routes have thus been established, branches built, subsidiary industries established, rival trunk lines bought entirely or controlled by majority stock purchase, or by community of interest in which the same men are on several boards of managers so that mutual agreements prevail.

When the railroad was first introduced, people thought of the various roads as connections between certain towns, which was indeed their only early goal. During the past 70 years we have seen the railroad develop from a set of links connecting two or three semi-adjacent cities into vast systems consisting of trunk lines and many branches or feeders.

While we have long since learned to think of railroads as systems, we are still prone to think of steamship lines as doing what the early railroads did—connecting two places. This idea must be discarded. The law of growth among steamship lines works surely to the development of trunks and branches, a development which has already taken place, although the branches are fewer than upon railroads. The improvement of the steamer and the use of the ocean cable gave the needed regularity, dependableness and knowledge for the organization of ocean commerce and transportation into a regular and systematic service akin to that of the railroad. The great ocean lines sail with precision and regularity. To supply these great lines with freight, their managers have been compelled to establish smaller lines to supply and distribute the

Principal Services of the Hamburg-American Packet Company.

necessary cargo. The largest transatlantic lines are, without exception, thus equipped at one or both of their termini. The North German Lloyd and the Hamburg-American connect at their European ends with lines running to South America, East Asia and other distant parts of the world. They also connect with smaller lines plying to the nearby European ports and with steamers on the German rivers. These two German companies carry the same system even further. Their trunk lines to East Asia are fed at Singapore and other eastern ports by lines of smaller German steamers which traverse the eastern archipelagoes and the Asiatic coasts and rivers, collecting cargo for the trunk line stations of the large steamers bound for Bremen or Hamburg, at which ports it is distributed by the European distributors referred to above or sent on to America by the transatlantic lines. The Wilson Line from New York to Hull connects in that city with an enormous fleet of small steamers which thread the coasts of the North Sea and reach all ports of importance in Scandinavia and along the Baltic. Some of the other British transatlantic lines connect with British coasting lines and with the lines to Australia and other British colonies. The French and Italian lines are fed by fleets of Mediterranean coasters and transoceanic liners at Havre, Marseilles and Genoa. The Cunard Line, giving a service from New York to Liverpool and from New York to southern Italy and Fiume, Austria, has a line connecting Liverpool and Fiume. These steamers call at more than 20 ports and gather freight which is to be transferred at the ends of the route to the next steamer bound for America. Other examples of this systematic trunk and feeder development of ocean service might be mentioned; but they would show no feature differing from the development of the examples cited or from the railroad and its branches except that the ocean service of single companies at times circumnavigates the globe and covers a much wider scope of territory than any railroad system the world can ever have.

Steamship Kaiserin Auguste Victoria; Fast Passenger and Freight Service.

The world's greatest steamship company, the International Mercantile Marine, differs from the other giant organizations, such as the Hamburg-American, North German Lloyd, and Peninsular & Oriental, in that, while exceeding any of them in tonnage, it covers a smaller area with its services. This results from the fact that it was formed for a different object. The three European companies referred to are older, and were built up gradually, ship by ship, service by service, as the traffic grew and the service expanded to meet it. One improvement or extension of service to get freight demanded another to dispose of it. The Mercantile Marine Company grew differently. It was the last step in a series of consolidations of equals. The American Line had taken over the Inman Line in 1884. It had later taken over the Red Star Line and become the International Navigation Company. This company now consolidated with four other great lines for the purpose, not of extending service, but of making living rates at a time when severe competition made general loss. Its genesis, therefore, differs profoundly from that of the other great companies.

In some respects the law compelling consolidation and the establishment of feeders works with stronger force among steamship lines than among railroads. The railroad runs through certain territory where it has scores of stations supplying it with traffic and many of them are so situated that they control freight that can find no other suitable outlet. This much the railroad has beyond per-

Steamship Alleghany; West Indian Service.

adventure. The steamship line that serves one port as many of them do, must find its freight there or nowhere, and in the port competition is free and the freight may go to any rival. If it has some coasting lines bringing in freight, the situation is instantly different.

The company that runs a line on one route only is at the mercy of any local fluctuation in traffic. A strike even might spoil the profits of a quarter, so might a drought or any local uncontrollable disturbance. Then, too, there are seasons in nearly all trades during which the traffic is abundant and others in which it is scarce. Just after harvest time, wheat, corn and cotton go forward in quantity and the trade falls away to small proportions as the next harvest approaches. The steamship company with many lines can have its annual work evened up by seasonal prosperity in one quarter as dulness comes in another. Instead of having ships half idle on its one dull route, it can shift them to the prosperous route. As the vessels get old and antiquated for the finer routes they can be shifted to a slower and inferior route. The greatest advantage, however, is the picking up of freight for the main lines, just as the branch roads feed a main trunk railroad.

All these forces are welding the ocean carriers into ever-growing systems. There are, of course, multitudes of small steamer lines as there are many small railroads, but there is a steady tendency toward their consolidation into well articulated groups. The reading public has been thinking of steamship lines as lines, as entities, when really they are parts of systems, and many of the North Atlantic lines have from their inception been but an outreaching arm of a European system.

of the Adriatic, they go in the Baltic to Russia and Sweden and out in the Atlantic to Iceland and North Cape and on to Arctic Spitzbergen. In Africa it touches at Alexandria and down the whole west coast as far as the mouth of the Congo. In Asia it serves Aden, the ports of Arabia, Persian Gulf, Ceylon, Calcutta, Straits Settlements, China, Korea, Siberia, Japan and finally and possibly most remarkable of all it sends steamers thence across the Pacific to Portland, Oregon—a grand total of 57 services crossing every ocean, touching all continents and every commercial zone.

The illustrations accompanying this chapter show the more important of the Hamburg-American Company's* 68 lines and services—an example of equalized traffic through world organization—and also a group of the company's steamers selected as being typical of four distinct types of service. The express steamer "Deutschland," 23 knots per hour, for some years holder of the Atlantic racing record, is 661 ft. long, and of 16,502 gross tons register with 37,000 h.p. This vessel can carry 467 first class passengers, 300 second class, 300 third class, but owing to a large crew and coal consumption and fine lines, she can carry less than 1,000 tons of express freight.

The "President Grant" represents a combination freight and passenger ship purchased and fitted especially for the Hamburg-New York emigrant trade. This steamer, 616 ft. long, gross tonnage of about 17,540, can carry 324 first class passengers, 125 second class, 1,000 third class and 2,320 fourth class on the middle and lower decks. This enormous steerage capacity is the direct result of the enormous westward movement of emigrants and the vessel can, at will, fill a large part of its space with low class passengers

Steamship President Grant; Designed Especially for North European Steerage Trade.

The North German Lloyd was formed in 1856-7 by the consolidation of nearly all the steamship lines, local and otherwise, in Bremen. Since 1827 there has been fairly regular sailing vessel traffic to New York carrying emigrants one way and cotton and tobacco the other. Now that nearly all the lines of the port, the assemblers and distributers of this trade, were consolidated, it was the most natural thing in the world for the company to reach out for the American traffic—and they reached again and again. In 1858 they started the steam service to New York and in 1866 it was made weekly, 1868 a line was sent to Baltimore, in 1869 to New Orleans, 1870 to the West Indies, 1875 to Brazil and Argentina, and so the company has gone on reaching out until with its partner, the Hamburg-American Company, it practically covers the world. The strong hold it had in the local trade of Bremen and nearby waters enabled it to beat off the four American attempts to establish service to Bremen 1866-1870, as it had the previous one of 1858-61.

The Hamburg-American Company, which in the minds of some may be thought of as a New York-Hamburg Line, is really one of the leading factors in the carrying trade of all America and of the old world as well. This one company dominates the metropolitan city of Hamburg and connects it with Montreal, Portland, Boston, New York, Philadelphia, Baltimore, Newport News, New Orleans and Galveston in the eastern United States. It sends steamers to Mexico, Central America, Panama, Colombia, Venezuela and the Lesser and Greater Antilles. They go to the Amazon, to the ports of Central and South Brazil, to Uruguay and Argentine Republic, to Chili and Peru. In Europe they circumnavigate the British Isles, skirt the coasts of France, Spain, Portugal and Italy, to the head

or with freight, having at times a capacity of something like 15,000 tons freight, but this at some sacrifice of full passenger list.

The twin-screw steamer "Kaiserin Augusta Victoria," at 17 knots per hour, 677½ ft. long, 24,581 gross tons, and 43,000 tons displacement, represents the highest type of combination freight and passenger steamer for the North Atlantic. She carries 550 first class, 350 second class, 300 third class and 2,300 steerage passengers, and in addition, about 10,000 tons of freight.

As a subsidiary type we show the "Alleghany," formerly of the Atlas Line; 2,494 gross tons, 2,000 h.p., 12 knots. This vessel is in the New York-West Indian service. It can carry 60 first class passengers and nearly 2,000 tons of freight.

While the Hamburg-American stands as the high type of world traffic development, it does not stand alone, and it differs only in degree from many others. In 1874 the Anchor Line, not particularly well known, because of its chiefly freight service from Glasgow to New York, was heralded by its admirers as the largest steamship company in the world, but it had not become so solely through its 18 years of New York service. Before the New York service began, the Anchor Line was great in the British Mediterranean trade, and for nearly a decade the New York service was a secondary interest to the Mediterranean service from which it had sprung.

The consolidation of a number of local European lines may be taken as the signal for the founding of a new line to some foreign land. In 1875, a period of great depression and failure and, therefore, of ease of consolidation by the hands of the strong, the Wilson Line from Hull to New York was started, but it was merely the

*Hamburg-Amerikanische Packetfahrt Aktien Gesel.

offshoot and distributor for one of the largest collections of coasting steamers that ever fed a port. The head of this firm is often called the largest ship owner in the world. As long ago as 1891 the firm had 140,000 tons of steamers, of which 40,000 tons were trading to the Mediterranean, others to South America, Hindustan and Australia. The Leyland Line, which started a service from Liverpool to Boston in 1876, was an old established firm with a large Mediterranean trade; and the Johnson Line to Baltimore was started in 1880 by a firm with a great business between Liverpool and the Danubian ports. The White Star Line on the Atlantic was the noble effort of old Australian traders, and they are Australian traders yet, despite Atlantic success and the Morgan merger into the so-called shipping trust.

The largest Italian Line, the Navigazione Generale Italiane, was formed in 1881 by the union of smaller lines, and in 13 years it had 105 steamships operated on many seas. A few years ago, the numerous small companies plying about the island capital of Copenhagen united to form the United Companies of Copenhagen and with that basis for distribution they began at once to send steamers to the far East to take their freight and get something for them to distribute.

With these facts and tendencies of line traffic organization in view, it becomes very plain that the forwarding of American goods by foreign steamers was the most natural thing in the world. Not only were the existing lines well equipped and located to render

Steamship Deutschland; Type of North Atlantic Express Service.

the service well, but in dozens of cases the goods could and did pass from the foreign country to Europe and thence to the United States and vice versa in the lines of the same company. One of the lines was merely serving as the feeder to the other as it was meant to do when it was created.

(*To be continued.*)

The Express Business.*

In the early days the stage driver was the expressman. He was indeed an important individual, next to the parson and the judge; not, however, below even them in his own estimation. He carried all sorts and kinds of big boxes, little boxes, band-boxes and bundles. He put them in the boot under his feet, and the letters, bills, orders, etc., into his bell-crowned hat. Many stage drivers became bald in consequence of this practice. The stage driver not only carried the packages, but executed commissions of various kinds at the terminal of his route, and, generally at least, the charges were his perquisite. Long prior to 1820, the grandfather of your speaker was a bank messenger, traveling on horseback, with saddle-bags and a pair of trusty horse pistols, to and fro between the scattered banks and bankers in Central New York, carrying what they considered large sums of money, and protecting his treasure at night in the rude roadhouses where he slept by a stout piece of steel with a fork at each end, one of the ends being forced into the floor and the other end into the door.

The bud of express evolution bloomed in the hand of William F. Harnden, of Boston, about 1839. The great Adams Express Company of the present day is the full-blown flower from that bud. Harnden's office in New York was at No. 1 Wall street.

As far as records are available, Harnden was the first man to make a contract with a railroad for the carriage of express matter. It seems quite an insignificant transaction now; less than 100 miles of railroad; but in the act an acorn of principle that has produced the oak, whose inception, growth and existing status has received the recognition of the Supreme Court of the United States. This contract differentiated Harnden from all who had gone before, and even to this day differentiates the express companies of the United States and Canada from all other freight forwarders in the world.

Let us glance at the statements of the Supreme Court in the Express cases of 1885. The Court said that the express business had become a public necessity, ranking in importance with the mail and the telegraph; that it was used in every conceivable way and for every conceivable purpose by the people and by the government, all have become accustomed to it, and it cannot be taken away without breaking up many of the long settled habits of business, and interfering materially with the conveniences of commercial life. That there never had been a time since the express business was started that it had not been encouraged by the railroad companies and no railroad in the United States had ever refused to transport express matter for the public upon the application of some express company of some form of legal constitution; that every railroad has recognized the right of the public to demand transportation by the railroad facilities which the public has permitted to be created. The Court further noted that the transportation required is of the kind which must if possible be had for the most part on passenger trains; that it required not only speed, but reasonable certainty as to the quantity that will be carried at any one time, as the things carried are to be kept in the personal custody of the messenger or other employee of the express company it is important that a certain amount of car space should be specially set apart for the business, and that this should, as far as practicable, be put in the exclusive possession of the expressman in charge. As the business to be done is express, it implies access to the train for loading at the latest and unloading at the earliest convenient moment. By inference at least, the Court held that it was the duty of the railroad to furnish express facilities.

The language of the Court is that the railroad company performs its whole duty to the public at large, and to each individual, when it affords that public all reasonable express accommodations. If this is done, the railroad owes no duty to the public as to the particular agencies which are selected for that purpose; the public requires the carriage but the company may choose its own appropriate means of carriage, always provided they are such as to insure reasonable promptness and security.

It was also noted by the Court that it was neither averred nor

*From an address before the Traffic Club of New York, by C. H. Crosby, Vice-President and General Manager of the United States Express Company.

shown that any railroad company in the United States had ever held itself out as a common carrier of express companies, that is to say, as a common carrier of common carriers; and then the Court went on to show, at some length, that when a railroad took an express company on its lines it was always under some form of contract. There are many interesting statements in this celebrated decision, but I have cited enough to prove my statement of the great advance made in the evolution of the express, when starting with Harnden, the carriage of the goods by the railroad was done under contract, and besides this, the principle was fixed at that early date that one of the considerations of the contract was the assumption by the express company of the risks of carriage and liability for delivery to consignee.

Outside of the facilities granted the express companies of transportation under contract, another feature of equal importance to the public, and of far greater expense to the express, is that of terminal and accessorial service which, subject to a very slight exception, distinguishes (at least in the United States) the express from the freight. Terminal expenses did not trouble Harnden at first, as for a long time he carried all his express matter in a carpetbag; but the growth of the business soon compelled him to procure horses and wagons, offices, bookkeepers, clerks and all the items of terminal service.

The tremendous increase in terminal service rendered by the express companies to the public is little known. To illustrate its phenomenal growth, there was quite a discussion in June, 1868, about extending terminal service north of Fourteenth street, New York City. At that time the rate to Chicago was $5 per 100 lbs. To-day the terminal service covers Greater New York to 181st street in Manhattan, and 170th street in the Bronx; and the rate to Chicago is $2.50 per 100 lbs. It would be wearisome to go into the details of increase of wages, rents, taxes, horses, wagons and materials.

At the present day the great difference in speed between the express and freight which existed 40 years ago has been materially reduced, and when one reflects that eight to 15 miles per hour used to be good speed for a freight train, and that they now run at anywhere from 25 to 50 miles per hour, it can be readily seen that the express has lost the greater part of its advantage in speed. The express company to-day is hanging on by its eyelids, by virtue of its terminal services, the personal care given to goods in transit, and the fact that it is ready to accept and transact all kinds of commissions. An example is goods carried C. O. D., with privilege of examination. Instruments for a brass band used to be tested in the express office, but recently shippers allow them to be taken away and the torture more widely distributed. Medicines, even, can be tested for a few weeks; if a cure is not effected, put the cork in the bottle and the express will carry it back. Suits of clothing can be tried on in the office, and rumor says that even fighting cocks have been tried out in front of the counter. If you want anything bought, from an early folio of Shakespeare to a bulldog or a Plymouth Rock hen, you merely need mention your wants to the express agent, and he will tell you where to buy, and generally be able to tell you the cost of the article. Information wanted: That is where the express agent comes out strong.

The line of demarcation between the freight and the express is drawn most sharply and effectively by the difference in price of the respective services. The express company cannot escape the cost of terminals, and the cost is just the same whether the goods have come ten miles or a thousand. The terminal costs in New York are just the same on a package from Jersey City as on one from Alaska. The result is frequently that the relative rates of express and railroad exhibit the widest variation. Quite recently the newspapers reported that a member of one of the western railroad commissions said his state did not want any express companies. They had found out that the railroad charged the express company 50 per cent. of what the express company charged the public; therefore, the railroad should do the express business at half the existing rates. This report may not be true, but I have not seen it contradicted.

The wonderful improvement in the construction of roadbed, bridges and rolling stock, and the consequent vastly increased speed of freight trains has gone far to deprive the express of that advantage, and has caused it to lose large lines of traffic formerly enjoyed by it. They are now carried by all sorts of special freight cars and arrangements. In great measure the express business has gone back to the days of its founders. It is largely a business of small parcels, combined with various side lines of collections, money-orders, commissions, etc. Our average transaction, great and small, is not over 50 cents gross. The time when the express practically did all the fast service has departed, and there is no probability that it will ever return.

There can be no competition between the express department of a railroad, or on a railroad, and the freight department of the same road. The severe terminal and accessorial expenses of the express effectually prevent it from meeting even part way the regular freight rates. The slower time and the terminal expense which must be borne by the shipper, prevent the freight from encroaching to any great extent on the express. One supplements the other and together they give to the American public a service that, with all of its occasional imperfections, is not excelled by any service on earth, and equaled by very few.

Pig Iron Production in 1907.

The Bulletin of the American Iron & Steel Association gives the following statistics, received from the manufacturers, of the production of pig iron:

The total production of pig iron in the United States in 1907 was 25,781,361 gross tons, against 25,307,191 tons in 1906. The following table gives the half yearly and yearly production in gross tons during each of the last five years:

Period	1903	1904	1905	1906	1907
First half	9,707,367	8,173,438	11,163,175	12,582,250	13,478,044
Second half	8,301,885	8,323,595	11,829,205	12,724,941	12,303,317
Total	18,009,252	16,497,033	22,992,380	25,307,191	25,781,361

The pig iron production of 1907 exceeded that of 1906 by 474,170 tons, an increase of 1.9 per cent.

Production in the second half of 1907 was 1,174,727 tons less than in the first half of the year. The whole number of furnaces in blast on December 31, 1907, was 167, against 359 on June 30, 1907, and 310 on December 31, 1906. The number of active furnaces at the end of 1907 was smaller than at the close of any year since 1896, when 159 furnaces were in blast. At the close of 1907 there were 276 idle furnaces, as compared with 89 idle furnaces at the close of 1906.

The total production of pig iron by states is shown in the subjoined table:

Total Production of Pig Iron by States.

States.	Blast furnaces: In blast June 30, 1907.	Dec. 31, 1907: In.	Out.	Total.	Production in 1907—Gross tons of 2,240 lbs.*: First half	Second half.	Total
Massachusetts	2	2	0	2			
Connecticut	2	3	0	3	8,746	10,373	19,119
New York	17	9	17	26	859,125	800,627	1,659,752
New Jersey	8	5	6	11	195,245	177,944	373,189
Pennsylvania	141	70	87	157	5,964,884	5,383,665	11,348,549
Maryland	4	1	4	5	221,145	190,688	411,833
Virginia	16	7	19	26	260,912	217,859	478,771
Georgia	2	1	3	4			
Texas	1	0	4	4	26,173	29,652	55,825
Alabama	31	15	34	49	861,771	824,903	1,686,674
West Virginia	4	0	4	4	151,643	139,423	291,066
Kentucky	5	1	7	8	79,013	48,933	127,946
Tennessee	14	9	12	21	193,371	199,735	393,106
Ohio	58	17	51	68	2,815,174	2,435,513	5,250,687
Illinois	24	11	13	24	1,263,258	1,194,510	2,457,768
Indiana	0	1	0	1			
Michigan	12	8	5	13	197,330	239,177	436,507
Wisconsin	6	2	4	6			
Minnesota	1	1	0	1	160,045	162,038	322,083
Missouri	2	1	1	2			
Colorado	6	3	3	6			
Oregon	0	0	1	1	220,209	248,277	468,486
Washington	0	0	1	1			
California	0	0	0	0			
Total	359	167	276	443	13,478,044	12,303,317	25,781,361

*Includes spiegeleisen and ferro manganese.

The production of pig iron in the United States is classified by kinds and by fuels. There were 13,231,620 tons of Bessemer and low phosphorus pig iron produced in 1907, against 13,840,518 tons in 1906, a decrease of 608,898 tons, or 4.4 per cent. The production of basic pig iron in 1907, not including charcoal of basic quality, was 5,375,219 tons, against 5,018,674 tons in 1906, an increase of 7.1 per cent. The production of spiegeleisen and ferro-manganese was 339,348 tons, against 300,500 tons in 1906, an increase of 38,848 tons, or 12.9 per cent.

In the production of the great bulk of pig iron bituminous coal and coke was used as a fuel, the pig iron made by these fuels amounting to 23,972,110 tons, as compared with 23,313,498 tons in 1906, an increase of 658,912 tons, or 2.8 per cent. The production of pig iron from anthracite coal and coke mixed as a fuel amounted to 1,335,286 tons, as compared with 1,535,614 tons in 1906, a decrease of 200,328 tons, or 13 per cent. Anthracite coal alone was used in the production of 36,268 tons, as compared with 25,072 tons in 1906. The production of charcoal pig iron in 1907 was 437,397, as against 433,007 tons in 1906, an increase of 4,390 tons. There were 437,397 tons of pig iron made in California in 1907 with charcoal and electricity.

The total production of all kinds of pig iron in Canada in 1907 was 581,146 tons, against 541,957 tons in 1906, an increase of 39,189 tons, or 7 per cent. In the first half of 1907 the Canadian production was 270,100 tons, and in the second half 311,046 tons. The growth of the Canadian output of pig iron is shown in the following table, which gives the production during the last 14 years:

Years	Grs tons	Years	Grs tons	Years	Grs tons	Years	Grs tons
1894	44,791	1898	68,755	1902	319,557	1906	541,957
1895	37,829	1899	94,077	1903	265,418	1907	581,146
1896	60,030	1900	86,090	1904	270,942		
1897	53,796	1901	244,976	1905	468,003		

GENERAL NEWS SECTION

NOTES.

At the special session on February 1, the North Carolina Legislature passed the $2\frac{1}{2}$c. fare bill.

The new Pennsylvania state railroad commission took the oath of office at Harrisburg, February 4.

The Interstate Commerce Commission expects to send out during this month forms for recording the depreciation of cars.

It is reported that the Pullman Company will abolish the operation of cars between Chicago and Cincinnati, on grounds of economy.

The Chicago, Milwaukee & St. Paul is reported to be receiving 500 inquiries a day about opportunities for location on its Pacific extension.

A prominent locomotive builder calls attention to the fact that orders from foreign countries are just now as scarce as orders from the United States.

It is understood that the Atchison is going to reduce its passenger train service in Oklahoma on account of the two-cent clause in the state constitution.

The House Committee on Interstate and Foreign Commerce is discussing the transportation of high explosives, and heard testimony by Dr. Charles B. Dudley, of Altoona, on February 7 and 8.

The Pennsylvania's suspension on December 15 of purchase of second-class timber has been supplemented by a notice that no ties of any kind will be bought after December 15 until further advice.

It is reported that the Union Pacific has received an inquiry about its motor cars from the Russian Government, with especial reference to the adaptability of the cars to Russian railroad conditions.

On February 7 the 8-in. pipe line, built by John W. Gates and his associates, from Tulsa, Okla., to Port Arthur, Tex., 582 miles, was opened for regular operation. The cost complete is said to have exceeded $6,000,000.

By the last eastbound transcontinental tariff points on the Northwestern Pacific will have the benefit of common point rates to eastern points. Heretofore points north of Santa Rosa have had to pay an arbitrary in addition to the common point rate.

The Governor of Mississippi has sent a message to both houses urging the passage of a two-cent passenger rate, but giving the State Railroad Commission a certain amount of discretion in the cases of individual roads not able to stand the reduction.

Beginning February 16, the New York, New Haven & Hartford will be operated in seven divisions instead of in 10 as heretofore. The divisions will hereafter be known as the New York, Shore Line, Providence, Boston, Old Colony, Midland and Western.

The Western New York Car Service Association handled 65,828 cars during December, 1907, at 587 stations. The average detention was high, being 2.19 days, of which 48 days were required by railroads and 1.71 by consignees. The percentage of cars released within the limit was 86.6.

Officers of the Atchison estimate citrus fruit shipments from the Coast this season at 32,000 cars as compared with 27,000 cars last year. The company has no surplus of refrigerator cars and has leased 1,000 additional refrigerator cars from Armour & Co. at the rate of $1 per day.

A press despatch says that the Harriman Lines in Texas have discontinued their suits to enjoin the Texas Commission from enforcing its whole group of freight rates, in consideration of the withdrawal by the Commission of the $2\frac{1}{2}$-cent passenger rate ordered on the Houston & Texas Central.

The New York Assembly Railroad Committee has ordered by unanimous vote, without amendment, the Wagner Bill providing for a flat five-cent fare from Brooklyn Bridge to Coney Island. The Assembly Committee has apparently learned nothing from the Governor's veto of the Baldwin two-cent bill last year.

The Mexico-St. Louis Special, which has been running since the beginning of the year for the third season from St. Louis to Mexico City via the St. Louis, Iron Mountain & Southern, the Texas & Pacific, the International & Great Northern and the National of Mexico, has been given up for purposes of economy.

An officer of a Mexican railroad warns railroad men of the United States who have been thrown out of employment that Mexico is crowded with American railroad men looking for jobs. He says that until recently there has been a good demand for Americans on the Mexican roads, but that this demand is now filled.

The Senate committee on interstate commerce has made adverse reports on the bills to allow newspaper publishers to accept railroad passes in payment for advertising and to permit railroads to exchange passes or tickets with passenger transfer companies or with other railroads for their officers and employees.

The Lake Superior Car Service Association reports that 5,518 fewer cars were handled in January, 1908, than in January, 1907, but that the recent cold weather has greatly increased the movement of coal, and also of pulpwood and other forest products, depending on snow in the woods to facilitate their movement.

Blueprint copies of the chart showing the position of all the telegraph wires on the Tucson division of the Southern Pacific are being issued from the office of the road master at Tucson. These charts are given to all of the freight conductors on the division and are to be kept in the cabooses for reference when it is desired to use the telephones with which each car is equipped.

The action of the interstate commission in insisting on the railroad companies keeping on file at each station two copies of all tariffs has caused the legal departments of certain roads to instruct their claim agents that rates quoted by agents or employees are given at the risk of the shipper and that clerks making such quotations are for the time being agents of the shippers.

The live stock agent of the Canadian Pacific in the West shows export cattle shipments from Alberta and Saskatchewan to have been 42,960 head in 1907 as against 71,710 head in 1906. Other live stock shipments also fell off materially, shipments of horses decreasing from 19,549 to 11,352; of all cattle from 114,651 to 80,013; of hogs from 30,099 to 29,588 and of sheep from 57,024 to 28,573.

Beginning February 18, the Missouri, Kansas & Texas will issue 1,000-mile books at 2c. a mile in Texas, being the first road to do so in that state. The Texas state commission has approved the issue of the Rock Island and the Colorado Southern two-cent interchangeable mileage books. They can be used in Texas on the Trinity & Brazos Valley, which, however, can collect the coupons at the rate of $2\frac{1}{2}$c. a mile.

The United States Forest Service announces that 150,000,000 acres of forest land in British Columbia have been placed in reserve by the Canadian government. This includes every acre of timber lands of the Province except what has already been leased. The action was taken to check wasteful exploitation of timber resources and to bring the care and cutting of timber more effectually under Government control.

It is reported that the Rosenbaum Grain Co. is going to sue the St. Louis & San Francisco for recovery of $42,000, alleged to be the loss sustained by failure of the railroad to deliver a large shipment of grain to a steamship on which it was booked to be carried to the Black sea. The matter has been under investigation since 1906, and brings up the question whether a railroad is liable to a shipper for delay which causes the shipper's goods to be sold on a falling market.

The transatlantic steamship war is ended, and substantial increases have been fixed upon as a minimum basis for a three-year period. The minimum rates on the Mauretania and the Lusitania have been fixed at $127.50, first class, as against a minimum rate of $72.50 during the rate war. Other passenger steamers take lower rates, but the minimum is higher than usual, and applies throughout the year instead of changing in the winter season. No agreement has as yet been reached about the freight and steerage basis.

On February 5, the Louisville & Nashville, following the action of the Baltimore & Ohio, the Erie and the Southern Railway, reduced the salaries of all employees making more than $250 a month. Those receiving $400 and over are reduced 10 per cent., while those receiving between $250 and $400 are reduced 8 per cent.

The Mobile & Ohio also announces a reduction of 10 per cent in the salaries of all executive officers, officials and employees receiving $100 a month or more. All employees receiving from $100 to $50 a month are cut 5 per cent., the reductions being effective March 1. Colonel Russell states that among the causes necessitating the changes are the financial crisis and unfair railroad legislation in the Southern states.

Dinner to H. H. Vreeland.

On February 7 a large dinner was given to H. H. Vreeland under the auspices of the New York Railroad Club in recognition of Mr Vreeland's long and successful career as President of the club. W. G. Besler, Second Vice-President of the club, was toastmaster, and at the close of the dinner which was attended by 321 persons, Mr. Vreeland was presented with a silver water pitcher. The speakers of the evening were John F. Deems, William J. Wilgus and George A. Post. Mr. Deems spoke of the foundation of the club and of the helpful part played by Mr. Vreeland in its rapid growth and development, Mr. Wilgus talked on his own subject of electrification, and Mr. Post gave a humorous address on the subject of Mr. Vreeland. Mr. Vreeland replied gracefully to the addresses in his honor and emphasized the point that a man living in the world to-day cannot make a first rate success alone, but must have the help of his friends in order to attain the highest usefulness.

Installation of Dr. Goss at the University of Illinois.

The formal exercises incident to the installation of Dr. W. F. M. Goss as Dean of the College of Engineering of the University of Illinois occurred February 5 in connection with the formal opening of the Graduate School of the University. The exercises of installation included two sessions and a tour of inspection through the laboratories of the College of Engineering.

Among the guests of the occasion were: William McIntosh, representing the American Railway Master Mechanics' Association; J. W. Taylor, representing the Master Car Builders' Association; F. H. Clark and C. A. Seley, representing the Western Railway Club; William Forsyth, representing the American Society of Mechanical Engineers; W. K. Hatt, representing the American Railway Engineering and Maintenance of Way Association; Morgan Brooks, representing the American Institute of Electrical Engineers; O. Stephenson, representing the Engineers' Club of St. Louis; C. F. Loweth, representing the Western Society of Engineers; Robert Quayle, representing the Chicago & North-Western R. R.; T. F. Barton and W. O. Moody, representing the Illinois Central R. R.; C. H. Young and M. H. Wickhorst, representing the Chicago, Burlington & Quincy Ry.; A. F. Robinson, representing the Atchison, Topeka & Santa Fe Ry.; A. L. Kuehn, representing the Cleveland, Cincinnati, Chicago & St. Louis Ry.; George N. Dow, representing the Lake Shore & Michigan Southern Ry.; A. F. West, representing Princeton University; H. C. Hoagland, representing the Illinois Traction System; C. H. Benjamin, M. J. Golden, C. A. Waldo, Stanley Coulter and L. E. Endsley, representing Purdue University; J. J. Flather, F. S. Jones and W. H. Kavanaugh, representing the University of Minnesota; W. H. Siebert, representing Ohio State University; W. D. Pence, representing the University of Wisconsin; C. R. Richards, representing the University of Nebraska; F. L. Bishop, representing Bradley Polytechnic Institute; G. F. Gebhardt, representing Armour Institute of Technology; L. E. Young, representing the Missouri School of Mines; E. C. Woodruff, representing Millikin University; Mrs. Laura B. Evans and F. L. Hatch, representing the Board of Trustees of the University of Illinois.

New Jersey Tax Contest Ended.

New Jersey railroads have given up their contest of the Perkins "Average Rate Main Stem" tax law of 1906, which taxes main stem property at the rate of $18.01 per $1,000 of valuation instead of at the rate of $5 as heretofore. The state treasurer has received more than $2,500,000 of the contested balance due, the principal amounts in arrears having been as follows:

Pennsylvania system	$1,061,089
Jersey Central	552,834
Philadelphia & Reading system	122,152
Erie	176,556
Lackawanna	136,129
Lehigh Valley	237,128

Telegraph Block System on the Wilmington & Northern.

The Philadelphia & Reading is about to install the telegraph block system on its Wilmington & Northern division, single-track, from Birdsboro, Pa., to near Wilmington, Del., 60.5 miles. There will be 19 block stations, eight of which will be operated continuously and 11 closed a part of each night. Communication from station to station will be by Morse telegraph and semaphore signals will be used. The outlets of long sidetracks will be connected to the nearest block station by telephone.

Offer to Buy Town.

Through Chief Engineer Morris the Santa Fe Railroad Company made a proposition to the state corporation commission, Feb. 4, to buy the entire town of Goodwin, Ellis county, reimburse the residents for all the money expended there and move them bodily and free of charge to the new town of Holstein, which the Santa Fe is exploiting on its Panhandle branch near the Texas-Oklahoma boundary. This would be a cheaper proposition for the company, they claim, than to grant the request of the Goodwin citizens to erect for them a station with the necessary switch and platform facilities requiring a deep cut of 15 ft. wide and 3,500 ft. long. The citizens had asked the commission to compel the railroad company to build the station when the counter proposition to buy the town was made.—*Topeka State Journal.*

Life on the Prairies.

A Kansas editor, since his pass has been cut off, has dropped the railroad time-tables from his paper and prints in their place this line: "Trains are due when you see the smoke."

Anderson Controlling Altitude Valve.

The accompanying drawings show the improved type of Anderson controlling altitude valve. A former design was described in the *Railroad Gazette* of September 1, 1905. The present form is simplified. The valve takes the place of a float in maintaining uniform water level in tanks, standpipes and reservoirs. A float is liable to failure through getting either water-logged or lodged in ice formed on the surface of the water. The valve is placed in a pit under the tank or in any other place where it is accessible and protected from frost. The body and top is of heavy cast iron. The upper part of the body is lined with bronze and the piston is solid bronze with rubber cups and seat.

The longitudinal section shows the main valve closed. When

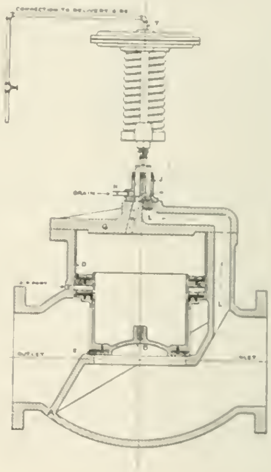


Fig. 1.

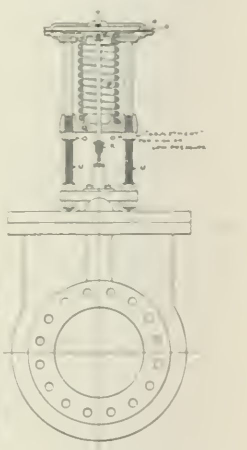


Fig. 2.

water is drawn from the tank, the pressure on the diaphragm, R, Fig. 2, is reduced so that the spring P lifts the valve spindle, K. The high-pressure valve, H, Fig. 1, then closes and the exhaust valve, I, opens, so that the water above the main valve, B, is free to escape through the port M, and the drain N. The pressure of the water in the main inlet pipe now lifts valve B and water flows into the tank. The main valve is cushioned in opening by the water above it which can escape but slowly through the small drain. As the valve moves upward it draws in, through the port, F, air which cushions the valve when it afterwards closes. When the water level in the tank has been restored, the pressure, through the pipe T and diaphragm R, closes the exhaust valve I and opens the valve H. Water now passes through the pipe L and the port M and puts the same pressure per square inch on the top of valve B as there is on the bottom. The top having a greater area than the bottom, the valve closes and shuts off the water from the tank.

The valve is made by the Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.

"Rights of Trains" a Text-book.

The University of Illinois has adopted as a text-book H. W. Forman's "Rights of Trains on Single Track," published by the *Railroad Gazette.*

A New German Cab Signal.

According to a report from Consul T. J. Albert, of Brunswick, Germany, the Prussian railroad administration now has in use a cab signal giving both a visual and an audible indication, in which the connection between the roadside fixture and the apparatus carried in the cab of the locomotive is made by means of a bristly broom of pliable copper wire, carried on an arm projecting from the side of the locomotive and rubbing against two parallel iron bars fixed near together and mounted along the track for several yards. This roadside apparatus is fixed at about 100 meters (330 ft.) in the rear of the ordinary visual signal, and its sole purpose is to warn the engineman that he is near such signal and must look out for it. Thus knowing the precise location of the roadside signal—presumably a distant signal—the engineman will be on the alert so as to bring his train to a stop at once in case, by reason of fog, he fails to see the visual signal.

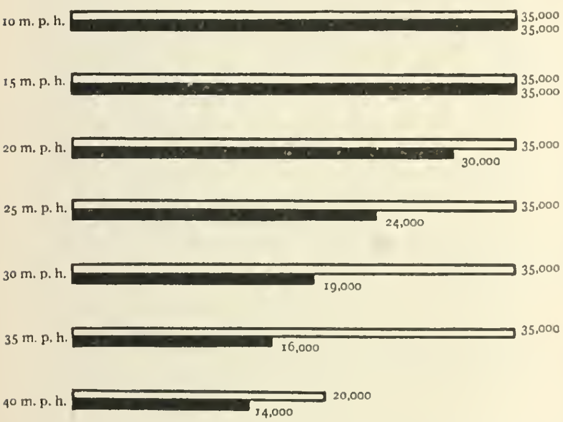
The Anti-Monopoly Crusade.

Uncle Jeptha—The railroad is sellin' tickets ter Chicago fer four dollars. They can't afford ter do it at that price.

Uncle Steven—No; that's what Hiram said. He went an' bought nine tickets an' didn't use one of 'em. Said if he had money enough he'd keep on buyin' tickets till he'd busted up the bull railroad monopoly. He's got it in fer the trusts, Hi has.—*Puck.*

Tractive Effort of New York Central Electric Locomotives.

The accompanying chart, compiled by Muralt & Co., New York, shows the comparative drawbar pull, in pounds, of a New York Central electric locomotive and a Pacific locomotive, at various speeds; that of the former is shown in white. Both locomotives are designed for about the same speed—35 miles an hour. The electric engine weighs 95 tons, with 70 tons on drivers, and the Pacific locomotive weighs 171 tons, with 70 tons on drivers. The former can exert its full power up to 35 miles an hour, after which its efficiency falls, primarily because of internal reactions in the motors. The efficiency of the steam engine decreases rapidly at speeds over 15 miles an hour.



Comparative Drawbar Pulls of Electric and Steam Locomotives.

Exports of Rails, Cars and Locomotives in 1907.

The value of exports of rails, cars and locomotives during 1907 was $30,800,000, which is the largest on record. The value of these exports from the United States in 1906 was $24,700,000, which was the previous high record. The exports during 1907 were almost equally distributed in value between rails, cars and locomotives.

Mexico bought more than $1,700,000 worth of cars, $1,500,000 worth of locomotives and over $860,000 worth of rails. South America took over $2,600,000 worth of cars and $3,000,000 worth of rails. British North America bought nearly $1,500,000 worth of cars and $2,000,000 worth of rails. Locomotives valued at over $1,000,000 were exported both to Mexico and to Central America.

The following table shows the value of the exports of these three items during the last two years:

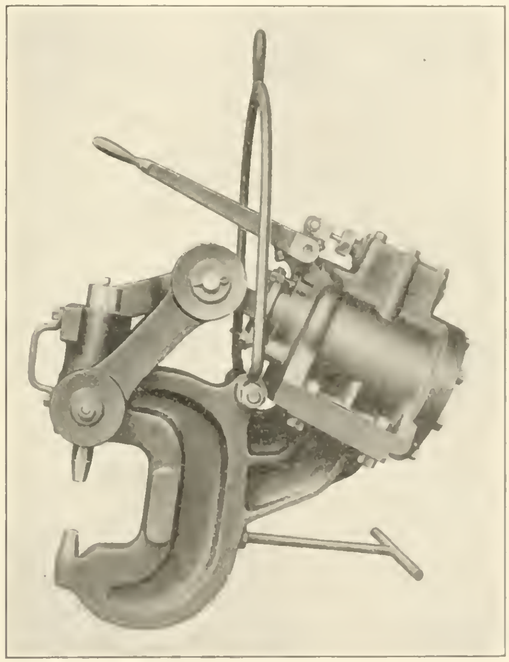
	1907.	1906.
Rails	$10,111,000	$8,903,000
Cars	11,332,000	8,367,000
Locomotives	9,080,000	7,430,000
Total	$30,828,000	$24,700,000

Pennsylvania Stockholders.

The Pennsylvania announces that on January 4, 1908, its stock holdings numbered 57,226, an increase of 16,370 for the year 1907. During the year the average holdings decreased from 150 shares to 110 shares. The number of women stockholders increased from 19,282 to 26,471, and the European investors increased from 7,753 on December 31, 1906, to 9,149 on December 31, 1907. In addition to the figures quoted above there are also 20,793 stockholders in the subsidiary companies; 11,111 for the Lines East and 9,682 for the Lines West.

A Portable Compression Riveter.

On heavy work it is economical to use a portable riveter. A portable hydraulic riveter is not practicable because high pressure water lines are unwieldy and the disposal of exhaust water is difficult. An air-driven machine, however, is well adapted to this work, as the air is carried to it by a comparatively light rubber hose. In the compression riveter shown by the accompanying photograph it will be noted that a comparatively small cylinder is used. The necessary pressure is obtained by the toggle leverage and the rivet is driven by one piston movement. The speed of riveting, therefore, depends mostly on how quickly the machine is moved from one rivet to the next. In one case 12,000 rivets were driven in 10 hours. The work was a long plate girder and the machine was hung from a trolley on an overhead runway. The operator had become very expert in moving the machine from one rivet to the next, the spacing being equal, and several heater-boys kept the holes ahead of the machine full of hot rivets. The rivets were $\frac{3}{4}$ in. in diameter. The hot dies were replaced by cool ones at given intervals. Under quite similar circumstances 10,000 rivets were driven in 10 hours. These figures are of interest merely to show what actually can be done. The class of work is all important, and on boiler work, where the rivet must be steam-tight and well driven, no such record could possibly be made.



Albree Portable Compression Riveter.

The riveter illustrated herewith is made by the Chester B. Albree Iron Works Co., Allegheny, Pa. It weighs 850 lbs., has 6 in. reach, and drives $\frac{7}{8}$ in. rivets.

The Eleventh Avenue Controversy.

The New York Public Service Commission, First District, considers that it is unwise to place a freight line either below or above Eleventh avenue, and recommends that an electric freight structure be built on the so-called marginal way along the North river water front between West street and the piers. The Commission says there is no doubt that an elevated freight road along the river front would some time be of advantage to shippers, although it holds that the present pier uses are such that there is no great demand for freight car connections, as the docks are used more and more for passenger and package freight and freight intended for the interior can be cheaply delivered to railroads. The Commission says: "The best available plan would seem to be to let some company build at its own expense—the New York Central if it would undertake the work on more favorable terms than any one else. An arrangement might be made analogous to that made by the authorities for the continuation of the McAdoo tunnel route through Sixth avenue to 33d street, which was substantially that the city could buy at its then value at any time after twenty-five years and in the meantime a fair consideration was made payable to the city for the franchise privileges."

Direct Current in Belgium.

The management of the Belgian State Railroads, after long investigation, has decided to use direct current and the third rail on several miles of road at the Parc de Laeken, near Brussels. This decision was made in accordance with the recommendations of a report by E. Lytboreck, electrical engineer of the government railroads, who some months ago visited the United States and spent considerable time investigating the operation of the New York Central, the New Haven and other installations, visiting manufacturing companies and fully acquainting himself with the state of direct current and single-phase development in this country. The Belgian government has been given a license to use the Wilgus-Sprague type of protected third rail, and orders for much of the necessary materials have already been placed in this country. The road on which this installation is to be made is new, but it is understood that this is the initial step in the electrification of certain lines near Brussels.

INTERSTATE COMMERCE COMMISSION RULINGS.

Midland Valley Need Not Re-establish Station.

The Commission, in an opinion by Commissioner Prouty, has announced decision in the case of Eddleman et al. v. Midland Valley. The complainants asked the Commission to order the railroad to re-establish its station at Elder, Okla. (formerly Indian Territory), which was removed in December, 1906. The complaint was dismissed by the Commission on the ground that the interest of the general public does not require such re-establishment. The Commission further found that the location of this station at Elder would be an unnecessary burden on the defendant. The Commission also declared that if the complainants had a contract with the carrier to locate and maintain its station at Elder, they may perhaps maintain a suit at law for breach of that contract; but that the Commission has no power to award damages for failure to perform such a contract.

Freight to be Billed at Actual Weights.

The Commission, in an opinion by Commissioner Lane, has announced decision in the case of Romona Oolitic Stone Company v. the Vandalia Railroad. The Commission decided that a rule of a carrier, subject to the act to regulate commerce, by which shipments of stone from non-scale points are billed from such points at weights equal to the marked capacity of the cars, subject to correction when weights are taken, is unreasonable, because on such cars as are not in fact weighed before delivery the carriers proceed to collect freight upon such marked capacity weights. A change of such rule to a rule that such shipments shall be billed at the published carload minimum is held to be also indefensible. The Commission ordered the defendant to desist and refrain from showing purported weights upon its billing until such weights shall have been ascertained either by weighing or by some fair method of computation from cubic contents.

Classification of Wire Coat Hooks.

The Commission, in an opinion by Commissioner Cockrell, has announced decision in the case of the Forest City Freight Bureau v. the Ann Arbor Railroad and 58 other carriers in official classification territory. The complainant asked that a change be made by these carriers in the classification of wire coat hooks packed in cases, when shipped in less than carload lots. As the classification now stands, these coat hooks are in the third class, being included in "hardware specialties not otherwise specified." It was asked that they be transferred to the fourth class, but the Commission held that the present classification of these articles in official classification territory is not shown to be unreasonable and ordered the complaint dismissed.

The Commission said that while it is evident that wire coat hooks are but little more valuable than the raw material from which they are made and no more liable to damage in transit, still the present classification is not unreasonable. The comparison as to their value and that of the spring hinges shows a wide discrepancy, but it is not shown that these hinges are typical of the bulk of the articles placed in the third class. It appears, moreover, that many articles of less value than wire coat hooks are also in the third class. It is true that these articles introduced at the hearing by the defendants are generally made of cast metal somewhat more liable to breakage than the wire coat hooks. It does not appear, however, that any considerable loss to the carriers is caused by breakage of these cast iron hardware specialties.

Freight Bureau Competent to Bring Complaint; Classification of Brushes.

The Commission, in an opinion by Commissioner Lane, has announced decision in the case of the Forest City Freight Bureau v. the Ann Arbor Railroad and others. The Commission held that the bureau, a concern which admits members upon written contract to perform certain services in return for an annual fee, is an association competent to bring a complaint before the Commission under the act to regulate commerce. The fact that it may not be able to answer in costs in case such should be awarded against it on appeal from the Commission to the courts does not take away its right to bring complaint under the act. The Commission decided in this case that the inclusion of wire brushes and brooms, not toilet, in cases in less than carloads, in the first class in official classification is unreasonable. Defendants were ordered to classify such brushes and brooms in official classification territory in the third class.

Grain Differentials from St. Louis and Kansas City to the Southwest.

The Commission, in an opinion rendered by Commissioner Prouty, has announced decision on motion for rehearing in the case of the Traffic Bureau of the Merchants' Exchange of St. Louis v. Missouri Pacific and St. Louis, Iron Mountain & Southern. In the original case the Commission ordered the carriers to cease from exacting for transportation of grain and products thereof from St. Louis, Mo., to Little Rock, Ark., a rate of 18 cents per 100 lbs. on wheat and its products and of 15 cents per 100 lbs. on coarse grains, so far as applied to such transportation after the traffic has been carried by railroad to St. Louis from points outside that city. The defendants were required to put in rates on wheat not to exceed 13 cents and on coarse grain not to exceed 11 cents per 100 lbs.

Defendants filed motion for rehearing on the grounds that the lower rates from St. Louis will necessitate a reduction in rates from western points of production, and that these lower rates will enable the St. Louis merchants to handle grain into territory which is now covered by Little Rock. The Commission refused to modify its former order on these grounds. A third reason was that if the rate from St. Louis to Little Rock was reduced, the Kansas City Southern will reduce its rates to Texarkana and corresponding points. The Commission did not think this was any justifiable reason, but in order to avoid giving any possible color to such action on the part of the Kansas City Southern, decided to make the differential between Kansas City and St. Louis into this territory 1 cent less than its former order contemplated; that is to say, 12 cents on coarse grains and their products, and 14 cents on wheat and its products.

Accordingly the Commission denied the petition for rehearing, but struck off its former order and issued a new order putting in effect these revised rates.

TRADE CATALOGUES.

Mill Type Motors.—The motors described in bulletin No. 4562 of the General Electric Co., Schenectady, N. Y., are the d.c. M D type and the a. c. M I type. They are built in sizes from 30 h.p. to 150 h.p. The d.c. motors, while generally rated at 220 volts, can be supplied for 500 volts with a slight variation from standard speed, and the a.c. motors are wound for either 220 or 440 volts, 25 cycles, three-phase. They are for operating rolling mills, hoists, turntables, conveying machinery, etc.

Lifting Magnets.—The Electric Controller & Supply Co., Cleveland, Ohio, is distributing a well illustrated pamphlet describing several types of lifting magnets for handling iron and steel to and from cars, in shops, in scrap storage yards, etc. Different types are furnished for handling different shapes of material. The pamphlet includes the list of the company's customers of the past three years.

Air-Brake Lubrication.—The Joseph Dixon Crucible Co., Jersey City, N. J., has issued a pamphlet calling attention to graphite air-brake and triple valve grease. It mentions the parts on which this lubricant can be used to advantage, and the lubricating troubles ordinarily experienced with the air-brake system are pointed out and the remedies given.

Illinois Central.—A folder issued by the passenger department calls attention to the coming Mardi Gras carnival at New Orleans. The folder is illustrated with photographs taken during last year's carnival, and describes train service from various points to New Orleans via the Illinois Central.

Lifting Magnets.—The Cutler-Hammer Clutch Co., Milwaukee, Wis., is distributing a booklet entitled "Lifting Magnets and Recent Improvements in Them." The booklet is a miniature reproduction of *Cassier's Magazine* for October, 1907, in which the article originally appeared.

Roofing.—A pamphlet issued by the Eastern Granite Roofing Co., New York, describes Granite roofing and shows photographs of buildings roofed with it. This material is made of alternate layers of wool felt and granite composition, surfaced on the outside with sea grit.

Second Hand Metal Working Machinery.—List No. 15 of the Niles-Bement-Pond Co., New York, is a catalogue of a large variety of second-hand metal working machines, which the company has for sale. Each machine is briefly described, with dimensions.

Valves.—Jenkins Bros., New York, have issued catalogue supplement No. 1, which describes and illustrates, with price lists, extra heavy gate valves for 250 lbs. working steam pressure and medium pressure gate valves for 150 lbs. pressure.

MANUFACTURING AND BUSINESS.

Robert W. Hunt & Co., Chicago, have established their St. Louis, Mo., office, which is in charge of C. W. Gennet, Jr., at 1415 Syndicate Trust building. Their chemical and cement laboratory will be in the same building.

The Sellers Manufacturing Co., Chicago, maker of railroad supplies and equipment, has bought a 16-acre tract adjoining its present plant. The land lies between north 45th and 47th avenues, adjacent to the St. Paul and the North-Western tracks.

J. W. Duntley, President of the Chicago Pneumatic Tool Co., Chicago, sailed for Europe on Feb. 4 to attend to business matters abroad. It is stated that the January business of the company in America showed a considerable improvement over December.

The usual convention of branch managers of the H. W. Johns-Manville Co., New York, was held in that city from January 29 to February 1. There was a general discussion of the business affairs of the company and on the evening of January 31 a banquet was given at the Union League Club.

William J. Seaton, Jr., Second Vice-President of the C. W. Hunt Co., West New Brighton, New York, died at his home at Clifton, Staten Island, on January 18, from typhoid fever. Mr. Seaton was 36 years old and had been with the company for 17 years. He began as office boy and was steadily promoted.

J. F. Donahue, for five years Secretary and Manager of Sales of the New Castle Forge & Bolt Co., New Castle, Pa., has been appointed Western Sales Manager of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., with headquarters in the Commercial National Bank building, Chicago.

The G. Drouve Company, Bridgeport, Conn., at the annual meeting of directors on February 3 elected G. Drouve President and Treasurer, and William V. Dee, Secretary. Mr. Dee, who recently resigned from the *Railway Age*, has been appointed also General Sales Manager. The company makes the "Anti-Pluvius" skylight, the Lovell window operating device, Drouve ventilator, drying stove, etc.

Iron and Steel.

The Pennsylvania has ordered 55,000 tons of rails. Details are given in our editorial columns.

The New York City Railway has ordered 2,500 tons of rails from the Pennsylvania Steel Co.

The Canadian Pacific is said to have ordered 40,000 tons of 85-lb. rails from the Lake Superior Corporation.

It is reported that certain western railroads are in the market for an aggregate of 100,000 tons of rails and that two eastern railroads are also making inquiries.

The Chicago, Milwaukee & St. Paul has ordered 3,000 tons of bridge material from the Pennsylvania Steel Co. According to Chicago despatches, the Chicago, Burlington & Quincy is about to order 1,600 tons of bridge material, and the Great Northern and the Chicago & North-Western have ordered, or are negotiating for, large amounts.

OBITUARY NOTICES.

Richard Tull, Treasurer of the Philadelphia & Reading Railway and the Philadelphia & Reading Coal & Iron Co., died at his home in Philadelphia on February 9.

Charles L. Francisco, for many years Superintendent of Building at the Grand Central Station, New York City, died at his home at Yorktown Heights, N. Y., on January 29.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Baltimore & Ohio Southwestern.—E. W. Scheer has been appointed Assistant Secretary, with office at Cincinnati, Ohio, in place of J. G. Walber.

Canadian Pacific.—W. R. Baker, Assistant to the President, has been appointed also Secretary, succeeding Charles Drinkwater, resigned.

Macon & Birmingham.—S. F. Parrott, Vice-President, has been appointed Receiver by the Superior Court at Atlanta, on petition of the Old Colony Trust Company.

Minneapolis & St. Louis.—W. W. Cole has been appointed Assistant Treasurer, with headquarters at Minneapolis, Minn., in place of Joseph Gaskell, deceased.

Mississippi Central.—John T. Porter has been chosen Treasurer and G. F. Royce, Secretary, both with offices at Scranton, Pa.

Mississippi Valley.—This company operates the Portland & Southeastern under lease. J. H. Byrd is President and M. G. Price, Vice-President and General Manager. Office at St. Louis, Mo.

San Antonio & Aransas Pass.—J. W. Terry has been elected Secretary. He will retain the position of Auditor.

Susquehanna & New York.—W. R. Campbell has been appointed Assistant to the President, with office at New York.

Western Allegheny.—The officers of this road, formerly the Western Allegheny division of the Bessemer & Lake Erie, are: Emmet Queen, President; Thos. Liggett, Vice-President; A. H. Eames, Secretary and Treasurer. Offices at Pittsburgh, Pa.

Operating Officers.

Annapolis, Washington & Baltimore.—Joseph O'Hara has been appointed General Superintendent, with office at Baltimore, Md., to relieve W. E. Slaughter, who continues as Traffic Manager. Henry Donavan is Master Mechanic, with office at Odenton, Md.

Canadian Northern Quebec.—R. S. Richardson has been appointed Assistant General Superintendent, with office at Montreal.

Canadian Pacific.—C. Murphy, hitherto Superintendent of district No. 2, Ontario division, has been appointed Acting General Superintendent of the Lake Superior division, taking the place of F. B. Brady, who is absent on account of ill health.

Fort Smith & Western.—W. E. Crane, Vice-President and General Manager, has resigned.

Gulf Line.—W. T. Hargrett has been appointed Superintendent in place of D. L. Turner, resigned; office at Sylvester, Ga.

Intercolonial.—J. H. Brassard, hitherto chief train despatcher, has been appointed Inspector of Transportation, to travel throughout the company's lines and co-operate with other officers in securing efficient service. John Stewart has been appointed Traveling Inspector of Locomotives and Cars, with similar authority and relations to other officers.

Louisiana Western.—See Morgan's Louisiana & Texas.

Mississippi Valley.—H. L. Pitman is Superintendent, office at Portland, Ark.

Missouri Pacific.—M. M. Richey, heretofore with the Southern Railway, has been appointed Superintendent of the Arkansas division, with office at Little Rock, Ark.

Morgan's Louisiana & Texas.—W. M. Hobbs, hitherto Vice-President and General Manager of the San Antonio & Aransas Pass, has been appointed General Superintendent of Morgan's Louisiana & Texas and of the Louisiana Western, with headquarters at New Orleans, La., in place of E. B. Cushing, assigned to other duties.

Morrissey, Fernie & Michel.—J. D. Hurd has been appointed General Manager, with office at Fernie, B. C.

New York, New Haven & Hartford.—In connection with a radical rearrangement and enlargement of divisions, assignments of Superintendent to the several new divisions are announced as follows: New York, J. P. Hopson, office at New York City; Shore Line, C. N. Woodward, office at New Haven; Western,

C. S. Lake, office at New Haven; Midland, B. R. Pollock, office at Hartford; Providence, J. A. Droege, office at Providence; Old Colony, Andrew Ross, office at Taunton; Boston, A. W. Martin, office at Boston. Each Superintendent will have a master-mechanic.

The new divisions are as follows:

Old Colony—From South Braintree to Provincetown, including the Easton, Fall Haven, Woods Hole, Hyannis and Chatham branches; from South Braintree to Plymouth, including the Hanover, Bridgewater and Plymouth branches; from Braintree to Kingston, including the Nantasket Beach branch; from Mayflower Park, Mass., to Newport, R. I., from New Bedford to Lowell and Fitchburg, including the Watuppa, Somerset, Middleboro, Marlboro and Sterling branches.

Midland—From Hartford to Readville, including the Hartford terminals; Hartford to Springfield via Melrose, Cedar Hill to Dike street, Providence, R. I., via Willimantic and Plainfield, including the Colchester branch; from Groton, Conn., to Worcester, including the Southbridge branch.

Western—From Bridgeport to Pittsfield, Mass., including the New Haven, Litchfield, Brookfield Junction and State Line branches; from Naugatuck Junction to Winsted, including the Watertown branch; from Hartford to Hopewell, N. Y., including the branch from Waterbury to Meriden; from New Britain to Berlin.

New York—From the Grand Central Station, New York, to Stamford, the New Canaan branch and the line from Harlem river to New Rochelle, including the New York and Harlem river water terminals.

Shore Line—From Stamford to Midway (near New London); New Haven to Turners Falls and Shelburne Falls, including the New Hartford, Holyoke and Williamsburg branches; Cedar Hill (New Haven) to Springfield, Mass., including the Suffield branch; Fenwick to Hartford; Wilson Point to Danbury, including the Ridgefield branch.

Providence—From Midway to Readville, including the Providence terminals, the Providence, Warren & Bristol, the Hope, Pascoag, Valley Falls, Franklin, Ashland, Wrentham, Stoughton, Attleboro and East Providence branches; Boston Switch, R. I., to Worcester, Mass., including the Woonsocket branches.

Boston—From the Boston Terminal Company's connection to Readville on the present Providence and Midland divisions; to Needham Junction; to Cook street; to South Braintree and all intermediate branch lines, including the South Boston freight terminals.

Northwestern Pacific.—W. J. Hunter has been appointed Superintendent of the Southern division, with office at Sausalito, Cal.; and John H. McRae, Superintendent of the Northern division, with office at Albion, Cal.

Ohio River & Western.—J. K. Geddes has been appointed General Manager in place of W. R. Crumpton; office at Woodsfield, Ohio.

Orange & Northwestern.—J. E. Kelly has been appointed Superintendent; office at Orange, Tex.

Quebec & Lake St. John.—Jas. J. Sunderland has been appointed Acting Superintendent in place of James Bain; office at Quebec, P. Q.

San Antonio & Aransas Pass.—W. M. Hobbs, Vice-President and General Manager, has resigned. J. S. Peter has been appointed General Manager.

Tallulah Falls.—J. A. Dodson has been appointed Superintendent in place of W. S. Irwin, resigned; office at Cornelia, Ga.

Western Allegheny.—H. F. Bickell has been appointed Superintendent.

Traffic Officers.

Canadian Pacific.—G. H. Smith, hitherto Assistant General Freight Agent at Vancouver, B. C., has been appointed Assistant General Freight Agent of the Central division in place of W. H. Robertson, who has been transferred, office at Winnipeg, Man.

W. H. Robertson has been appointed Assistant General Freight Agent of the Pacific division, changing places with G. H. Smith.

Chicago, Burlington & Quincy.—See Quincy, Omaha & Kansas City.

Great Northern.—M. J. Costello has been appointed Assistant Traffic Manager in place of H. M. Adams, resigned, office at Seattle, Wash.

Iowa & St. Louis.—See Quincy, Omaha & Kansas City.

Quincy, Omaha & Kansas City.—A. J. Handy is in charge of the Freight and Passenger Departments, with the title of General Freight and Passenger Agent; and he has charge of the same department of the Iowa & St. Louis, which road is leased to the Chicago, Burlington & Quincy.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & El Paso.—J. G. McLaren has been appointed Master Mechanic, with office at Dalhart, Tex., in place of J. McDonough.

Chicago, Rock Island & Pacific.—H. F. White, Engineer of Maintenance of Way, has resigned, and the position has been abolished.

Union Pacific.—John A. Turtle, hitherto Assistant Superintendent of Motive Power, has been appointed Master Mechanic of the Colorado division, with headquarters at Denver, in place of E. F. Fay, transferred to Cheyenne, Wyo.

Purchasing Agents.

Chicago Great Western.—A. D. Ward has been appointed Purchasing Agent in place of V. F. De Vinney, resigned. Mr. Ward held the position until he resigned two years ago.

Delaware & Eastern.—K. H. Dunham has been appointed Purchasing Agent.

Mexican Central.—E. V. Dexter has been appointed Purchasing Agent, with headquarters in the City of Mexico. The offices of Acting Purchasing Agent in the city of New York, and Assistant Purchasing Agent in the City of Mexico have been abolished.

Pere Marquette.—W. C. Atherton has been appointed Purchasing Agent; office at Detroit, Mich.

LOCOMOTIVE BUILDING.

The New York, New Haven & Hartford has ordered six electric locomotives from the Westinghouse Electric & Manufacturing Co. They will be similar to those now in use on the road.

CAR BUILDING.

The Atlanta & West Point is ordering accessories for 150 freight cars.

The Atlanta, Birmingham & Atlantic has ordered 188 box cars from the American Car & Foundry Co.

J. D. McArthur & Co., Ltd., Winnipeg, have ordered 50 flat cars of 60,000 lbs. capacity from the Hicks Car & Locomotive Works.

The Texas Interurban Company, which plans to build about 30 miles of road in Texas, is figuring on gasolene motor cars. T. Moore, Elizabeth, N. J., is interested.

The West Chester & Wilmington (Electric), which is to build 17 miles of road this spring, expects to ask bids on rolling stock in March. T. E. O'Connell, Wilmington, Del., is President.

The Charleston & Summerville (Electric), under construction in South Carolina, will shortly ask bids on rolling stock. W. O. Sprigg, 15 Whitehall street, New York, is Chief Engineer.

The Great Cosmopolitan Shows have ordered four 60-ft. flat cars of 60,000 lbs. capacity from the Mount Vernon Car Manufacturing Co. The special equipment includes: Mount Vernon brake-beams, brake-shoes and wheels.

The Colorado & Southern, as reported in the *Railroad Gazette* of January 10, has ordered for the Denver & Interurban eight interurban motor and four interurban trailer cars from the St. Louis Car Co., for April, May and June delivery. The motor cars will weigh 55 tons, and measure 55 ft. 6 in. long, 10 ft. ¼ in. wide over all, and 11 ft. 3 in. high from rail. The trailer cars will weigh 35 tons, and measure 53 ft. 10 in. long, 10 ft. ¼ in. wide and 11 ft. high, over all. The special equipment for all includes:

Brake-shoes	Sargent
Brakes	Westinghouse American
Brasses	Hewitt
Curtain fixtures	Forsyth
Curtain material	Pantasote
Heating system	Consolidated
Journal boxes	Franklin
Paint	Murphy
Seats	St. Louis Car Co. standard
Springs	Railway Steel Spring Co.
Trucks	American Locomotive Co.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ABERDEEN & ASHBORO.—The Carthage branch of this road has been opened for business from Pinehurst, N. C., north to Carthage, 13 miles. (Dec. 6, p. 701.)

BLUE RIDGE TRACTION.—This company, operating seven miles of electric roads in Pennsylvania, proposes to build extensions to various points aggregating 16 miles. The principal extension will be through Cherryville, Weaversville and Bath. A bridge is also to be built at Alliance. The headquarters of the company is at Bethlehem.

Cananea, Yaqui River & Pacific.—See Southern Pacific.

Central California.—See Southern Pacific.

Coast Line Railway.—See Southern Pacific.

Colorado & Southern.—On the terminals that the Galveston Terminal Company is building at Galveston, Tex., for the Chicago, Rock Island & Pacific, the St. Louis & San Francisco, the Colorado & Southern, the New Orleans & Pacific and the St. Louis, Brownsville & Mexico, $850,000 has already been spent filling in and putting up a freight house. About $5,000,000 is to be spent altogether. Over 40 miles of track has been laid and large repair shops, roundhouses and other buildings will be put up. In addition to the six blocks of water front, which the company owns, as a site for extensive shipping facilities, the company has 130 acres of land on which the railroad terminal will be established. About $3,000,000 will be spent for improving the water front, including the dredging of a 30-ft. channel, so that large steamers may load at the railroad docks.

Columbus & Erie.—See Erie.

Columbus, Magnetic Springs & Northern.—This company, which is a consolidation of the Delaware & Magnetic Springs Railway and the Richwood & Magnetic Springs Railway, operates 18 miles of line from Delaware, Ohio, via Magnetic Springs to Richwood, of which a length of five miles was built last year. The company intends to extend the line from Richwood north to La Rue, 12 miles. W. M. Galbraith, President; C. Magee, Vice-President and Treasurer, Pittsburgh, Pa.; H. E. Buck, Secretary, Delaware, Ohio.

Cortland & Auburn.—An officer writes that this company expects to begin grading work early this spring on its proposed line from Cortland, N. Y., northwest via Homer, Scott, Glenhaven and Owasco to Auburn, 36 miles. It has not yet been decided whether the road shall be operated by steam or gasolene. Walter L. Webb, Ch. Engr., 2221 Land Title building, Philadelphia, Pa.

Erie.—The Columbus & Erie will soon be finished. It is a single-track line from Columbus, Pa., to Niobe, and a double-track line from that point to Lakewood, N. Y., a total of 23 miles. The work was done by Burke Bros., of Scranton, Pa., and J. G. White & Co. About 8.34 miles of this line was finished last year. The line is a part of the improvements being carried out to reduce the grades and improve the alinement of the main line.

Eureka Hill.—This company has finished its line from Silver City, Utah, via Dragon Hollow to the Beck tunnel and the Colorado mine, and is now in operation hauling ore to Silver City, at which point a smelter is being built by Jesse Knight, President of the company. J. William Knight, Vice-President; R. E. Allen, Secretary and Treasurer, and W. Lester Mangum, Director and General Manager, Provo, Utah.

Florida Central.—This road is now opened for business from Thomasville, Ga., south to Roddenbery, 13 miles, and from Fanlew, Fla., south to Veren, 12 miles. Work is under way from Roddenbery, Ga., south to Fanlew, 34 miles. (Jan. 3, p. 36.)

Galveston Terminal.—See Colorado & Southern.

Grand Trunk Pacific.—Bids, it is said, are wanted March 10 by P. E. Ryan, secretary of the Transcontinental Railroad Commission, Ottawa, Ont., for building the following sections:

District D.—From a point designated on the plans of the commissioners, about 8 miles west of the Abitibi river, crossing in Ontario, west about 100 miles.

District E.—From a point 19½ miles west of the crossing at Mud river, near Lake Nepigon, for about 75 miles.

Bids are also wanted for building 195 miles in New Brunswick and 52 miles in Quebec.

The company, it is said, has settled the differences with the British Columbia government in regard to the lands around Prince Rupert, B. C., and a contract for the first 100 miles from Prince Rupert eastward is to be let within three months.

Indianapolis, Huntington, Columbia City & Northwestern (Electric).—This company, of which William Self, Syracuse, Ind., was the receiver, was sold Feb. 1 by order of the Superior Court of Marion county at Warsaw, Ind., to Melvin A. Peoples, of Chicago. This line is built for five miles from Syracuse, Ind., to Vawter's Park, and has about five miles additional graded toward Goshen, Ind. The company was organized to build an electric line from Goshen, Ind., south via Syracuse, Wawasee Lake and Columbia City to Huntington. Mr. Peoples, associated with Burns & Company, Isabella building, Chicago, plans reconstructing and extending the line as projected.

Inter-California.—See Southern Pacific.

Interstate Railway (Electric).—This company expects to start grading this spring on its proposed electric line from St. Joseph, Mo., to Kansas City, 47 miles. Right-of-way secured. Smith H. Bracey, 1606 Tribune building, Chicago, will have charge of the construction work.

Joliet & Southern Traction.—This company which last year built about three miles of line in Joliet, Ill., and seven miles from Joliet to New Lenox, expects to finish work on the last named, the Blue Island division, this year; also south from Joliet through Ellwood to Wilmington, 16 miles.

Kanawha Central.—This road is opened for business from Broundland, W. Va., where connection is made with the Coal River Railway, to Olcott and Dungriff, five miles.

Kansas City, Mexico & Orient.—The Chihuahua division has been extended from Picachos, Mex., to Falomir, eight miles.

Kansas Southern & Gulf.—This company expects to build this year an extension from Westmoreland, Kan., to Manhattan, 22 miles. The work will include a 300-ft. bridge over the Blue river. Surveys are made for an extension from Blaine, Kan., to Falls City, Neb., 65 miles. Grading is to be begun about May 1. O. J. Collman, General Manager, Lincoln, Neb., and J. E. Williams, Chief Engineer, Westmoreland, Kan.

Kentucky & Tennessee.—This company, building from Stearns, Ky., west to Rockcreek, 20 miles, has finished the line to Oz, 10.5 miles. Work on the rest of the line has been indefinitely suspended.

Laramie, Hahn's Peak & Pacific.—An officer writes that contracts are about to be let for some of the work on the extension from Centennial, Wyo., south to Hebron, Colo. Part of the work is being done by J. F. White and some by the company's men. (Jan. 17, p. 105.)

Lima & Toledo Traction.—See Ohio Electric Railway.

Lincoln Northern Railway.—See Southern Pacific.

Manistique.—This road has been extended from Curtis, Mich., to Wilman, three miles.

Mexican Pacific Coast.—See Southern Pacific.

Nevada County Narrow Gage.—This company began work last year on a cut-off between Colman Station, Cal., and Long Ravine to shorten its line about two miles. Work is being done by the company's men. Grading finished for 1½ miles and track laid for about three-quarters of a mile. The work includes putting up a steel bridge 190 ft. high and about 800 ft. long, which is to be begun April 1.

Norfolk & Southern.—The Columbia branch has been extended from Creswell, N. C., south to Columbia, nine miles.

Ohio Electric Railway.—The Lima & Toledo Traction, building an extension from Deshler, Ohio, northeast about 30 miles to Toledo, has finished a reinforced concrete bridge 1,220 ft. long over the Maumee river near Waterville. Grading has been finished to the Toledo city line. Work has been suspended, but will be resumed this spring, and the line finished into Toledo this summer. (Dec. 6, p. 701.)

Oregon Eastern.—See Southern Pacific.

Oregon Railroad & Navigation.—This company has opened the Pilot Rock branch for business from Pilot Rock Junction, Ore., south to Pilot Rock, 14 miles.

Oregon Western.—See Southern Pacific.

Peninsular Railroad.—See Southern Pacific.

Philadelphia & Reading.—Bids are wanted February 27 by W. Hunter, Chief Engineer, Philadelphia, Pa., for work in connection with the elimination of grade crossings on the Philadelphia, Germantown and Norristown as follows:

Contract No. 28 car cleaning yard Huntington street.

Contract No. 30 coal pocket yard between Berks and Norris streets (East Side).—(Nov. 22, p. 636.)

Portland, Eugene & Eastern (Electric).—This company, which has projected an electric line from Portland, Ore., via Eugene to a point in eastern Oregon, about 182 miles, has grading work under way from Eugene to Springfield, six miles, and track laid in Eugene for three miles. The work includes putting up three bridges. Under the name of the Salem-Mehama, a line is projected from Salem, Ore., southeast to Mehama, 24 miles. Surveys and rights-of-way secured by Walters Bros., of Salem. The project is financed by A. Welch, of Portland.

Port Simpson & Fort Churchill.—Application is being made for incorporation by this company, with a capital of $100,000, to build a line from Port Simpson, B. C., northeast to Fort Churchill on Hudson Bay. The incorporators include, W. H. C. Duvall, Surveyor General for Canada; J. Brandon, Victoria, B. C.; H. White, former Mayor of Seattle, Wash.; J. McLaughlin, Los Angeles, Cal., W. H. Harding, New York; S. Shenstone representing the Rothschild; E. B. Dean, Scranton, Pa., and A. C. Latimer, Washington, D. C.

St. Joseph Valley Railway.—See St. Joseph Valley Traction.

St. Joseph Valley Traction.—This company is building a line from Middlebury, Ind., east via Shipshewana to La Grange, and, under the name of the St. Joseph Valley Railway, from that point via Mongo and Orland to Angola, 43.7 miles. Construction work is about finished with the exception of some grading, on which work will be resumed this spring. Preliminary surveys have been made from Middlebury west to South Bend; also from Angola east to Pioneer, Ohio, and Montpelier. G. T. Moore, General Manager.

Sacramento Valley & Eastern.—This company is building with its own men from Pitt, Cal., to Delamar, 16 miles. Contract for the bridge work let to the Globe Construction Co., of San Francisco. Address T. J. Dearborn, Winthrop.

Salem-Mehama.—See Portland, Eugene & Eastern.

South Dakota Central.—This company has opened for business the extension from Arlington, N. Dak., north to Hayti, 21 miles. (Aug. 30, 1907.)

Southern Pacific.—The report of this company for the year ended June 30, 1907, shows that work was under way as follows:

Grading is finished on a line from Benedict, Cal., to Smeltzer, about six miles, and about seven miles of track has been laid on a line from Empire to Rossi, about eight miles, and the grading finished on the remaining mile.

The Bay Shore Line cut-off, a double-track line from San Francisco to San Bruno, about 10 miles, during the year was finished for about nine miles. The line will be finished during the early part of 1908.

Central California.—Organized to build from Niles, Cal., to Redwood City, about 16 miles. Grading finished on three miles and work in progress on the remainder.

Coast Line Railway.—Building north from Santa Cruz, Cal., about 12 miles; nine miles finished and work on the remaining three miles progressing.

Peninsular Railroad.—Building from Mayfield, Cal., to Vasona, about 16 miles; nine miles graded and grading work under way on the remainder of the line.

Lincoln Northern.—Organized to build a line from Lincoln, Cal., to Dairy Farm Mine, about 11 miles.

On the Inter-California branch line from Old Beach (now Imperial Junction), Cal., on the main line of the Southern Pacific, south to Calexico, 41.36 miles, an extension is building east from Calexico, Cal., through the northern part of the Republic of Mexico to Yuma, Ariz., 55 miles. About 19 miles of track laid and three miles additional graded. Work under way on the remaining 33 miles.

Central Pacific.—A spur track from Tacoma, Nev., to the Ore Bins of the Salt Lake Copper Company, about 3.88 miles, was opened September 6.

Oregon Eastern.—On the 152 miles projected by this company, the surveys between Natron, Ore., and Klamath Falls, and between the eastern side of the Cascade Mountains and Ontario have been finished and considerable right of way secured.

Oregon Western.—Projected line 82 miles. Surveys made from Drain, Ore., via Marshfield to Ward and considerable right of way secured. Grading and tunneling on the line is progressing, and a large part of the steel bridges, rails, ties and other track material for the line were bought during the year.

Texas & New Orleans.—A line from West Port Arthur, Tex., to Port Arthur, about three miles, was opened for traffic on September 15.

Cananea, Yaqui River & Pacific.—On this line, from Empalme, Mex., a point on the Sonora Railway, to Tonichi, about 159 miles, the line from Corral north to Buena Vista, about 18 miles, was opened for traffic in February, 1907, making a total of 82 miles in operation. Work is progressing on the remaining 73 miles. On the extension from Corral southeast to Alamos, about 92 miles, the line from Corral to Velderrain, about 27 miles, was also opened for traffic in February, 1907, and from Velderrain to Navojoa, about 27 miles, was opened in May, making a total of 54 miles in operation. Work on the remaining 38 miles is progressing.

Mexican Pacific Coast.—Building from Navojoa, Mex., on the Cananea, Yaqui River & Pacific, southeast to Guadalajara, about 720 miles. About 10 miles was finished from Navojoa, south, and work is progressing on other sections of the line.

Morgan's Louisiana & Texas.—On the extension from Lafayette, La., to Port Allen (opposite Baton Rouge), about 21 miles is finished and work on the remaining 32 miles is in progress. On the extension from Bayou Sale to South Bend, about 11 miles, grading is finished.

Louisiana Western.—On the extension from Eunice, La., to Mamou grading is finished on about 10 miles and work under way on the remaining seven miles.

Other improvements during the year include: second main track on the Pacific system between Burbank, Cal., and Los Angeles, 8.10 miles. The 15 miles between Elvas, Cal., and Roseville will probably be finished early in 1908. Work is under way on three miles between Shriever, La., and Thibodaux. About 24.75 miles of narrow gage was changed to standard. Work is also under way on a change of line near Palisade, Nev., on 1.48 miles of main track where the line is to be shortened, also near Santa Barbara on 1.60 miles of main track and second track.

Union Central.—This company, it is said, has announced that work on its main line from Dallas, Tex., to New Orleans is to be started this month and pushed to completion. The first section to be built will be from Dallas to Irondale, 60 miles. A branch is already finished from Irondale to Wortham, 30 miles. The office of the company is at Dallas. W. J. Hogue is President.

RAILROAD CORPORATION NEWS.

Detroit, Toledo & Ironton.—Thomas D. Rhodes, of New York, formerly receiver of the Detroit Southern, has been appointed a third receiver of the Detroit, Toledo & Ironton on the application of the Knickerbocker Trust Company on behalf of security holders in New York. Officers of the railroad were appointed as the first two receivers.

Great Northern.—The approximate gross earnings for January were $3,316,130, an increase of $769,604. For the seven months ended January 31, gross earnings were $38,906,974, an increase of $4,885,204.

Illinois Central.—Decision is to be given on February 20 on the right of E. H. Harriman to vote 281,231 shares of Illinois Central stock held by outside corporations, principally by the Union Pacific.

Louisville & Nashville.—Gross earnings for December were $3,358,000, against $4,053,000 in 1906, a decrease of 17 per cent. Net earnings were $379,000, against $1,371,000 in 1906, a decrease of 72 per cent. For the six months ended December 31, 1907, gross earnings increased 3 per cent. and net earnings decreased 22 per cent. The 1906 figures are revised so that the comparison is not vitiated by the Interstate Commerce Commission's classification of earnings and expenses in use since June 30, 1907.

This company has issued a circular to its stockholders, giving information about the Louisville Property Company, in whose stock an extra dividend of 1 per cent. was paid this week to Louisville & Nashville stockholders. The Louisville Property Company is a Kentucky corporation whose entire capital stock, amounting to $50,000, was owned by the Louisville & Nashville. It held many tracts of land adapted to the uses of the railroad and also considerable bodies of coal lands, chiefly in Kentucky. Because of the provision of the Rate Law against transportation of coal in which a railroad has an interest direct or indirect, the close relations between the two companies were severed by dividing the railroad's interest in the property company among the railroad's stockholders. To this end the capitalization of the property company was increased from $50,000 to $600,000 and certain conveyances of land were made in order that the large indebtedness of the property company to the railroad company should thereby be reduced. "It is believed that the shares of the Louisville Property Company are reasonably worth their par value, if not more."

Norfolk & Southern.—J. F. Pierson, Jr., & Company, New York, are offering at 91 and accrued interest, netting about 8½ per cent., $500,000 of the $2,750,000 three-year 6 per cent. collateral trust notes dated November 1, 1907, and subject to call at 102½ and interest. First and refunding mortgage 5 per cent. bonds are reserved to retire these notes, which are secured on $2,040,000 general mortgage 5 per cent. bonds, $1,200,000 5 per cent. equipment trust bonds and $1,000,000 first and refunding mortgage 5 per cent. bonds. The notes were issued to provide funds for finishing the new construction connecting the various lines of the company and for working capital.

Phillips & Rangeley.—See Sandy River.

Sandy River.—There is a report that the Phillips & Rangeley, which runs from Phillips, Me., to Rangeley, 29 miles, and has been for two years in the hands of a receiver, is to be freed from its receivership and merged in the Sandy River Railroad, which runs from Farmington, Me., to Phillips, 18 miles. The Sandy River has acquired all the outstanding bonds of the Phillips & Rangeley and of the Eustis Railroad, which runs from Eustis Junction to Berlin Mills Camp, 15 miles, and the Madrid Railroad, which runs from Madrid to a point in Township No. 6, six miles, both of which are operated by the Phillips & Rangeley. All these roads are 2-ft. gage railroads, their business is principally lumber.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 8. FRIDAY, FEBRUARY 21, 1908

Colonel Prout, editor of the *Railroad Gazette* from 1887 until 1903, contributes this week a letter on the Soudan Railroad from the Red Sea to the Nile, which brings vividly to remembrance a piece of uncommonly interesting history, in the making of which he had an important part. We printed in the issue of February 14 an account of the operation of the railroad which has been built just about where Colonel Prout made surveys, more than 30 years before. If this line had been built at the time when he recommended it the political and economic history of the Soudan would have been changed radically. Colonel Prout is quite wrong in supposing that there is anyone on the editorial staff of the *Railroad Gazette* to-day who is ignorant of his work, first as Major and then as Colonel in the army of the Khedive, and as Governor-General of the Provinces of the Equator, succeeding General Gordon while Gordon was in command at Khartoum. If those who served with him on the *Railroad Gazette* fail to grasp all the detail of his remarkable work in the East, it is because the Colonel combined performance with silence, to a degree unknown in most offices, and conspicuously absent in the government of this country. It is very much to the Colonel's credit that those who worked with him and knew him best have learned most of what they know about his record in the Nile country from outside sources.

It is announced that the Interstate Commerce Commission on February 27 will take testimony as to the need of action by the commission postponing the day on which railroads shall comply with the law limiting the working hours of telegraphers and signalmen. This law goes in effect March 4, unless the commission shall issue an order modifying it. The proviso giving power to the commission in this respect applies only to these classes of employees (not to trainmen) and the commission has issued a notice holding that the proviso is extremely limited. It is believed to apply only in exceptional instances of unusual conditions which could not have been foreseen. Conditions common to many railroads cannot be deemed "a particular case" for relief by the commission. The fact that business is small at a given station can have no weight; neither can the commission accept testimony as to a scarcity of operators, if it appears that higher wages would secure as many as are needed. The commission cannot postpone the taking effect of the law because compliance will be inconvenient or costly, nor can a suspension be ordered after the law has taken effect. It has been given out in the newspapers, though not in a formal statement that the commission has received thousands of telegrams informing it that operators are plenty. As these telegrams appear to have had their inception in a request sent broadcast by an officer of the Order of Railway Telegraphers and as no evidence is adduced to support the statement as to the number of operators available it remains to be seen how much force it should have. In his telegram to the commission one of the operators said that "10,000 telegraphers were being turned away by the railroads" and he pleaded that "the law should remain as it stands for humanity's sake." It is greatly to be regretted that this law was not subjected to a little more rational discussion before its terms were crystallized. "Humanity" would be much better subserved by the application of more rational methods of improvement to the telegraph and signal departments of most of our railroads, than by a "strike law" which gives some men too little work and to others allows much. There is evidence a-plenty that in Maryland, where an eight-hour law for telegraphers has been in force for a year or two, the charge has done little or nothing to promote increased safety while some of its results have been demoralizing, as where a man works eight hours a day for one company and another period of eight hours for another. In putting such a strict construction on the law the Interstate Commerce Commission seems to be only following the policy which it has adopted with rate and tariff questions and all other points which have arisen since the amendments of 1906 were passed; and the strict construction would seem to be one which the courts would be likely to sustain. But to appeal to Congress for a modification will probably be as futile as were the appeals for more rational treatment of the question a year ago.

INCREASING THE CAPACITY OF THE BROOKLYN BRIDGE.

The Brooklyn Bridge is the most congested passenger terminal in the world. For half an hour on four afternoons of every week, from 5.40 to 6.10 p.m., passengers come into the Manhattan terminal at the rate of 1,000 a minute. This does not include those who walk across the bridge. For years it has been the practice during rush hours to carry passengers bound for points on the elevated railroads in Brooklyn across the bridge in trains of bridge cars operating by cable, necessitating a change at the Brooklyn terminal. An article in another column describes the most important physical changes which have been and are being made to increase the capacity of the bridge. The extension of the Manhattan terminal over Park row, which was put in service on January 27, has made it possible to run elevated trains from Brooklyn to and from Park row direct during the whole day, doing away with the change at the Brooklyn terminal. The chief engineer of the Public Service Commission for New York City, in a report to the commission published last Saturday, criticized the new system and urged a return to the old method of running trains of bridge cars, on the ground that a test made on February 3 showed that the new service does not furnish sufficient capacity to do the work required, and that with it it would be impossible to carry as many people as were accustomed to use the bridge before the subway tunnel to Brooklyn was open. The principal reason for arriving at this conclusion was the fact that a bridge car being wider and having center doors, thus saving the space which would otherwise be used in the middle of the car by seats, can accommodate more people than an ordinary elevated car.

In answer to this report of the commission's engineer, the Bridge Department of the city, which has had direct charge of the Brooklyn Bridge improvement, on Monday, February 17, between the hours of 4 and 7 p.m., made a count of passengers using the elevated and surface lines on the bridge and a comparison of their number with the number of passengers who by actual count had used the bridge during the same hours on the afternoon of Thursday, October 10, 1907, before the Brooklyn subway was in operation. It should be observed that Monday is the day of heaviest travel of all the week.

The surface lines in the February count ran 987 cars in the three hours, or at the rate of 329 cars an hour, which is 26 cars more than were run in the October count. These cars carried 5,321 less passengers than were carried during the corresponding three hours in October. The elevated lines between the same hours ran 1,026 cars, carrying 59,994 passengers, as against 700 cars carrying 57,207 passengers in October, an increase of 326 cars and 2,787 passengers. The comparison, both for the elevated and surface lines, is affected by the fact that in October the local traffic across the bridge was carried in elevated cars, but now is carried in trolley cars. In the three hours on the afternoon of October 10 there were 4,518 such local passengers carried on the elevated, so that the increase in the number of people who used the elevated lines for through srvice on February 10 over October 10 was really 2,787, plus 4,518, or 7,305. Correcting the comparison, from the standpoint of the trolley traffic, the 4,518 local passengers must be added to the decrease of 5,321 trolley passengers, making a total falling off in through travel on the trolley cars of 9,839 people. The through elevated service over the bridge has apparently attracted a total of 7,305 passengers to the elevated who formerly used trolley cars. The net decrease in the number of people carried over the bridge on both elevated and trolleys was 2,534, which may fairly be said to represent the number of passengers who formerly used either one service or the other on the bridge, but now use the subway tunnel. This number would represent the loss in through travel to the Brooklyn Rapid Transit, which operates the elevated lines and all but two of the trolley lines. In order to gage the whole effect of the subway tunnel on the whole business of the company, however, it would be necessary to know the increased number of passengers who take the Brooklyn Rapid Transit elevated lines and trolley lines at or in the neighborhood of Borough Hall, Brooklyn.

These figures of the number of passengers carried across the bridge are surprisingly close to the previous estimates made by the Bridge Department of the new service as compared with the old. They show that the present elevated service, which is the crux of the operating problem at the bridge, has a greater capacity than the old service of bridge shuttle trains.

Further improvements to the bridge will increase this capacity. Some of these are outlined in the accompanying article. In addition, contracts have already been let for eliminating the grade crossing of trolley cars at Sands street at the Brooklyn terminal of the bridge. When this crossing is done away with the ease of moving the trolley cars across the bridge will be increased. It has already been arranged with the Brooklyn Rapid Transit that, as soon as this change is finished, a service of elevated trains originating at Sands street will be begun, to which people crossing the bridge by the local trolley service can transfer direct and take elevated trains not already filled with passengers.

The arrangements which have been made for handling the crowds at the large Manhattan terminal are interesting. The general plan of the terminal is shown in one of the drawings with the article. Passengers come from the street up a stairway 40 ft. wide to a mezzanine floor, from which there is access to each of the different tracks [illegible] of the elevated lines. One of the greatest [illegible] is to handle the crowd when getting into the trains, for it is here that the most disgraceful crowding occurs. Experiments are being made to solve this problem. Two iron fences or railings have been built parallel to the tracks, one with a 1 ft. clearance between it and the edge of the platform, the other about 1 ft. further back from the platform edge. The 1 ft. clearance between the nearest railing and the edge of the platform, together with the 8 in. of additional clearance between the edge of the platform and the side of the cars, leaves a total clearance wide enough to prevent accident to any one who should happen to be caught between this railing and a train. There is an opening in the nearest railing opposite the gates of the cars when they are lying in the terminal. In the morning rush hour the outside railing will be opened opposite this same point to let passengers out of the train.

When the rush of travel is inward instead of outward, that is, in the afternoon, passengers of incoming trains are unloaded on outside platforms, and this opening in the second railing will be kept closed. At a point opposite the middle of each car there is another opening in this outside railing, through which, whether there is a train ready or not, passengers will be allowed to go, walking from here to the open part of the inner railing nearest the track and opposite the car gates. The space between the two railings is designed to be just large enough to hold half a carload of passengers, the passengers for the other half of the car being in a similar space facing the other way. The total capacity of all these spaces is the capacity of the trains. When one of these spaces is filled the opening in the outside railing is closed by an iron bar and no more passengers are allowed to crowd inside. When the train pulls up to the platform, the passengers who arrived first are nearest the door and the passengers who arrived last furthest from it. Instead of crowding toward the two car platforms from three directions, all going to one platform proceed in the same direction, those coming to the adjoining platform of the other car, coming in the opposite direction. The train can be loaded in this way in 40 seconds. In order to make passengers walk as fast as possible the interval which now exists of about 8 in., between the edge of the station platform and the edge of the car platform is to be bridged by an iron grating filled with carborundum to prevent people's feet slipping, and lighted from underneath by an electric light. An interesting fact in this connection is that the spaces designed to hold half a carload each will probably be made larger for some lines than for others. It has been found that the passengers on the lines serving the better parts of the city will not crowd together as closely as those bound for other parts.

The principal disadvantage of the system of running through elevated trains on the bridge is that for 20 to 30 minutes on Monday, Tuesday, Wednesday and Thursday, the four busy evenings of the week, a delay of two or three minutes to an elevated train will result in blocking the platform. That is, so many passengers will arrive in this time that the entrance gates will have to be closed until the platform is cleared. It would appear, however, that this is a defect which will steadily grow less with experience. In order to prevent a crowd thus detained from rushing the entrances where the chopping boxes for tickets are, partitions have been built in the entrances to prevent shoving from side to side. If this plan is not successful, these partitions are to be extended out from the railings so as to effectually separate the crowd 5 or 6 ft. away from the barrier.

A further improvement to increase capacity is the installation of automatic block signals across the bridge. This is already under way. These are to be worked on a new system developed especially for this use. Each block is 700 ft. long. This is to be the minimum interval between two trains, but each block is divided into seven sections of 100 ft. each, so that as soon as a train in the block ahead moves 100 ft. ahead, the following train can move 100 ft. ahead also instead of having to wait until the leading train has cleared the 700 ft. block. This system, it is believed, will give the maximum efficiency of the tracks. Still other improvements are to be made. The yard at the Brooklyn end of the bridge is to be rebuilt to allow trains to be more promptly and efficiently handled and better interlocking mechanism is to be put in at the terminals to provide for quicker operation of switches and signals.

In one sense these improvements are temporary, for when the subway between the Brooklyn and the Williamsburg Bridge is finished, there is to be through service over the two bridges as a loop. The immediate changes, however, are of special interest as examples of the way in which the largest and most violent body of concentrated rush hour traffic in the world is handled.

STEAM AND TROLLEY DURING HARD TIMES.

The present period of financial and industrial strain will, before it ends, test for the first time in this country the relative strength of the steam railroad and the electric railway in resisting, as investments, the shock of hard times. It is true that in the latter part of the year 1893 and the twelvemonth following, there was financial depression that rested heavily upon the railroads and, in less degree, upon the street railway properties also. But at that time the street railway had barely emerged from its "horse railroad" character. It was still in its infancy of the "novelty" traffic that increased receipts; it had not settled down to business; and what is of more importance in the comparison, it had not reached its high expansion of these later times when, in many quarters, it competes with the steam lines. But now steam and the trolley, with both their systems greatly developed, face together the ebb of the industrial tide which has been running out for two months. Such a period is a short one for the test. The returns from the steam roads are still pretty meager; from the electric roads, only fragmentary. But from the best information available, it appears that a group of eighteen fairly representative electric properties actually *increased* their earnings 2 per cent. in December, as compared with December, 1906, while 61 steam roads decreased 4.28 per cent. in the same month. In January, six electric properties (including the Chicago elevated lines) increased their earnings 3.6 per cent., while 53 steam roads (including certain lines in Canada and Mexico) decreased 7.45 per cent.

These returns, viewed as statistics, are unsatisfactory. We are lumping city elevated lines with interurban lines, and including with the steam roads certain properties in Canada and Mexico which are showing gains instead of losses. The entire number of companies is too small to neutralize these imperfections. But from one quarter, the steam and trolley lines of the New York, New Haven & Hartford, we have returns on so large a scale and representing such a diversity of operating conditions that the figures are very suggestive, even for a brief period.

Alone among steam railroads, the New Haven has made investments in trolleys which may justly be called vast. It holds them in four states, and in two states, Connecticut and Rhode Island, it has almost a street railway monopoly. Its trolley lines represent a market value of considerably more than $100,000,000;; they comprise more than 1,300 single track miles; their gross receipts are upwards of $15,000,000 a year; and they include lines of all types—urban, suburban, cross-country, long distance and short distance, parallels to steam roads and laterals. January, 1908, was the first month of traffic depression in which to measure the steam system against its trolley subsidiaries. Gross earnings from operation of the steam system, as compared with January, 1907, fell off $643,000, or 16 per cent. The trolley earnings fell off only $21,000, or 2 per cent.; and, in one of the four states, there was a positive gain. On both the steam and trolley systems, changes in mileage operated for the year were unimportant. In the year 1894, when the New Haven company first encountered fully the financial setback that began in 1893, its earnings—allowing for earnings of the Old Colony just absorbed—fell off for the whole year only $903,435, or a little more than 5 per cent. At that time the company had only a few miles of street railways, and comparative earnings then are meaningless. But the contrast between the 5 per cent. reduction of 1894 and the 16 per cent. January reduction of 1908 suggests the severe industrial depression in the New Haven's territory which its trolleys have just met with the slight reduction of a little more than 2 per cent.

Pushing the analysis further, it is to be noticed that the New Haven's great street railway system, particularly in Rhode Island and Connecticut, depends in a considerable degree for its earnings on the patronage of factory hands, for whom in places special groups of cars are operated at "rush" hours. That under such conditions street railway gross earnings should all but hold their own during industrial ebb seems strange on its face. But it is to be remembered that an equation of trolley earnings at annual periods means a loss of what, in normal times, would have been an increase; that to the trolleys paralleling the steam lines, particularly on interurban routes there has been perhaps a division of steam passenger traffic due to the lower trolley fares; and that the unemployed may for awhile, until idleness begins to pinch the pocket hard, use the trolleys freely. But even with such modifying elements, the retention of the New Haven's trolley business seems remarkable. It argues, for one thing, for the persistence of passenger business through hard times, as compared with freight, and also for the intensified relation of public necessity which the street railway has assumed—somewhat the same as the telephone in another field.

The more it is looked into, indeed, the New Haven example of comparatively undiminished trolley business seems but a strong illustration of a general truth that hard times hit the freight traffic first and hardest. The great loss of the New Haven in January last was in the freight traffic, the loss in steam passenger business relatively small. Going back again to 1893-94, one finds that the New Haven's freight receipts fell from $8,115,524 to $7,260,433, or somewhat more than 10 per cent. Allowing for the Old Colony merger; passenger business fell off from $9,807,515 to $9,761,201, or hardly at all. In the same period of industrial stringency with due allowance for a nine months report, the passenger earnings of the Boston & Maine actually rose from $7,801,352 to $7,894,968, while freight earnings fell $786,113, or nearly 10 per cent. The New York Central passenger earnings were almost unchanged, while freight earnings fell off $3,267,561, or almost 12 per cent. The Pennsylvania, however, lost about 15 per cent. in passenger receipts and about 12 per cent. in freight, being the exception that accentuates the rule in a somewhat similar group of eastern roads, the Boston & Albany reasserting the rule with about 8 per cent. loss in passenger and more than 17 per cent. in freight. It looks therefore as though in our hard times street railway earnings, almost all of them on our eastern lines derived from passengers, are to prove much more stable than those of the steam roads, and demonstrate even more strikingly than heretofore the general stability of passenger business as contrasted with freight. A few weeks more will tell the full story.

The New Haven returns, so far as they have gone, bring out another bit of comment. President Mellen has been censured by his critics, notably in Massachusetts, for nothing more severely than for his bold excursion into street railways. Many changes have been rung on the rashness of that venture, upon the size of the new liabilities assumed, upon the water solidified by the leases of the parent corporation, and upon reduction of its dividends as the ultimate result. The first returns in hard times now indicate that his trolleys are ballast rather than excess of sail and that it is the old line business, which he has been criticized for not sticking to, that has fallen away. As our troublous times go on it will be an instructive experience to see how far the stability of street railway earnings extends beyond the New Haven system and whether or not it includes, for example, the mixed freight and passenger long distance electric lines of the Middle West. It is one of many lessons that our hard times are to teach, and a lesson that bears directly on the future fiscal relationship of electricity and steam in the land carrying trade.

CONTRIBUTIONS

The Soudan Railroad from the Red Sea to the Nile.

Swissvale, Pa., Feb. 17, 1908.

To the Editor of the Railroad Gazette:

One of several disadvantages of living long in the world is that you become a sort of contemporary ancestor and you have the bitter experience of finding that your progeny forget you. I have just noticed in the *Railroad Gazette* of Feb. 14 an account of the railroad from the Red Sea to the Nile, in the Soudan, but nowhere in that account do I find mentioned the fact that the first suggestion for such a railroad, and the first rough survey for such a railroad, came from a former editor of the *Railroad Gazette*.

Many years ago a young Major of Engineers in the Egyptian army was ordered into the Soudan. He survived, and later became the editor of the *Railroad Gazette*. This Major went into the Soudan by practically the route now followed by the new railroad, the account of which by Mr. Carpenter appears in your issue of Feb. 14; that is, he went to Suakin on the Red Sea, about latitude 19, and crossed the desert to Berber on the Nile. He, being somewhat familiar with railroad enterprises in the United States, was at once struck by the practicability of building a railroad from Suakin to Berber, and by the strategic value of such a railroad for military and for commercial purposes. He made an itinerary of his route, keeping directions by prismatic compass, estimating distances by rate of march, checking directions and distances by sextant latitudes and longitudes, and getting elevations by aneroid barometers. The result was a quick, rough survey, sufficiently accurate for a preliminary reconnaissance. He found that the distance from Suakin to Berber was about 240 miles. In the first 60 miles from Suakin he rose about 3,000 ft., and then for the next 180 miles descended gently and gradually to the Nile. He went through a somewhat rugged range of mountains by a pass not at all formidable or impracticable.

When the Major got to Berber, he sat down and wrote his report to the War Office in Cairo, reporting such things as he had been sent out to observe, and then made an appendix, urging his notion that a railroad ought to be built from the Red Sea to the Nile on something like the line that he had traveled over. Had this road been built troops could have been put into the Soudan from deep water by 240 miles of rail transportation, and probably the Rebellion of the Mahdi would never have taken place and Gordon would have died in his bed if his energetic temperament had permitted him to do so, the development of commerce with the Soudan would have been greatly advanced, and possibly that unhappy country would have been something like 50 or maybe 100 years in advance of its present condition, because the wars following the Rebellion of the Mahdi caused a destruction of population and a desolation which cannot be conceived of by anybody who has no intimate knowledge of the country.

The Khedive of Egypt at that time was Ismail Pasha, who was a very able man indeed, but came far short of being a great man. He was not permitted to keep a navy, and, obviously, was not willing to put the key of the Soudan in a deep water port far down the Red Sea, and so endeavored to hold the Soudan by the tedious and costly line of the Nile Valley; and we know the result.

The young Major's report, with the sketch of his itinerary and with the barometric profile, was printed at the War Office in Cairo, and something of it appeared later in the Bulletin of the American Geographical Society, in the *Railroad Gazette* and in *Engineering News*.

When Gordon was besieged at Khartoum, and England reluctantly decided to do something for his rescue, the project of building a railroad from Suakin to Berber was taken up, and at that time it was spoken of in the English newspapers as the "Prout route." Some light railroad material was shipped out to Suakin, and if I am not mistaken, a few miles of road was laid in and from Suakin. But while it would have been easy to build the road before the rebellion and in times of peace, it was a different thing to do in the face of an active enemy, and the project never went very far. That route for the relief expedition was abandoned and the expedition went up the Nile.

Years later, after the English had thoroughly established themselves in the Soudan and had restored peace and had introduced good government and security to life and property, they took up again the project for the railroad from the Red Sea to the Nile, but they abandoned Suakin and went a little farther north to a better harbor, where they established Port Soudan. They wisely carried the line farther south than the pass by which the Major had gone through the mountains, and so got better grades and lighter work, and having gone so far south they naturally made the Nile terminus at the mouth of the Atbara, between Berber and Khartoum. So instead of a line 240 miles long, as the Major had estimated, they made it 332 miles, but they undoubtedly got a much better line.

This page of history may be new and interesting to some of the present editorial staff of the *Railroad Gazette*, and may possibly amuse for a few moments some of its readers. H. G. PROUT.

Steel Car Design.*

F. W. Brazier (N. Y. C. & H. R.).—I would like to emphasize the importance of standardizing steel cars so as to reduce the number of designs. I can see no reason why we should not have a standard length of flat car, coal car and drop-end gondola car. There is a tendency among car designers to have just enough difference in the design of cars to make them call for a great many different parts for repairs. Not only does this apply to steel cars, but it should apply to what is known as the American Railway Association standard box car. A box car that is suitable for one trunk line could be made standard throughout the country, but to-day each road has its own standards for doors, trucks, size of sills, kind of roofs, and different makes of couplers, which I think is unnecessary. Not that I would cut out competition in such matters, but I believe many of these parts can be standardized as well in steel cars as in box cars.

We have found that the steel cars we have had in accidents can be repaired and in many cases put back in their original shape at a reasonable cost. They certainly will deteriorate fast if allowed to remain idle and I would suggest that steel cars be kept in service in preference to wooden cars, in these days when there is not such a demand for cars.

One of the greatest drawbacks has been to find a paint that would prevent rust. Our experience has been that many of the steel cars began to deteriorate at the joints from, I believe, lack of proper bending or some treatment for stopping corrosion. Possibly this may be overcome in the future. It is only a few years ago that we began to use steel stake pockets on our coal and flat cars, with results well known to us all, they simply rusted to pieces, and to-day nothing remains but streaks of rust in place of the steel. These have been condemned and malleable iron used as a substitute. I believe steel construction for baggage and postal cars or in fact all passenger service cars will be the standard of the future because cars in this service will have better care taken of them.

Twelve months ago car manufacturing companies were filled with orders and were not able to take additional orders for many months to come. To-day, with many of the car manufacturing companies' plants closed down and with all railroads economizing and at least 200,000 empty freight cars standing on side tracks there is time for us all to investigate and look over idle equipment to see what if any are defective and to plan improvements.

G. R. Henderson.—Mr. Waitt speaks of a design to carry all the load on the center sills. This must depend very largely on the type of car. Where we have a car with sides eight feet high there is a great strength available to support the load. I think under conditions like that it would be manifestly unwise to design our car, so that the entire load is carried on the center sills. When you consider a hopper car with the deep hopper possible, you will see that there is no difficulty whatever in transferring the strain from the side sills to the center plate. In other words, the design of the car should depend on the service for which it is intended.

Mr. Waitt makes a point of the necessity of keeping down the various sizes of parts so as to reduce the amount which must necessarily be kept in stock for interchange repairs in the shops, etc. I cannot second this too heartily. Anyone who has had to do with car repairs, particularly in the West, knows the difficulty of getting standard shapes for repairs to these new types of freight cars. It seems to me that the suggestion that merchantable shapes will be generally more acceptable than pressed steel shapes is a very good one. I think that the shapes of structural steel work used in the various industries in this country will indicate the class of merchantable shapes which may be used in car repairs. We should try to regulate our standard shapes so that we will be in a position to repair almost any kind of a car by using these merchantable shapes. I think that this club should initiate some action toward unifying the construction of steel cars, and I do not know of any better way than for it to suggest this subject to the Master Car Builders' Association committee as a subject for action at the meeting of the association next summer.

It is important that the standard sizes be amply strong. Some time ago I prepared the following specifications for sills of 50-ton steel hopper and flat cars:

"For hoppers, the body is to be proportioned for carrying 125,000 lbs. uniformly distributed between bolsters, in addition to the dead weight of the car. For flat cars, the sills are to be proportioned for carrying 125,000 lbs. uniformly distributed in addition to the dead weight, and also for 75,000 lbs. concentrated on a line across the car at any point between the bolsters, the side sills being considered as carrying the same proportion of load as the center sills, to allow for concentrated applications in loading heavy objects.

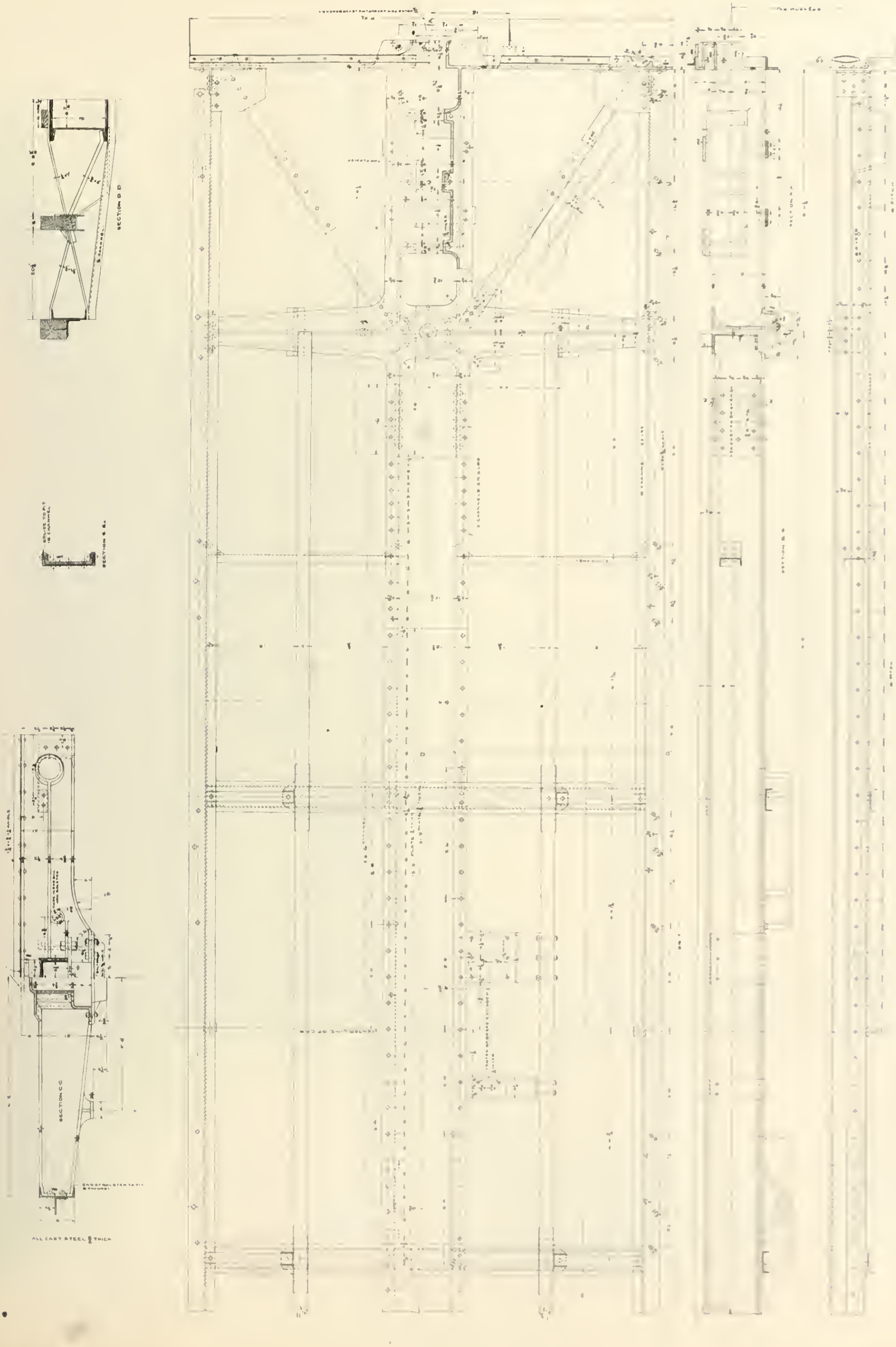
"In both types of car the center sills and draft attachments must be proportioned for a force of 100,000 lbs. pulling, and 200,000 lbs. buffing, and strains due to either or both the horizontal forces and the vertical loading combined must not exceed 12,000 lbs. per square inch in tension (net section), or 12,000—l/r in compression where l = the length and r = radius of gyration, both in inches. The maximum rivet shear must not exceed 8,000 lbs. per square inch and the rivet bearing, 16,000 lbs. per square inch."

There recently appeared in one of the engineering journals a suggestion that 500,000 lbs. buffing strain be provided for. In the same article the author states that he would work up to the elastic limit of the sill on such an allowance. That actually brings it to the same figures which I have here stated, viz., 200,000 lbs. with 12,000 lbs. allowable strain.

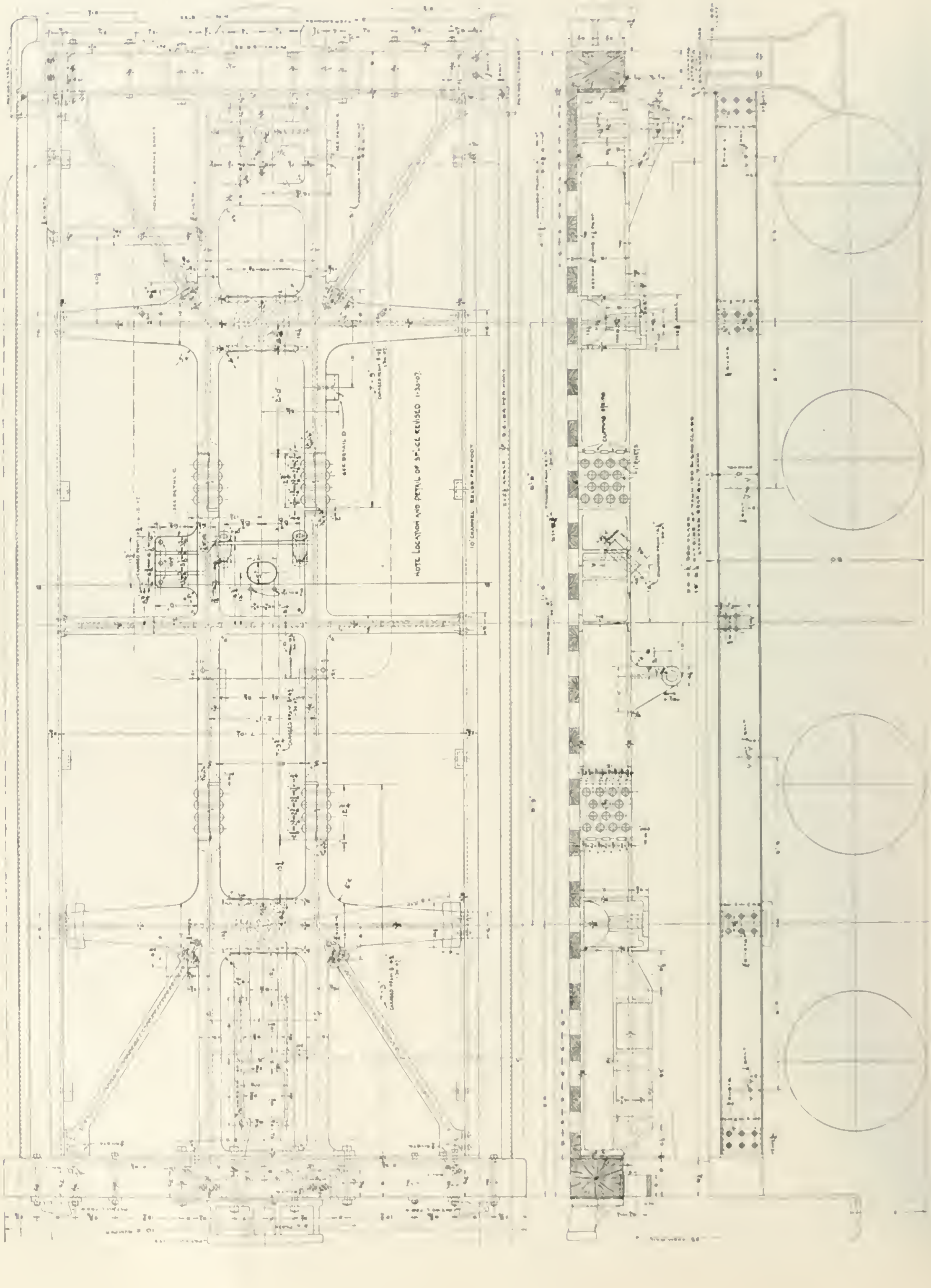
Mr. Waitt refers to the great carrying capacity and reduced traction in large capacity cars as a strong argument in favor of steel car construction. I agree generally with this, but I would call attention to the fact that some years ago there were wooden hoppers of 30 tons capacity which, I think, weighed about 30,000 lbs. Now, if you take the present designs, you will find that they run about 40,000 lbs., so that with the one-third more weight per car we get two-thirds more carrying capacity. I think that is well worth the extra expense, when you take into consideration a great many other points in favor of the larger cars.

Now we come to the question of cost. That is a great bugbear to many railroad companies, especially at present. I know of a railroad that got some figures on steel cars and also cars with wooden frames, and when it was found that for the same money they could obtain a great many more wooden cars, it appealed so strongly to the "powers that be" that they said "well, we will put in the steel cars a little later, but now buy wooden cars which will give us more cars for the same money." In the early part of last year we got bids on steel cars, and the prices ran a little less than three cents a pound. You can get very little structural steel erected for less than four cents a pound, and even at that price very few people would think of putting up a wooden building nowadays. In the long

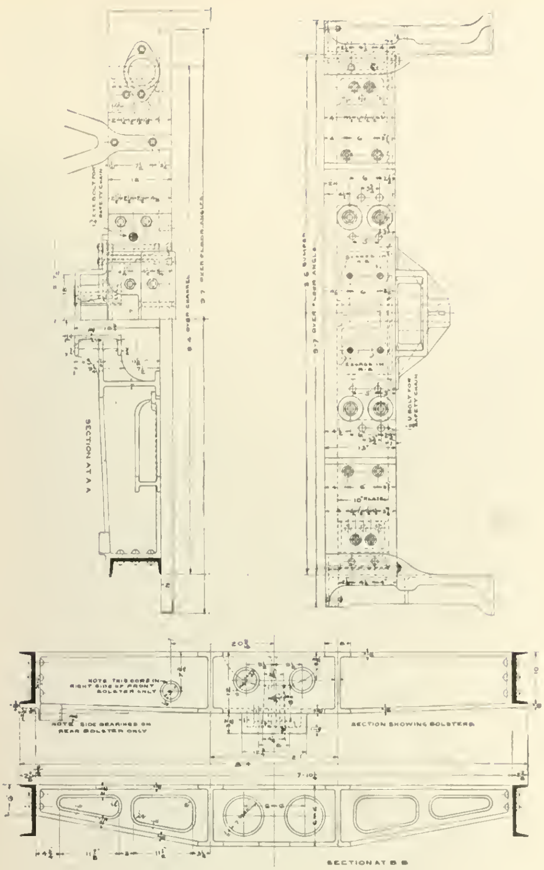
*Discussion of the paper on "The Era of Steel and the Passing of Wood in Car Construction," read by A. M. Waitt before the New York Railroad Club, Jan. 17.



Cast Steel Bolster Applied to Thirty-Ton Box Car; Central of New Jersey.



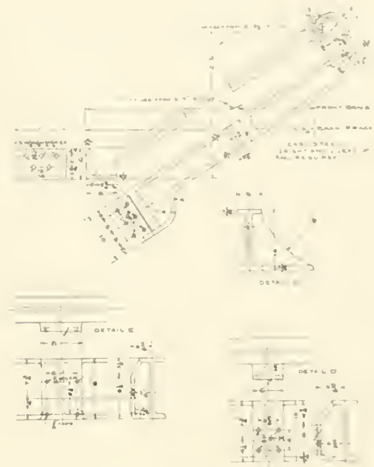
Cast Steel Tender Frame; Central of New Jersey.



Sections and End Elevations of Cast Steel Tender Frame.

run the saving on the steel car is certainly very large, and it seems to me that it is perfectly logical that railroads should put up steel cars rather than continue their old wooden cars on side tracks and hold them there for months for repairs.

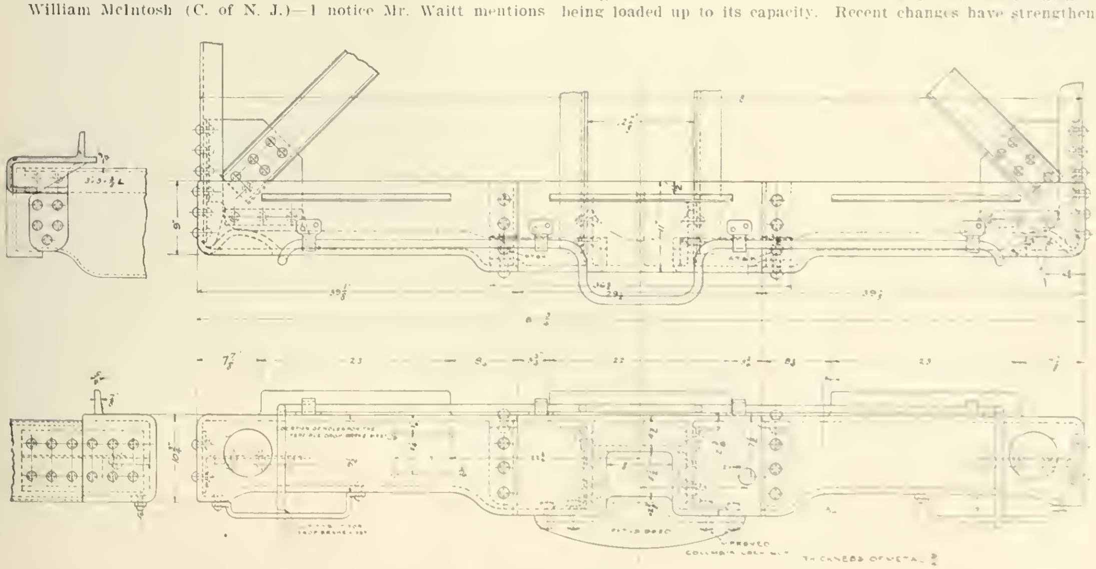
William McIntosh (C. of N. J.)—I notice Mr. Waitt mentions the earlier construction of steel cars built in 1897 to 1900 and a departure from that construction since seems to be largely on account of the difficulty that was encountered in obtaining the pressed steel forms for repairs. I found those same difficulties and rather favored the change to the structural steel forms with the expectation that a good many troubles would be eliminated. We did find less difficulty in making repairs, but I want to pay a tribute to the pressed steel car and say candidly that as far as my observation goes it has given as good an account of itself as any cars that have been produced since, that is, taking into consideration the weight and the results obtained. It seemed to possess a good many elements of



Details of Cast Steel Tender Frame.

resistance that the latter cars do not have to the same extent. In other words, it had some of the interesting features of an old tin can, that it would shove up under stress and if given a little time it would stretch out again like an accordeon and assume its original form. However, I think some of the difficulties we have met with in the later construction are owing to the quality of steel that has been furnished. No doubt a good deal of ordinary Bessemer has been pressed into service in car construction under the stress of scarcity of material, where we supposed we were securing the open-hearth product.

Mr. Waitt comments on the slowness of some of the New England people in taking up the larger forms of cars. This was perhaps owing to the lack of confidence in the cast iron wheel which was being loaded up to its capacity. Recent changes have strengthened



Cast Steel End Sill.

this wheel materially and increased confidence in its ability to carry additional weight.

I am disposed to take exception to Mr. Waitt in his remarks where he mentions three designs of different construction, but does not give cast steel any consideration at all in modern construction. I believe a fourth design ought to be brought in embracing more or less cast steel, which is quite a factor in car construction at present and, I believe, is destined to cut a much larger figure. It is possible in designing cars for withstanding great resistance and weight to use a very considerable proportion of cast steel. We have made some strides in that direction in the construction of cast steel tender frames. My attention was first attracted in that direction by reason of the rapid deterioration of the structural steel frames from corrosion; we found that we could produce a very strong and substantial frame of cast steel or a combination of cast steel and structural steel. We built some tender frames of this kind two years ago which have been in constant and hard service since and have not shown any indications of weakness or being affected unfavorably by corrosion. Mr. Waitt must, therefore, leave a niche for that design.

In the matter of repairs to steel cars, but little need be said. It only requires some capable men of the laboring class, properly directed to do that work and do it well. As has also been said, the proportion of repairs to steel cars is very much less than that to wooden cars.

As to standardization, this is a good time to suggest it, and a great deal can be done in that direction. Of course, as in all new developments, there is a tendency toward introducing many different ideas, and everyone thinks his is the best. He soon finds that somebody is doing as well, if not better, and then the disposition to compromise comes in and there is ultimately the survival of the fittest. We have had experience enough now to get together and appoint some committee with the necessary capacity to select the best and embody those specifications in some form of construction that will meet the requirements of all companies. Then it will remain for the higher officers to secure its adoption and thus eliminate a great deal of the useless designing now going on.

We are satisfied from our experience with the use of cast steel that a similar design to the one used in tender frames can be used in car construction. We have not done much in the way of car design except in the matter of cast steel end sills. We have introduced a great many of these, with much satisfaction. In the early construction of steel car frames, it was not thought necessary to put a great deal of strength in the end sills, as it was figured that the buffing was supported by the center sills. We all know that cars are not always handled in that manner and that they are subjected to a great deal of unnecessary stress. And it is advisable, for self-protection, to provide cars with strong enough ends to resist a considerable amount of unfair treatment and, I think, it is only with cast steel end sills that this can be accomplished. Structural steel ends are either broken or distorted under the force of the cornering blow they so often get in switching, while a well designed end sill of cast steel is not easily distorted under punishment of this kind and seldom breaks.

The cast steel end sill, tender frame and the application of the latter's principle features to a box car under frame, as mentioned by Mr. McIntosh, are shown in the accompanying drawings. Of a number of the tender frames built, some have been in service for two years without developing any indications whatever of weakness. In this construction the members carrying the draft gear attachments are cast in one piece with the body bolster. From the bolster toward the center of the tender extend short I-beam sections to which are riveted the intermediate framing of the tank, which in turn carries the water scoop, etc. The draft gear used in these designs is the ordinary tandem spring type and also the transom gear. The end sills are of wood and plates, and the side sills are channels.

In applying the same bolster and draft gear principle to a freight car, channels are used for intermediate sills largely as a matter of convenience in construction; cast steel center sills could be used if desired. The point considered especially advantageous is the combination of bolster and center sills extending from the bolster to the end of the car, and the short channel-shaped extensions toward the center of the car which make it easy to build up the intermediate framing in any manner desired.

A number of cars have lately been built with the design of cast steel end sill shown herewith, and it has been found entirely satisfactory. It is made either in three parts or in one casting. It has the advantage as compared with wooden or light structural steel sills of being strong enough to resist cornering.

John M. Goodwin (Goodwin Car Co.):—The pioneer steel dump [illegible] car in this country was built by me in 1894. Its weight was 21,000 lbs., with a capacity of 40,000 lbs. It was of structural steel and operated by air pressure. After numerous experiments the capacity was increased to 60,000 lbs. and the weight to 16,000 lbs. A few cars of this design were built by the Goodwin Car Co. in 1895. Years after thorough testing and experimenting, profiting by the service experience with the first cars I produced, in 1896, a steel car in which the weight was reduced to 43,000 lbs. and the capacity increased to 125,000 lbs. This was entirely of structural steel combined with malleable iron and cast steel. All parts were coated before being assembled with a carburet compound mixed with graphite, with very satisfactory results.

In the early part of 1895 the Goodwin Car Co. began to exhibit the operation of their cars to the Carnegie Steel Co. and for several months the cars handled almost every kind of material handled about the furnace yards, including pig iron, rail ends, slag, coal, coke, ore and all such material. I personally operated these cars during this entire period and made copious notes as to costs and methods of operation.

As a result of these exhibitions the Carnegie Steel Co., about a year later, built two all-steel hopper cars of structural forms in its own bridge shops. The weight of these cars was 39,900 lbs., with 95,000 lbs. capacity, estimated to safely carry 125,000 lbs. if the roadbed would allow it. The company exhibited these two cars at the M. C. B. convention at Saratoga in June, 1896. Up to this time the Goodwin company had had only its own equipment to refer to for information as to service requirements.

In 1897 the Carnegie Steel Co. made an arrangement with the Schoen Pressed Steel Co. to design a pressed steel car on the lines of the two structural steel cars of hopper bottom type which had proved too expensive to sell. The understanding was that the weight must be reduced something over 6,000 lbs. and the capacity increased to 100,000 lbs. The Schoen company was then making pressed steel stake pockets and center plates and was just starting to build pressed steel trucks. Mr. Hanson, the designing engineer of the Schoen company, designed and patented the pressed steel forms from which the Schoen company built a number of pressed steel cars of the hopper bottom type in 1897. They weighed 34,100 lbs., with 100,000 lbs. capacity. These were the first pressed steel hopper cars built in this country. As Mr. Waitt has stated these cars "proved somewhat too light to stand in an entirely satisfactory manner the strains of service."

The weight of pressed steel cars has gradually been increased, until to-day it appears to contain sufficient material to meet ordinary service requirements. In a car that has a carrying capacity of 100,000 lbs. and weighs much over 41,000 lbs. the earning capacity must be increased through a special design which saves labor in unloading.

In my research in several foreign countries, I found many designs of steel cars and was able to gather considerable data. I took measurements and photographs throughout Germany and France and even secured full information in the Far East, where steel coal cars were in general use, particularly in Burmah. In considering all of this foreign investigation, I find that my strongest point consists in knowing what not to do.

The problem of building cars for railroads in the United States stands absolutely by itself. Our railroads must have to-day a car that they can buy at a price approximating the present cost of a wooden car for its life service.

As something over 70 per cent. of the freight of this country is coal, if railroads can secure for their coal service a simple two sill design, strong in construction, with discharge hoppers sufficiently enlarged over the present designs to allow free discharge of coke as well as of coal, and if this design produces a car that will carry its 110,000 lbs. of coal with a dead weight not much over 41,000 lbs., I believe that the limit of economy in capacity and in weight will have been reached. The only remaining question will then be the proper distribution and quality of material used, and the class of labor employed in meeting the above requirements.

William Marshall (Anglo-American Varnish Co.):—This subject in different forms has come up a number of times of late, and the matter of a proper protective coating is always sure to be brought to the front. Mr. Waitt practically ignored it in his paper, because he is thoroughly imbued with the idea that steel cars and cars of metal construction have come to stay. Mr. Brazier, who is perhaps more intimately connected with the matter of car building at the present time, touched upon it but slightly. Mr. Goodwin referred to it in the form of pigment he uses on the plates in his cars. Whatever may be done by the Master Car Builders' Association or whatever association may have the final adjustment of this matter, the question of the protective coating must have full consideration. I do not know that anyone can say what may be the best coating to apply to metal. The difficulty seems to lie in the difference between a metal surface and a wooden surface. All paint has a vehicle for the pigment; the vehicle in which most pigment is ground is linseed oil. If you apply paint to a wooden car the wood begins to absorb the oil and the paint grips the wood so that it stays there for an indefinite period. Now when you apply paint to metal it is very different. Metal has very little affinity for linseed oil. It lies on the surface like a skin and has not the "tooth," if I may use the term, on the metal. No matter how good a paint you use, if it has not that clutch on the metal its life is very short. The [illegible] I have is a partial remedy. I suppose that [illegible] the parts of the car are assembled a coat of raw linseed oil be applied to the plates while hot, because while iron is heated the pores are opened up in such a way that linseed oil will be absorbed. Subsequent coats of paint will cling to the oil.

A number of years ago I recommended a paint made of linseed oil and lamp black as being the most desirable for painting iron and steel structures, for the reason that lamp black absorbs more linseed oil in proportion to its weight than any other pigment. This paint has proved to be the most durable and is the nearest approach to perfection in painting metal cars. The Central of New Jersey uses lamp black as a color on all its freight cars.

W. R. McKeen, Jr. (Union Pacific).—The character of steel being so entirely different from that of wood, a great many advantages and possibilities are obtainable in a steel car design which were impossible with wooden cars. The use of steel is no reason why there should be a material increase in weight; my opinion is that it should decrease the weight. I make the following suggestions for steel passenger car construction:

1. Round roof, saving weight and giving greater strength.

2. Induced or mechanical ventilation, instead of the gravity system; intake of fresh air at the floor of car and exhaust ventilation at the top.

3. All laterally disposed steel should be utilized for strengthening the car frame in resisting shock, including side sills, plates, steel side, braces, etc. Sufficient area of cross section provided in center sills for small or ordinary shocks.

4. End construction such as to preclude the possibility of telescoping.

As to Mr. Waitt's item of the sweating of steel box cars with ordinary materials, this is limited to the amount of water contained in the air confined in the car; the volume of water in this condensation is self-evidently very insignificant. With the transportation of moisture bearing materials, however, there may be a slight increase of this condensation, but we have had two steel cars in service over a year, and there has been no damage from this cause so far. It is reasonable to suppose that the slight volume of water that might be condensed in the steel cars from such materials as potatoes, etc. would not be detrimental to the potatoes. Box cars however, are not the proper equipment for shipping such materials as a general proposition. They should be shipped in refrigerator cars, or in such cars as are provided with proper means of ventilation, ventilation being an absolute necessity as a rule for such things.

Mr. Waitt speaks of the trouble from the increased heat incident to the use of steel box cars in railroad yards. We have at present three to four hundred steel cars in railroad yards, and we have experienced no practical trouble from this feature; I believe our hopper bottom and gondola coal cars, so-called "baldheaded box cars," will give off as much heat as box cars would.

It is true, as Mr. Waitt states, that some steel elevators are lined. However, it is also true that for many years it was considered that elevators holding wheat should be made of wood, inside and out, to protect this very valuable grain, but at present there are steel elevators without any lining, the grain coming directly in contact with the steel shell. If these steel elevators are a success, as they unquestionably are, there should be no question as to the practicability of steel cars in the wheat trade. In fact, our steel box cars were used in this wheat traffic for a while with great satisfaction to the shippers.

C. A. Seley (C., R. I. & P.).—It is believed that center sills strong enough to carry their proportion of the lading will also be strong enough to transmit the pulling and buffing stresses. The remainder of the load may then be calculated for the side framing and transmitted by the bolsters to the trucks.

There is not much to be hoped for in standardization of framing of steel cars if we can judge of the record in regard to wooden cars. Such cars were mainly designed by the owning roads who had it in their power to get together on standardization. The majority of steel car designs have been made by the car builders, and because of competition it will be difficult to unify designs. There is not much need for this as an economic proposition as regards interchange repairs. It has been found in repairs of cars of composite construction that two-thirds or more of the cost is for labor leaving a small proportion for new material required. It is well known that heavy repairs of wooden cars reversed these ratios. This proves that the steel, though not indestructible, can in most cases be repaired and returned to service without much new material being required.

There is no doubt this is the era of steel and the passing of wood in car construction, but if in freight car design the sills, plates, posts and braces are of steel, it eliminates all of the expensive lumber, now difficult to obtain, and there is reasonable hope of securing suitable lumber for flooring, roofing, lining and sheathing for many years to come.

R. P. C. Sanderson (Virginian Ry.).—In 1896, a committee of the Master Car Builders' Association made ten recommendations which it believed should be followed by the designers of steel cars as follows:

1. Specially forged, pressed or rolled shapes, cast steel, etc. or patented forms of construction are undesirable for cars to be used in general interchange business.

2. Steel and iron bars and shapes of standard bridge specifications and regular market sizes should be generally preferred, so that railroads and car builders can avail themselves of the competition in open market when purchasing.

3. Accessibility in the design is of the greatest importance in keeping down the first cost and maintenance; parts that are riveted together should be so arranged that they will be equally convenient for hydraulic or power riveting when the car is being built, or for field riveting in repair work.

4. In designing riveted work it should be laid off with plenty of rivets, these to be spaced closely as in the boiler work, and with the same care to insure true, fair holes; hot rivets, well driven, and completely filled holes, as in first-class boiler work, if necessary.

5. If bolts are used to hold iron or steel parts in position, not merely to carry weight, they must be turned bolts (a driving fit) in carefully reamed holes, fitted with the greatest care.

6. Every structure has a foundation, every machine has a bed plate, every animal, bird, fish, and most of the higher works of nature have a backbone or spine on or around which the structure is framed; this cardinal principal of design seems to have been largely overlooked in freight car construction, and it is believed that the center sills of a freight car should be made its main strength and reliance, and that the entire load should be carried from the platform, the upper works being arranged simply as a housing to confine and protect the load.

7. To enable the center sills to withstand collision and every shocks to the best advantage these sills should be spaced so that they will be directly in line with the dead blocks, and thus take the buffing and collision shocks in direct compression. Also their depth should be such that at least the center line of draft and center of the dead blocks will be within the vertical dimensions of the sills.

8. That care should be taken to avoid punching or drilling holes in the flanges of channels or I-beams where these are subject to heavy strains, especially tension or bending strains, unless additional material is added to compensate for this.

9. That with the change from wood to steel the necessity for truss rods no longer exists for cars of reasonable lengths, but that ample and sufficient strength can be obtained within reasonable limits of weights without the use of truss rods and consequent need of adjustment.

10. On account of the sweating and rusting of iron and steel wood is preferable to iron or steel for flooring, siding and lining of merchandise and stock cars.

There is one other cardinal principle of design for steel cars not mentioned by the committee, which I believe to be of the first importance. Wherever possible, parts and attachments, and also the means of attachment, subject to strains in collision shocks etc., beyond their elastic limit should not be strained in reversal whenever it is possible to avoid this; when it is impossible, double or triple the usual margin of security should be allowed, and for this reason it is especially important to-day that collision shocks be transmitted to the underframing through dead blocks and not through the couplers and draft attachments. The dead-blocks, so called man-killers in the day of link and pin couplers, had a bad name then, and there was a strong sentiment against their use based on humane consideration; but since the Interstate Commerce Commission says that no man shall go between cars for the purpose of coupling and uncoupling cars and we have gone to the expense of furnishing automatic couplers, etc., it seems foolish to dispense with this most valuable protection to the steel underframe of the car from the excessive damage which will follow in a collision whether light or heavy when the dead blocks are not used.

The Fortieth Street Track Elevation of the Chicago Junction.

The Fortieth street track elevation work in Chicago of the Chicago Junction Railway, although not unlike much other track elevation work that has been done there in its general features, is of special interest because of the construction by the Chicago Junction, as a part of the work, of branch lines for the South Side Elevated Railroad.

The Chicago Junction is a switching road the chief function of which is to handle the Union Stock Yards business. The 40th street line runs east to connect with the Illinois Central on the lake front and crosses the Lake Shore & Michigan Southern, the Chicago Rock Island & P[illegible] Pittsburg Ft. Wayne & C[illegible] and the Chicago & Western Indiana, all of which [illegible] to the stock yards through it. Built some 3[illegible] years ago [illegible] in a closely built section of the city, occupying the former [illegible] the thoroughfare from which it takes its name.

The South Side E[illegible] runs south to 40th [illegible] turns east for four blocks and [illegible] south[illegible]. It was desired to extend the [illegible] eastward [illegible] 40th [illegible] to traverse the populous [illegible] district [illegible] Kenwood and also to build a line westward in 40th street to the Union Stock Yards. The Chicago Junction agreed to build both lines and lease them to the elevated railroad company. For the eastward extension the Chicago Junction built a three-track line on its raised grade, the two southerly tracks being equipped for the exclusive use of the elevated trains. The westward, or stock yards, extension is the usual steel structure which is being built above the team road as far as Union avenue, two blocks from the yards, where it swings southward to enter the yards.

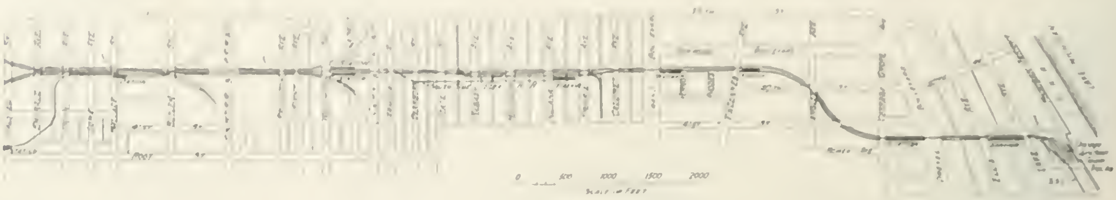


Fig. 1—Map of 40th Street Track Elevation Work; Chicago Junction Railway.

The accompanying map, Fig. 1, shows the extent of the track elevation work, which ends on the west with a run-off starting east of Union avenue. Work was begun in April, 1905, at the east end. As the map shows, besides the Illinois Central connection, the Chicago Junction has some team tracks at this point, which lie at right angles to the general direction of the line. The grade of the north track, used by the Junction, descends gradually from Drexel boulevard, while that of the other two rises from Ellis avenue to enable the elevated railroad's tracks to acquire the requisite head room over the tracks at grade east of Lake avenue. From this avenue eastward the elevated road built its own line on a steel structure. It turns southward to a station on 42d street and Oakenwald avenue, a block further south than the map shows. Adjacent to the station is an elevated yard of several tracks.

The Chicago Junction had a double-track line from the lake to Wentworth avenue before elevation work began, four tracks from Wentworth to Butler, and six from Butler to the stock yards. As already mentioned, the elevation work started at the east end. The south retaining wall of the section east of State street was built first, the adjacent track being used as a construction track and traffic carried on the other. When the south wall was done, a trestle was built to west of Langley avenue and traffic thrown on this while building the north wall from the northerly track, still at grade. From Langley avenue to Grand boulevard there was more room and the line from the trestle was run off on to a partial fill. The north track also was raised by filling as the work advanced, though kept at a lower lever than the operating track. From Grand boulevard to State street the north 26-ft. of the right-of-way had to be given up to the city for a street, under the terms of the ordinance. While this stretch of the north wall was being built the operating track was run outside of same, as the space between walls was too narrow to accommodate the construction and operating tracks conveniently.

The line formerly crossed under the Lake Shore and the Rock Island tracks, already elevated. With the new work the Chicago Junction agreed to go over these two roads. Passing under the South Side Elevated east of State street it rises on a 1.3 per cent. grade to a maximum of 41 ft. above city datum above the two roads mentioned, which depressed their tracks slightly to give an 18-ft. net clearance under the Junction's bridge. From this point the Junction runs down on a 1.33 per cent. grade to an under crossing of the P. F. W. & C. and the Western Indiana. This formerly was a grade crossing, but the grades were separated, the north-and-south roads going overhead, while the Junction raised only about 2 ft. to secure the gradient above mentioned. The grade ascends again to an over crossing of Butler and Wallace streets and Union avenue, the run-off starting a short distance east of the latter, as already mentioned, and extending west of Halsted street.

All masonry work is gravel concrete, the retaining walls being an equivalent 1:3:6 mixture, and the copings and bridge seats 1:2:4. The walls averaged a foundation depth of 6 ft., but where there was a possibility of the walls being in proximity to future large buildings, especially where the soil was mostly sand, safety was assured by going down 10 ft. Piles were used only at two points. The abutments of the Lake Shore-Rock Island crossing are so founded, due to the height of same, the soil conditions and the length of the bridge span. Also, where the elevated railroad structure crosses over the P. F. W. & C. and C. & W. I. the poor bottom and the length of span—230 ft—necessitated piling.

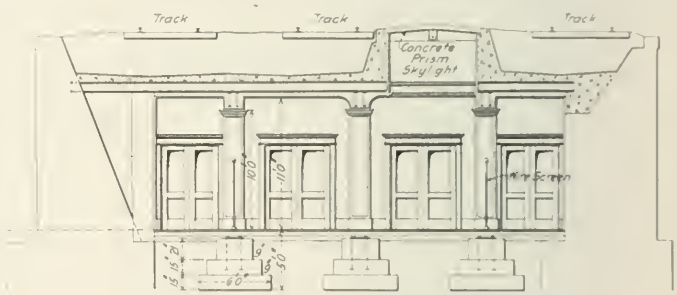


Fig. 2—Cross Section Showing Details of Entrance.

It has already been mentioned that the western extension of the South Side Elevated is built above the Chicago Junction for a part of the distance. As the map (Fig. 1) shows, this is between Armour and Union avenues. The steel structure is carried on the retaining walls, which are widened, or buttressed, at the top, wherever the steel columns occur, to furnish the requisite bearing area for the latter. The load is not sufficient to require any increase in the base dimension of the wall.

An interesting detail of the north wall as far west as Dearborn street is a conduit for telephone, telegraph, signal and electric light wires. It is a four-duct conduit embedded in the wall 12 in. below the top, with openings at intervals of about 300 ft., which are 12 in. wide, 24 in. deep and 48 in. long at intervals, as shown in the

Chicago Junction Railway and Elevated Railroad Bridges Over Lake Shore and Rock Island Tracks.

Elevated Station in Stock Yards; Chicago Junction.

Drexel Boulevard Crossing, Kenwood Line; Chicago Junction Track Elevation.

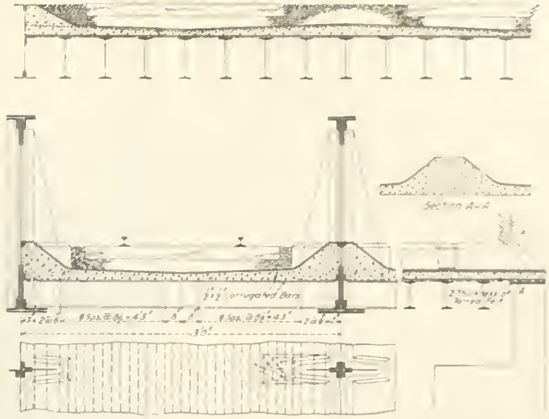


Fig. 3—Bridge Floor Details; Chicago Junction Track Elevation.

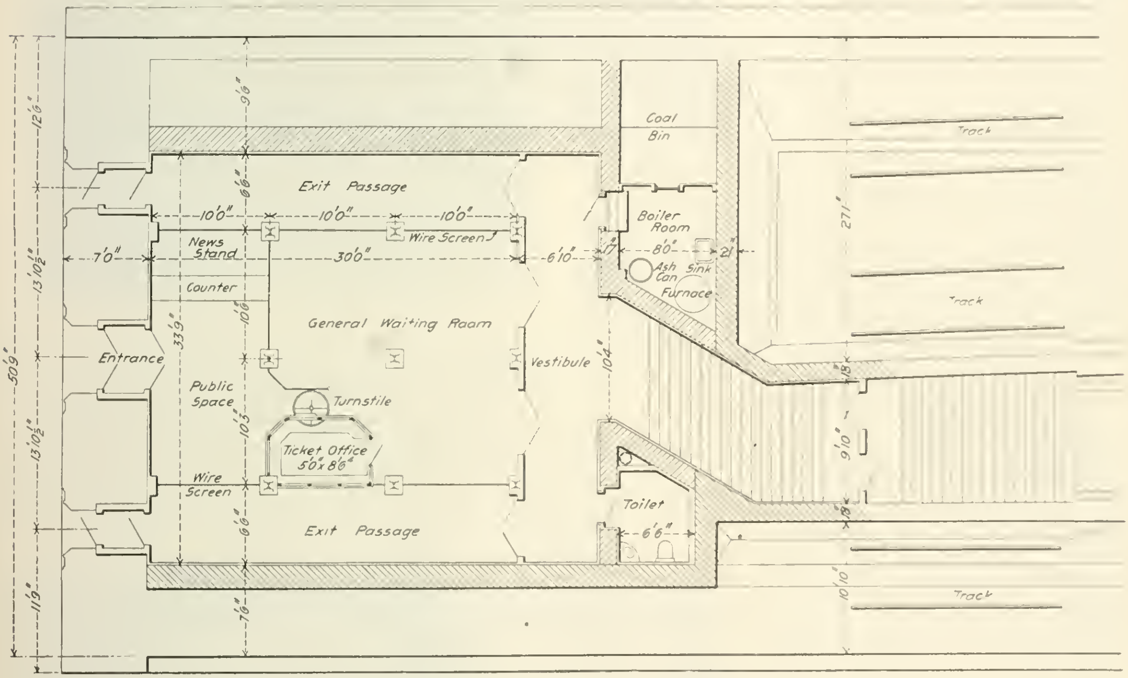


Fig. 4—Details of Typical Elevated Railroad Station; Chicago Junction Railway.

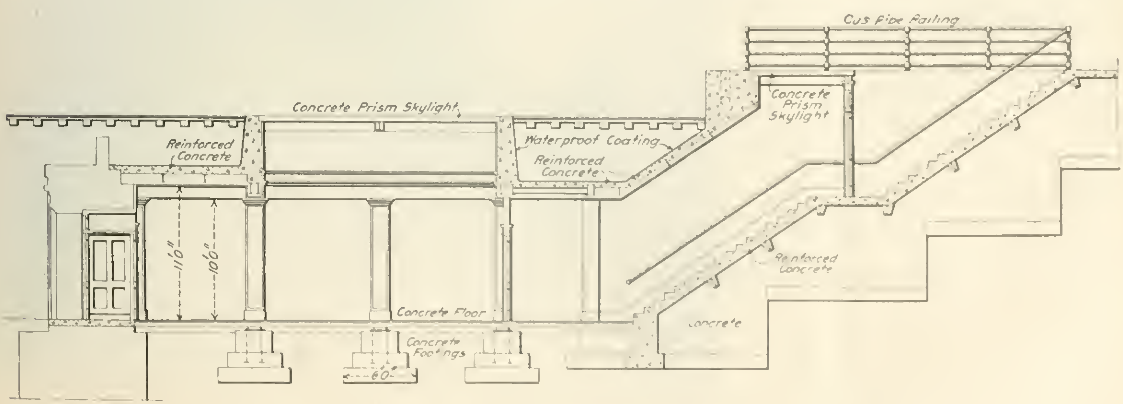


Fig. 5—Longitudinal Section Through Approach.

drawing. The openings have a wrought iron band around the top anchored into the concrete by four short rods bent downward, and are closed with a malleable iron cover.

Details of the longer span bridge floors are shown in Fig. 3. For the alleys and narrow streets the I-beams run longitudinally and girders are not used. The floors are the same for both kinds. The concrete slabs, which are a 1:2:4 gravel mixture, are reinforced with ½-in. corrugated steel bars. The slabs are waterproofed on the horizontal portion with "Medusa" compound contained in a 1-in. sidewalk finish top coat, overlaid with a ½-in. coat of gum asphalt and above this 1 in. of asphalt mastic. In the inclined side sections, where a trowel finish could not be applied on account of the forms, the "Medusa" compound was put in the body concrete. The small triangular-shaped trough next to the girders is filled with gum asphalt. At the overlap of slab and abutment two thicknesses of tarred felt are placed. Four of the bridges are exception to this form of construction, limited clearance preventing the use of the concrete slabs. In these instances metal plates are laid directly on the I-beams.

The stations for the elevated railroad on the Kenwood extension are a feature of special interest. Details of a typical station are shown in Fig. 1. They are at the street level and are of fireproof construction throughout. Entrance and exits are through the abutment, the face of which is bush-hammered, presenting a good appearance. The station interiors are roomy, well-lighted and well-arranged. The train platforms are concrete and the roofs are the usual umbrella type with steel framework and transite board roof covering. The stations between Lake and Ellis avenues and between Drexel boulevard and Cottage Grove avenue have entrances from both streets. All subways are lighted by the railroad company, the power being furnished by the station at the stock yards. The wall conduit already described is used east of Dearborn street.

The Kenwood line has been in service for about two months. It is expected to have the work west of State street ready by the first of the year or shortly thereafter. All of the concrete work, street paving, sidewalk and sewer work was done by James O. Heyworth, Contractor, Chicago. The steel work for the elevated railroad, including erection, is being done by the American Bridge Company. W. M. Hughes, Consulting Engineer, Chicago, designed all of the steel work, which included the subway bridges and the elevated railroad structure. The filling and tracklaying are being done by company forces. The work was designed and executed under the direction of J. B. Cox, until recently Chief Engineer of the road. O. F. Cole, who as Principal Assistant Engineer was in active charge of the work, succeeded Mr. Cox as Chief Engineer and now has entire supervision of the work.

The Hudson & Manhattan Tunnels.

The first of the Hudson & Manhattan Railroad tunnels under the Hudson river will be opened to the public on February 25. This section consists of a twin tube tunnel from Hoboken, N. J., to Morton street, New York, and thence northeasterly to Sixth avenue and Nineteenth street, nearly three miles in all. The accompanying map shows the entire system, which has direct connection with the principal transportation lines on both sides of the river. The first section comprises the north tunnels, which are about to be opened. The second section, the south tunnels, is to be opened next September. They run from Cortlandt and Fulton streets, New York, to Jersey City, where a large terminal station has been built in solid rock directly beneath the present Pennsylvania Railroad station. The third section is a tunnel, 1¼ miles long, connecting the terminal in Jersey City with that in Hoboken. The principal point on this line is the Erie terminal, where the tunnel station is nearer the train shed than the entrance to the Erie ferry itself is. The fourth section is a branch line running from Jersey City to Newark. This runs underground through Jersey City and then comes to the surface near the Summit avenue station, from which point the trains will run over the Pennsylvania tracks to Newark. Another branch is now being built in Manhattan. It runs from Sixth avenue east under Ninth street and will connect with the Interborough Rapid Transit subway near Astor place.

The project of building a tunnel under the Hudson river for handling local passenger traffic between New Jersey and New York City dates back to 1878, when D. C. Haskins, a civil engineer, planned a brick tunnel from Hoboken to New York. Trains were to be operated by steam and the New York terminal was to be in the vicinity of Washington Square. A company was formed which spent a good deal of money and built about 1,200 ft. of tunnel. This company failed and in 1889 the undertaking was temporarily abandoned. Ten years later another company was organized with English capital, and S. Pearson & Son, the firm which is now building the East river section of the Pennsylvania tunnels, resumed work where the Haskins company had left it. This company added about 1,800 ft. to the part already built and then also failed. These early attempts were marked by several accidents. The tunnel was

Interior of Tube; Hudson & Manhattan.

finally allowed to fill with water. In 1899 the property was sold at a receiver's sale and in 1902 it was taken over by the New York & Jersey, organized by William McAdoo. The Hudson & Manhattan was incorporated the next year to build the south tunnels and the former company and other subsidiaries have since been merged with it. The Hudson Companies is a construction company. The old tunnel was completed as one of the north tubes, of which the westbound tube was driven through in March, 1904, and the eastbound some months later. Work on the south tunnels was begun in the summer of 1905, and both of these tubes have now been driven from the New Jersey side to about the pier-head line at New York. The

Station Platform; Hudson & Manhattan.

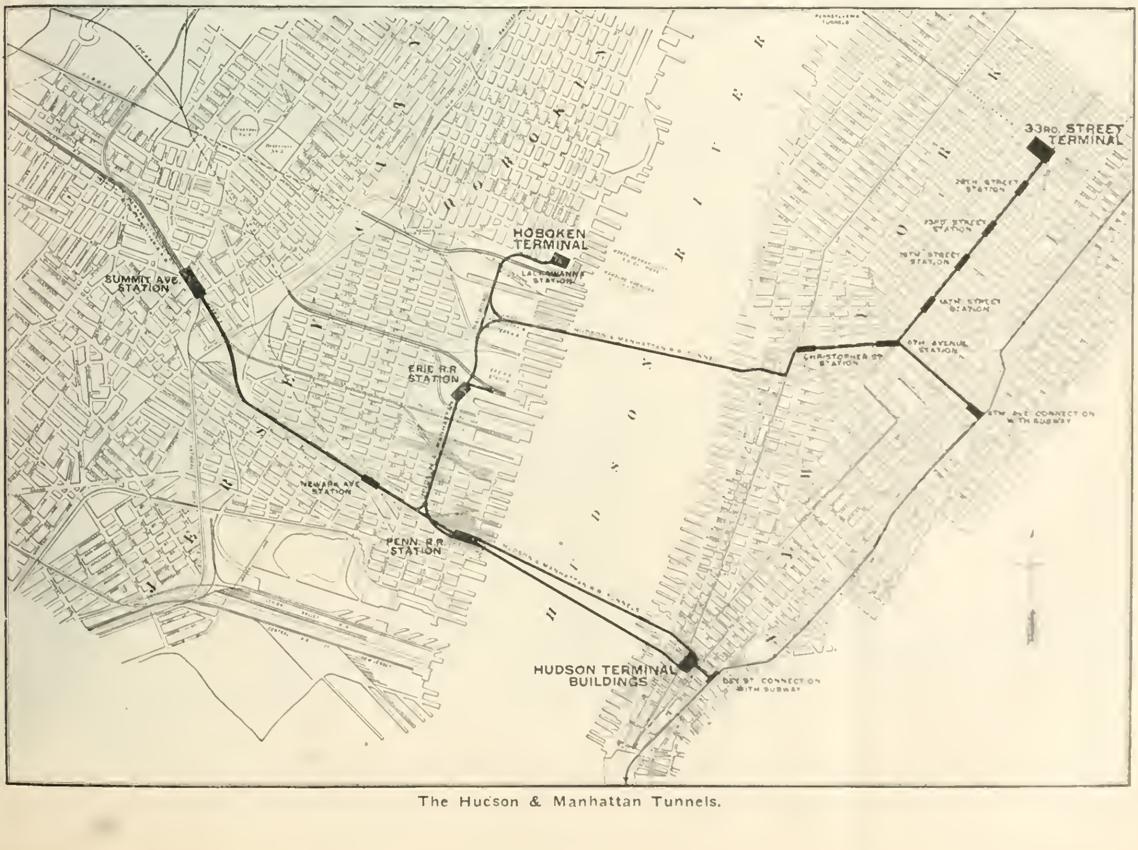
entire system, nearly nine miles, is to be double-track and will be put in operation during the coming summer. The cost is estimated at $70,000,000.

There will be no rail connection with other lines except, as mentioned above, at the Summit avenue station. Passenger stations in Manhattan, on the line about to be opened, will be located as follows: Christopher and Greenwich streets, connecting with the Ninth avenue elevated; Christopher street and Sixth avenue, connecting with the Sixth avenue elevated; and, in Sixth avenue, at Fourteenth, Nineteenth, Twenty-third, Twenty-eighth and Thirty-third streets. For the present, trains will run only to Nineteenth street and Sixth avenue. At the Hoboken terminal, connection is made with the Delaware, Lackawanna & Western, where all through and local passengers coming in from the west may get out of the trains and descend directly to the tunnel cars without leaving the station. The first section is to be operated by eight-car trains, and the time between Hoboken and Nineteenth street, New York, will be about 10 minutes. The cars were described in the *Railroad Gazette* of June 14, 1907.

View Near Hoboken Terminal; Hudson & Manhattan.

The platforms are so arranged at the terminal stations that passengers enter and leave the cars at the same time, those leaving go out on one side and those entering come in on the opposite side. This, it is hoped, will do away with much of the congestion which occurs at terminal stations on other lines. The tracks at all station platforms are on a tangent, so that there is no dangerous space between the cars and the platform, as is the case where stations are built on a curve.

The stations are intended to be large enough to accommodate present traffic and provide room for increased crowds if improved train service later gives the tunnels more carrying capacity. Every part of the stations is of either concrete or metal. One of the accompanying photographs shows the interior of a station. A noticeable difference between the appearance of these stations and those of the Interborough Rapid Transit subway is that in the former there is a curtain wall between the tracks at all points except where there are crossovers as shown in the photograph taken near the Lackawanna terminal. This view shows the form of construction of the tunnels under city streets in part of Hoboken and Jersey City and under Sixth avenue in New York. Most of the line, however, is tube construction. A typical view of this is shown in another photograph. The tubes are entirely lined with concrete except in the under-river sections and on certain curves. In these cases, the concrete is carried only half-way up the walls. The object of separ-



The Hudson & Manhattan Tunnels.

ating the tracks by curtain walls in the sections where they do not run in tubes is to secure natural ventilation due to the movement of trains. A system of power ventilation has also been installed.

The interior diameter of the tubes is 15 ft. 3 in. Under the river the rails are from 60 ft. to 90 ft. below the surface of the water. The depth of earth and rock between the roof of the tunnel and the water ranges from 15 ft. to 40 ft., the deepest part of the river being on the New York side. The two tubes are about 30 ft. apart for the greater part of the distance under the river.

The down town New York terminal is to be under the Hudson Terminal buildings at Church and Cortlandt streets. These structures occupy the larger part of two city blocks and are 22 stories high. They will accommodate 10,000 office tenants and will be opened on May 1. They contain more than 25 acres of floor space. One building is on Cortlandt street and one on Fulton street. They are separated by Dey street and are connected by a bridge at the third story. The tunnels come from under the Hudson river and under the terminal buildings about 30 ft. below the street level, forming a loop. The train platforms are two stories below the street level. A foot passage runs under Dey street to a station on the Interborough subway under Broadway.

It has been estimated that 75 per cent. of the passenger traffic now carried between New York City and the New Jersey side of the river by ferries will be diverted to the tunnels when they are all in operation. The numbers of passengers carried in the last three years by three of the largest ferries are as follows:

	1907.	1906.	1905.
Pennsylvania	43,406,750	37,745,012	32,829,182
Erie	19,718,465	18,796,871	17,321,759
Lackawanna	46,389,825	40,252,022	34,986,798

The officers who have been in charge of the building of the tunnels are: Walter G. Oakman, President of the Hudson Companies; William G. McAdoo, President of the Hudson & Manhattan; Pliny Fisk and William M. Barnum, of the banking firm of Harvey Fisk & Sons; Charles M. Jacobs, Chief Engineer, and J. Vipond Davies, Deputy Chief Engineer.

Increasing the Capacity of Brooklyn Bridge.

Improvements looking to a considerable increase in the traffic capacity of Brooklyn Bridge, with especial relation to the Manhattan terminal, are now underway and an important part of the work covered by the plans in their entirety—the extension of the bridge approach over Park Row—has been completed and is now in operation. The plans for adapting the bridge to its part of the service required as a section of the loop now being built, which is designed to form a close connection between the boroughs of Manhattan and Brooklyn, are now being carried out. This improvement involves principally the widening of the Manhattan approach so as to afford room for team traffic to the outside of the space now utilized for that purpose, which latter will be occupied by tracks connecting with the loop subway near Park Row and Centre street.

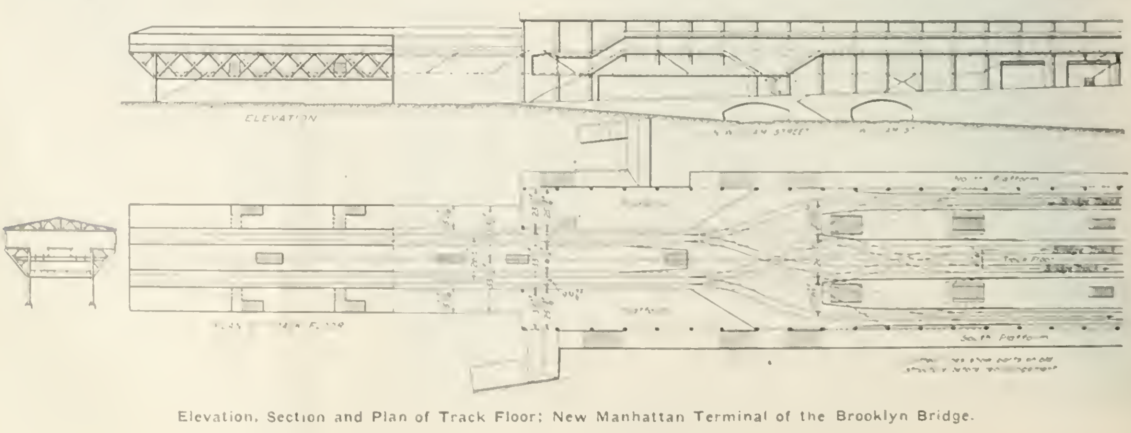
The object of the widening and its general character will appear clearly from an examination of the accompanying engravings. From North William street to Pearl street the bridge approach is being widened to the building line on each side by the erection of steel structures supported from the ground upon columns and attached to the existing stone masonry of the approach. These additions are of a general width of about 20 ft. on each side as far as Cliff street, at which point the widening is tapered off, so that at Pearl street the outer limit of the new structure ends on a line with the present approach.

How the connection will be formed between the subway level and the level of the bridge tracks is shown upon the plan and elevation of the bridge approach. The tracks will be brought up on a gradual incline from Park Row and Centre street so as to reach the present bridge level at or near Cliff street. This will involve cutting through the upper part of the various warehouses now occupying the space underneath the arches of the bridge approach. At the extreme Manhattan end, in order to avoid interference with other bridge traffic the tracks leading from the subway will be carried at the outer edge of the approach structure. Hence the necessity of the widening to afford teaming space. Beyond Cliff street, when the incline has reached the present bridge track level, the tracks will

Widening of Manhattan Approach.

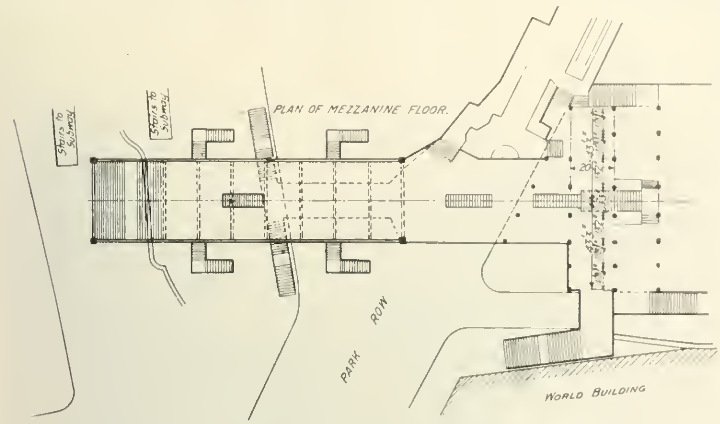
be brought closer together, as shown upon the plan, and occupy the space now used by bridge trains.

On account of the nature of the location and the close quarters within which the work is confined, the character of the structure forming the lateral extensions varies somewhat in detail. Typical bents, however, are composed of girders made up of web plates 38½ in. by ⅜ in., four angles each 5 by 5 by ⅝ in., a top flange 16 in. by ½ in., and a bottom flange 12 in. by ⅝ in. These are supported upon built-up columns. The floor beams are generally 20-in. I-beams of a 65-lb. section, and these are supported by three rows



Elevation, Section and Plan of Track Floor; New Manhattan Terminal of the Brooklyn Bridge.

of tie-rods 1 in. in diameter upset at the ends to 1¼ in. It is required that all outside fascia girders be exactly 40 in. deep from the top of the top cover plate to the bottom of the first cover plate of the bottom flange. The floor beams vary in spacing on different sections in order to equalize spacing between block limits, but it is ordinarily 4 ft. 2 in. or 4 ft. 3 in. The whole length of the steel structure is 612 ft. 6¾ in. on the south side of the approach and approximately the same on the north.



Plan of Mezzanine Floor of New Terminal at Park Row, Manhattan.

Work upon the widening has progressed to the extent that most of the steel work is now in place. A general idea of the nature of the work may be gained from the photograph.

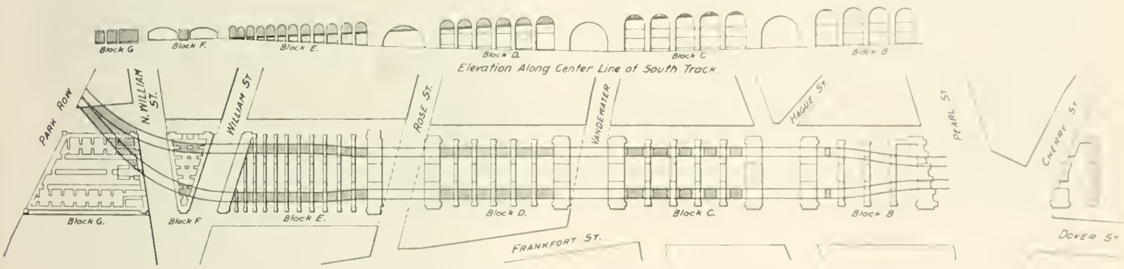
The improvements above described are entirely independent of those now about completed and which are involved in the extension of the elevated track floor of the bridge over Park Row. This was put into service on January 27. The difficulty which this temporary extension was designed to remedy was the lack of room at the Manhattan terminal to handle trains of sufficient length to care for the traffic in rush hours. Previously bridge cable trains of five cars each were run which involved a change at the Brooklyn terminal for all passengers destined for points on the elevated lines of the Brooklyn Rapid Transit—a very large percentage of the entire bridge travel.

On the date above named, six-car trains from the several Brooklyn elevated lines began running through to the Manhattan terminal without change at the Brooklyn end; and during the evening rush hours similar trains now run from the Park Row terminal to the terminals of the several lines in Brooklyn without change.

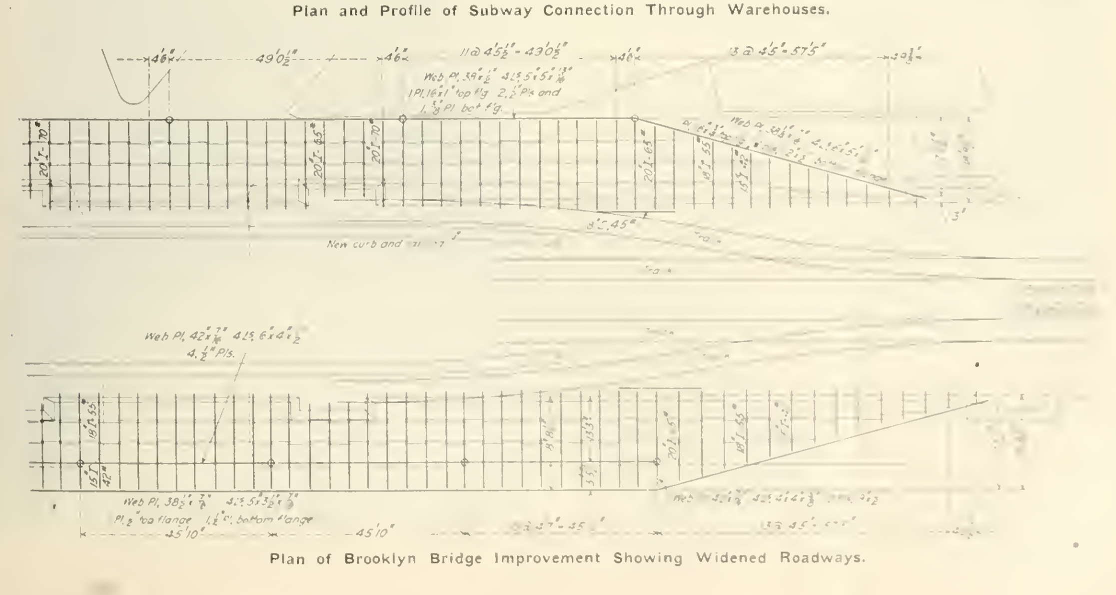
It is also expected to increase the bridge trolley service from 270 to 310 cars in the morning rush hours and from 300 to 320 cars in the evening rush hours.

The extension and the rearrangement of terminal facilities rendered possible by its completion are clearly shown in the engravings and one of the photographs. A steel structure 160 ft. long has been erected over Park Row, having a main floor on a level with the level of the previously existing elevated tracks, and with tracks extending to the end of the addition. The latter reaches almost to the line of fence of City Hall park and is directly opposite the entrances to and exits from the subway. It is architecturally in harmony with the previous structure and has a broad stairway, 40 ft. wide, leading to a mezzanine floor whence the crowd is distributed by five stairways leading to the train floor above and designated according to the destination of trains. Aside from the additional track room afforded, this whole amount of space is a substitute for the two stairways and narrow platform which formerly extended over Park Row. This is shown in dotted lines upon the engraving of the plan of the mezzanine floor.

With sufficient room for the extension of tracks to accommodate



Plan and Profile of Subway Connection Through Warehouses.



Plan of Brooklyn Bridge Improvement Showing Widened Roadways.

six-car trains. It has been possible to rearrange the crossovers between inbound and outbound tracks. These were formerly at the point shown by the dotted lines, but have now been moved toward the end to the location shown in full lines. Under this arrangement about 310 ft. of free space for loading and unloading is afforded between the end of the tracks and the fouling points of the switches, ample room for six-car trains. This change of tracks also made necessary some changes in platforms, lengthening some and shortening others, as indicated in dotted lines upon the track plan, with, however, little change in the amount of available space.

It is estimated that the increase in loading and unloading facilities, the use of six-car trains and the avoidance of change at the Brooklyn end of the bridge, will increase its capacity about 9,000 passengers per hour. The two weeks during which the extension has been in service afford some ground for hope that bridge crushes of unsavory notoriety are things of the past—temporarily, at least. The first few days of service were marked, during the hours most favorable to congestion, by crushes perhaps equal to anything in the previous history of the bridge, but both by the engineers of the city bridge department and the officials of the operating tenant, the Brooklyn Rapid Transit Company, these were attributed to the lack of familiarity with the proper lines of passenger progression on the part of the public and of the company's employees. Since the first week, however, there has been no noticeable difficulty in handling traffic as fast as it presented itself and even during that week 61 trains per hour were despatched from the Manhattan terminal. With the completion of the signal and interlocking arrangements it may be expected that trains will be handled regularly and smoothly under this or even less headway.

New Extension of Manhattan Terminal of Brooklyn Bridge.

It has, however, been suggested that a considerable improvement could be effected by increasing the door and gate space. It is calculated that in the absence of side doors and on account of the narrow gates upon the regular cars of the Brooklyn Rapid Transit Company, the entrance space is some 18 ft. less than upon the cable cars of which they take the place. This would be roughly equivalent to a stream of nine persons abreast. Even with the present equipment it is apparent that a great improvement has been made, though it is possible to attribute some of the decreased congestion upon the bridge to the relief afforded by the East river tunnels from the battery to Borough Hall.

Both of the improvements herein described were planned and executed, or are under execution by the city bridge department, C. M. Ingersoll, Chief Engineer. The extension and rearrangement of tracks was made in accordance with general plans accepted by the Brooklyn Rapid Transit Company. Though the work was accomplished under a daily traffic of 126,000 persons, it has been brought to completion with remarkable rapidity.

Foreign Railroad Notes.

The French Minister of Public Works has submitted to Parliament a bill for pensions to railroad employees, by which all employees who have served as long as two years will be entitled on reaching the age of 55 to a pension at the rate of 17 per cent. of their regular pay, and at the same rate if invalided at an earlier age. In case of the employee's death his widow is to be entitled to one-half of this pension. In case of death before 55, widow and orphans will have the same rights as if he were already enjoying a pension. This is to apply to employees of the railroad companies as well as to those of the small system of State Railroads.

The Prussian State Railroad authorities lay stress on providing trainmen, etc., with facilities for taking something hot to eat or drink when on duty during cold weather. One group of lines offers them powdered sweet chocolate, put up in packages each of which is enough for a large cup, which can be prepared very quickly with boiling water kept ready for the men at a large proportion of all the stations. The prepared chocolate is sold to the men for $1.20 per 100 packages, which may be charged against wages.

To encourage traveling for winter sports, the Swiss railroads will accept those long snow shoes which the Norwegians call "skis" and small toboggans as baggage, but not bob-sleighs (spelled out in just those letters as if the Swiss were Yankees), which are a little clumsy for baggage cars.

To show how much more important to France is the old Mont Cenis Tunnel than the new Simplon the statistics of French traffic passing by the two routes in the first quarter of 1907 are cited, when 93,115 tons of freight went from France to Italy by the Mont Cenis and 3,336 by the Simplon.

Car Surpluses and Shortages, February 5.

The following table is from bulletin No. 17 of the American Railway Association's Committee on Car Efficiency. It summarizes the car surpluses and shortages from October 30, 1907, to February 5, 1908, inclusive, being similar to the table published in the *Railroad Gazette* of February 7, 1908, but carried to a later date, and with the figures for January 8 and January 22, 1908, revised to include reports since received.

While the figures for February 5 represent fewer roads than those for January 22, the omitted roads are small and would make no material change in the totals. The total surplus of all cars on February 5 is larger than on January 22 because of some large increases in coal, gondola and flat cars.

Considering all classes of cars together, the surpluses have decreased slightly in the Eastern, Middle, Central Western and South-western groups. All the other groups show increased surpluses of cars, the highest percentage of increase appearing in the Southern group. The surplus of box cars has considerably decreased, showing an improvement in general business. The surplus of box cars decreased in the New England, Eastern, Middle, North Atlantic, Northwestern, Central Western and Southwestern groups, while the other groups reported slightly increased surpluses of box cars. Surpluses of coal and gondola cars show increases in all groups except the Northwestern, Central Western and Pacific. The heaviest increase was in the Eastern group. The increase in the Middle group, where the surplus of these cars has been heaviest, was slight, while there was a continued decrease in the Northwestern group and a slight indication of improvement in the Pacific group. The total surplus amounts to about 15 per cent. of the country's cars.

	Number roads	Surpluses: Box	Flat	Coal, gondola and hopper	Other kinds	Total	Shortages: Box	Flat	Coal, gondola and hopper	Other kinds	Total
Feb. 5, 1908	155	111,[illegible]46	30,28[illegible]	156,620	44,974	343,217	737	281	0	67	1,085
Jan. 22, 1908	161	124,622	27,328	142,[illegible]38	48,292	342,580	392	132	79	135	738
Jan. 8, 1908	163	149,661	23,087	127,158	41,871	341,763	457	34	42	120	653
Dec. 24, 1907	158	87,711	14,719	64,556	42,300	209,310	187	81	191	265	724
Dec. 11, 1907	153	18,957	9,888	27,162	33,012	119,339	2,306	120	746	848	4,520
Nov. 27, 1907	160	16,216	3,615	10,028	10,429	40,348	11,908	868	2,964	2,224	17,964
Nov. 13, 1907	161	4,403	1,218	2,365	4,525	12,201	37,473	3,066	10,914	5,550	57,003
Oct. 30, 1907	161	786	600	1,285	1,275	3,946	61,592	3,516	15,987	9,632	90,757

Raven's Cab Signal.*

BY J. PIGG.

Actuation of Apparatus. As already stated, this system is electrical, and it is designed to collect indications by the rubbing of metallic brushes (Fig. 4) carried on the engine over metallic bars (Figs. 8 and 10) placed on the line. This method of collection is not essential to the system, since it is capable of being operated equally well without contact, by causing electromagnets on the line to influence magnets on the engine. This method of collection is not now being put forward.

Characters of Indications.—The system is one which uses visual and audible signals. The visual signals are (1) a small semaphore arm by which the "condition of line" signals are given, and (2) two small pointers showing 1—2 and 3—4 respectively, which are the route indicators. The audible signals, which are of the nature of "call attention" signals, are given by a bell.

Fig. 1—Failure Indicator.

Fig. 3—Diverging Route Indicator.

Besides these indicators, the instrument carried on the engine includes a visual failure indicator, by which the conditions of the apparatus can be gaged.

Figs. 1 and 2 show several forms in which the indicator on the engine has been made the circular form being the latest. Fig. 9 shows in diagrammatic form the complete equipment of engine and line circuits, the latter being for a 3-way diverging junction. Fig. 5 is a photograph of the back of the engine indicator with the cover removed to expose the apparatus.

Details of Indicator.—The action of the apparatus is of the simplest possible character, the main principle being the invariable operation of the apparatus at certain points by the natural action of certain parts without the aid of either the signalman or the driver, and the subsequent continuance of the indications resulting from the natural operations until they are stopped or reversed by the action of the signalman.

Considering Fig. 9, and leaving, for the present, consideration of the line of bars out of the center of the space between the running rails, it will be found that the short-circuiting of brushes 1 and 2 on, say, bar A, causes a current to pass through the main magnet, A¹, by which its armature is raised, putting the semaphore arm to danger. At the same time the armature closes the circuit of the springs *c d*, diverting the current direct back to the battery after passing through A¹. Hence the armature of the latter will remain attracted to the poles as long as may be necessary for the purposes of the apparatus.

Besides passing through A¹ and the brushes, the initial current passes through the bell relay C¹ during the continuance of the short-circuiting of the brushes 1 and 2, the armature is attracted and breaks the circuit through the spring contact (*e*). This contact forms part of the bell circuit, which itself is connected in shunt across the electromagnet A¹. Hence when the armature of A¹ is raised, the current from the engine battery tends to divide, part passing by A¹ and part by the bell. The connections, however, are such that current only passes to the bell when C¹ is unenergized, and this condition only obtains when the brushes 1 and 2 are not short-circuited. When the brushes are on a metallic bar, say A, therefore, the bell is silent, but as soon as they pass off the bars it commences to ring.

In addition to passing through the electromagnets A¹ and C¹, as described, the current to the brush 1 passes through the springs c^1 d^1, and c^2 d^2, each pair of which is normally in contact. These springs are opened by the raising of the armatures of D¹ and D² respectively. Opening the circuit at either c^1 d^1 of c^2 d^2 obviously releases the armature of A¹, and, as a consequence, stops the ringing of the bell and lowers the semaphore arm.

Currents passing through D¹ are collected from the line by the brush 2, currents passing through D² are collected from the line by one or the other of the brushes 3 and 4.

Between the poles of D¹ and D² are placed magnetized needles, n, n^1, pivoted to turn under the polarity of the poles when the electromagnets are energized. The spindles carry the pointers shown in Fig. 1. Each spindle also carries a small metal sector, slotted as shown by Figs. 9 and 5, in which rides a small metallic loop, pivoted at the other end. The passage of a current through, say, D¹ deflects the needle to one side, and the loop drops into a recess at the end of the slot and locks the needle and pointer on the front of the instrument in the deflected position. At the same time that this occurs the lifting of the armature of D¹ breaks the contact c^1 d^1, and lowers the semaphore arm and stops the bell as already stated.

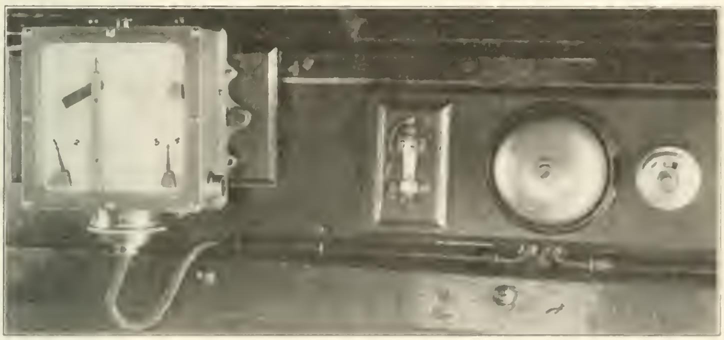


Fig. 2—Apparatus in Cab of Engine.

Auxiliary Apparatus on Engine.—The engine carries, in addition to the apparatus described, two rotary switches, the arrangement of which is shown in Fig. 6. Each switch consists of a cast steel wheel free to rotate, the spindle of which carries a two-part commutator, on which bear two springs. The wheel is weighted so as to take up a normal position. In this position the springs bearing on the commutator are insulated from each other, but when the wheel is rotated they are connected through the commutator. The springs are connected with the brushes 1 and 2 respectively, and each rotary switch, when turned from its normal position, connects the brushes in the same way as the latter are connected when on the bar A, or any subsequent bar of those shown in Fig. 9.

Track Apparatus.—The rotary switches run over fixed bars on the line side of the general form shown on the diagram, and of which more detail is shown by Fig. 7. These bars are fixed in close proximity to the bar A, as shown by Fig. 8. Hence the rotary switches are only actuated at or near the bar A.

Turning now to the line equipment, the point represented as being approached is, as already stated, a three way diverging junction. The six levers shown represent the home and advance signals for each of the diverging lines. Each home lever is fitted with a double-pole, and each advance lever with a single-pole switch, which are operated by the levers in the ordinary movement for operating

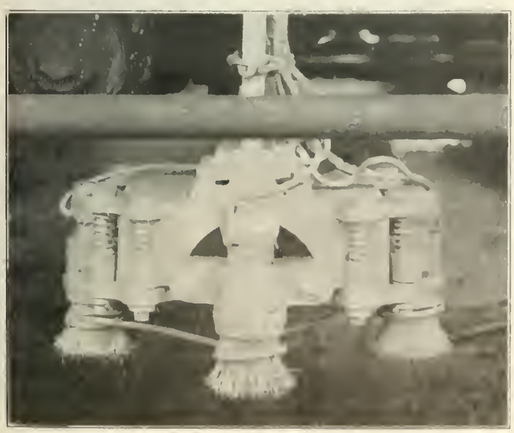


Fig. 4—Brushes.

*From a paper read before the Institution of Electrical Engineers, London, December, 1907. The introductory part was given in the *Railroad Gazette* of Feb. 14.

the signal. The home and advance levers for the lines marked Nos. 1 and 2 connect the battery in the cabin with the bars B, C, D, E, placed in the center of the track, the only difference being that the levers marked 1 apply the positive pole of the battery to these bars, and the levers marked 2 apply the negative pole to the same bars. The two levers, No. 3, connect the battery in the cabin to the supplementary bars, and if the junction was a four-way one, other levers would reverse the polarity precisely as is done by levers No. 2.

As will be seen, the battery is not applied to the bars unless both the home and the advance signal levers are pulled over. The mechanical interlocking prevents the levers for more than one line being pulled over at once, or the home signal for one line and the advance for another, and therefore in the case under consideration there is no need for more than one battery.

A view of the bar A is shown in Fig. 8. It is mounted on wood blocks, which are in turn mounted on stoneware reels. The insulation is not high, as there is no need to aim at a high degree of insulation for this bar. Fig. 10 shows the arrangement for mounting the bars. It is necessary that these bars should be well insulated, and they are therefore mounted upon doubleshed porcelain insulators of the ordinary telegraph pattern.

Fig. 5—Circular Indicator. Rear View. Cover Removed.

A further consideration of Fig. 9 will show that the preparations made for signaling to trains are indicated in the signal cabin. The two indicators required in the case of a three-way or four-way diverging junction are shown in Fig. 9. When the levers are pulled over, the current passes through a high resistance fixed at bar B, which limits the current passing before and after the engine reaches the signaling bars, but which, being in shunt with the engine circuits when signals are being given, does not affect the current to the comparatively low-resistance circuits of the engine. The resistance of the indicator is kept low with the same object. The permanent deflection of the indicator needle is comparatively small. When the signals are being given, the deflection is increased, and it can be used as an indicator to the signalman (1) of the position of the train which is approaching, and (2) whether the signals are being given on the engine.

Consecutive Operations. Consider now in further detail what takes place in a typical instance. Assume that an engine is approaching the junction shown in Fig. 9, and that line No. 1 has been prepared for it to pass forward. The home and advance signal levers No. 1 are both in the off position, and the battery in the cabin is connected positive to line. All the bars, E, D, C and, B, are connected to the battery. Bar A is never connected to the battery, and is in no way under the signalman's control.

When brushes 1 and 2 are on bar A, the current from the engine battery passes through c^2 d^2, c^1 d^1, A', C', brush 1, brush 2, and to the battery. At practically the same instant, the same circuit is separately established by each of the rotary switches 5 and 6. The semaphore arm is put to danger, and as soon as the brushes are clear of the bar, the bell commences to ring. Ordinarily the time occupied in passing over the bar is from ⅛ to 1 second, so that the bell practically begins to ring simultaneously with the raising of the semaphore arm.

The visual and audible indications given at bar A continue until the brushes, or brush 2 comes into contact with the bar B. A current then passes from the bar B to brush 2, thence to the coils of D', and the engine frame, and the rails, etc., to the battery in the cabin. The armature a^1 of D' is raised and breaks the circuit through the springs c^1 d^1, lowering the semaphore arm and causing the bell to stop ringing. At the same time the polarized needle n is deflected so that its pointer indicates 1, and the wire loop drops into the depression and lock, the pointer in the position it has taken up (Fig. 3).

The visual and audible signal given at bar A is a warning signal indicating locality with reference to the signaling point being approached; the reversal of the warning signal is the off signal. If the further passage of the train on its journey to the home signal be followed, it will be found that the bell will ring momentarily at the instant the engine passes over each of the bars C, D, E, but no change is made in the character of the visual indication.

The indicator now shows the off signal by the semaphore arm and route 1 by the pointer. These indications continue until the next signaling point is reached, and are a reminder of the last signal received.

Assume that the engine has reached another bar A. The same actions take place as described for the previous signaling point, but in addition to raising the semaphore arm, the electromagnet A, by the rod R (Fig. 9), raises the wire loop out of its recess and allows the pointer to assume its normal position. We assume again also that the road has been prepared for the train to pass forward, but in this case it is the right hand road of a two-way diverging junction. On reaching the bar B, the same operations are carried out with the exception that No. 2 route is shown. It happens, however, say, that at the time the engine obtains the off signal, and route indication, 1,000 yards away from the cabin, the signalman is being informed of a circumstance which makes it imperative for him to stop the train if possible, and he instantly throws his home signal to danger, and immediately afterward the advance. The engine at the moment is just reaching bar C, say, and on passing on to it, the off signal shown by the semaphore arm is reversed and danger shown, the route indicator is displaced, and the bell commences to ring as soon as the engine is completely over the bar. These indications will continue as long as may be necessary.

These actions constitute the receipt of a warning signal, the off and route indications and an emergency signal, calculated to avert a disaster from circumstances which have suddenly arisen.

Assume now that another bar A, belonging to another signaling point, has been reached. Precisely the same effects are produced there as have been already described. The line, however, has not been prepared for the passage of the train. On arriving at bar B the bell stops ringing momentarily, but the semaphore arm remains

Fig. 5—Fire-Proof Fixtures at Switches.

at danger. Immediately the brushes have left the bar the bell recommences. The same effects are produced at bars C, D and E if no other signal is obtained at either of those points. The last bar is placed close to the home signal and is double the length of the other bars to allow of the train being brought to a stand easily with the brushes on the bar.

Hence the on signal is obtained by the continuance of the warning signal after the engine has passed over bar B, and that indication is continued until a subsequent indication is given by the signalman. The on signal, moreover, is of such a character, considered in view of the momentary stoppages of the bell by the intermediate bars, as to enable the driver to locate his position between the point at which he obtained the warning signal, and the home signal at which he must be prepared to stop.

Assume that as the engine approaches the bar D, the signalman lowers the home and advance signals. When the brushes come upon the bar the off signal and route indication will be received precisely as already explained.

Hence the on signal originally received at B may be reversed, and an off signal may be obtained at points between B and the first stop signal just in the same way as the driver sees the line signal lowered before he reaches it in clear weather by the projection of his vision.

Making another assumption, suppose that the engine has been brought to a stand on bar E close to the home signal, and is waiting for the receipt of an off indication. The semaphore arm is at danger, but the bell is silent. The signalman lowers the home and advance line signals for the train to proceed. Immediately the semaphore arm on the engine is lowered, the route indication appears, and the bell commences to ring and continues to do so until the brushes have left the bar. Hence, the receipt of the off signal when standing at the home line signal is given, and the driver's attention is called to the change by the bell commencing and continuing to ring.

Fig. 7—Spring Bar and Ramp.

Suppose, now, that instead of sending the train straight away after bringing it to a stand at the home signal, the signalman wishes merely to call the train forward to communicate with the driver, or to bring the train forward to the advance signal, the signalman lowers the home signal and works the advance signal lever back and forward. The semaphore arm on the engine will be worked up and down and the bell will ring intermittently and call the driver's attention to the character of the indication given. Hence a cautionary or "calling on" signal can be given to trains standing at the home signal, and the indication is of a different character to other signals obtained in that position.

In the foregoing description the signals have been given for a two-way diverging junction, or for a straight road. Suppose a train traveling to the signaling point in Fig. 9, and that road No. 3 has been prepared for it. The brushes 3 and 4 are connected together so that either is available for the same purpose. As shown by the diagram, brush 4 will engage with the bars parallel to B, C, D and E. The warning signal is given by brushes 1 and 2 on A as before. On the arrival of the engine at B, the brush 4 takes the current from the bar, after which it passes through the coils D^2, deflecting the needle n^1 to 3, and by the raising of the armature breaks the contacts c^2 d^2. The wire loop drops into the recess at the end of the slot in the sector, and locks the route indicator in the position required. The net result is precisely the same as described for the route indications 1 and 2 with the exception that the first of another pair of such indications is given. Had the junction been a four-way one, the action of the levers for the signals for the fourth line would reverse the polarity of the bars, and the indication 4 would be obtained. The next operation of the electromagnet A frees the route indicators, 3—4, precisely as described for 1—2. The double brush, 3—4, is to enable signals to be obtained whether the engine is running engine or tender first, toward a three-way or four-way junction, and it is also used in connection with single line working to be described later.

Failure Indicator on Engine.—The means for testing the condition of the circuits and battery on the engine have not yet been referred to. The actual indicator is a small disc (Fig. 2) or a grid (Fig. 1) appearing at an opening in the front of the instrument, which is white when the engine battery is in operation, and red if the battery fails or is cut off. The failure indicator circuit is independent of the other apparatus. Current is taken to the coils of E^1 from one end of the battery, and thence to the brush 2, which completes the circuit. Interposed in this circuit are two small electromagnets, the poles of which embrace the polarized needles n n^1, and tend to preserve their magnetism. As the failure indicator is always in action when the engine is at work, there is a constant current available for this purpose. In carrying the "failure indicator" to brush 2, the insulated wire is wrapped around all four brushes as shown in Figs. 9 and 4. Hence any obstruction on the line which displaces the brushes will break the failure indicator circuit and bring it into action. The failure indicator magnet E^1 has a back contact, e^1, which is open when E^1 is energized, but is closed if the armature a^3 is released. This contact simply bridges the open springs, c, d, of A^1, and if the armature a^3 is released, through the breaking of the circuit of E^1, the semaphore arm rises to danger, the bell commences to ring, and the disc or grid (Fig. 1) shows red. When the battery fails the disc or grid shows red.

Single Line Working.—Fig. 11 shows the engine equipment available for single or double line working. It only differs from Fig. 9 in the addition of a small three-pole, three-way switch. It is unnecessary to describe this in detail, as the side references afford sufficient information to follow the connections. In the center position of the switch the apparatus is ready for double line working engine or tender first. In the left-hand position it is available for single line working, engine first; and in the right-hand position for single line working, tender first.

The peculiarities of single line working require modifications of the track apparatus to obviate the receiving of signals on an engine proceeding in one direction, from the track apparatus provided for traffic proceeding in the opposite direction on the same pair of rails. A simple form of single line equipment is shown in Fig. 11, an examination of which will show that the bars A are double, but connected together electrically, and that only one spring bar for operating the rotary switches is provided near A, instead of two as in double line working. The additional bar connected to A is always on the left-hand side of the latter looking in the direction in which traffic passes for which the line signals are provided. Similarly the spring bars for the rotary switches are always on the left-hand side.

An examination of the switch circuits will also show that the operation of the switch to right or left always cuts out of use the right-hand rotary switch and the right-hand brush (3 or 4) looking in the direction in which the engine is traveling. It also puts out of action brush 1. Hence only the left-hand rotary switch and the left hand brush (3 or 4, according to whether the engine is running engine first or tender first) are operative, and while the right-hand rotary will be turned by the spring bars for trains going in the other direction, the brush 1 will always bear upon the center bars, and the right-hand brush (3 or 4) will always bear on the right-hand bars, their usual functions are in abeyance in consequence of the position of the switch. The warning signal is given by the short-circuiting of the brushes 2—3 (or 4) and the rotation of the left-hand rotary. The off signals are taken up by the brush 2 for the route indicators 1—2, and by the brush 3 (or 4) from supplementary bars for the route indicators 3—4. All other operations remain as described. Hence a simple movement of the switch to one side or the other, according as the engine is running engine or tender first, is all that is necessary in passing from double to single lines, or *vice versa*.

Fig. 8—Bar A.

Recording Indications Obtained.—The system iends itself readily to the adoption of means by which the "condition of line" signals obtained may be easily recorded for each signaling point. The length of time during which the semaphore arm is maintained at danger differs in accordance with the condition of the line. If an off signal is obtained at B the time is short, if the on signal is received the time will be longer, and will depend upon the point at which the off signal is ultimately received. In any case the difference is appreciable. This difference may be utilized in order to produce marks of corresponding length upon a cylinder which rotates and travels longitudinally at the same time, by adding a marking pen or pencil to the rod b of A, so that a mark is made as long as the armature (a) is raised. The motion of the cylinder causes the marks to form a spiral. For places where the off signal is obtained at the bar B, the mark is a dot only. Where the on signal is obtained at B, the mark is a line of greater or less length according to the time that elapses before the off signal is obtained. The drum carrying the paper cylinder is driven by clockwork, and is under the control of the signaling apparatus, so that it is only running when marks are to be made, and the driving mechanism and the marking cylinder are therefore kept of quite moderate dimensions. Arrangements are made by which the driver can produce a space longer than that provided by the design of the apparatus, and so distinguish between the marks made during one journey and the next.

CONCLUSION.

I. — (a) The natural action of the bar A through the brushes and that of the yielding bars upon the rotary switches upon the engine circuits constitute a signal, warning the driver of his approach to a signaling point, at which further indications must be looked for at once. (b) Neither the engine driver nor the signalman are required to do anything to produce this signal. (c) The indications being given from three independent points for double lines and from two for single lines, provide ample marking for failures of apparatus from any cause outside ordinary maintenance of the battery. (d) The alternative method for producing this indication and the difference in their positions on the engine and track are guarantees that anything likely to affect one means prejudicially is not likely to affect the other.

II. — The continuance of the warning signal constitutes an effective danger "condition of line" signal, relating to the stop signals which are being approached. The bar A is situated at a distance of about 100 yds from B. The warning signal proper is therefore of short continuance only if the stop signals are off. No time is lost in conveying the further indication on when the stop signals are in that position. The subsidiary indications given by the

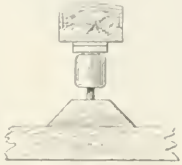


Fig. 10—Support of Insulated Bar.

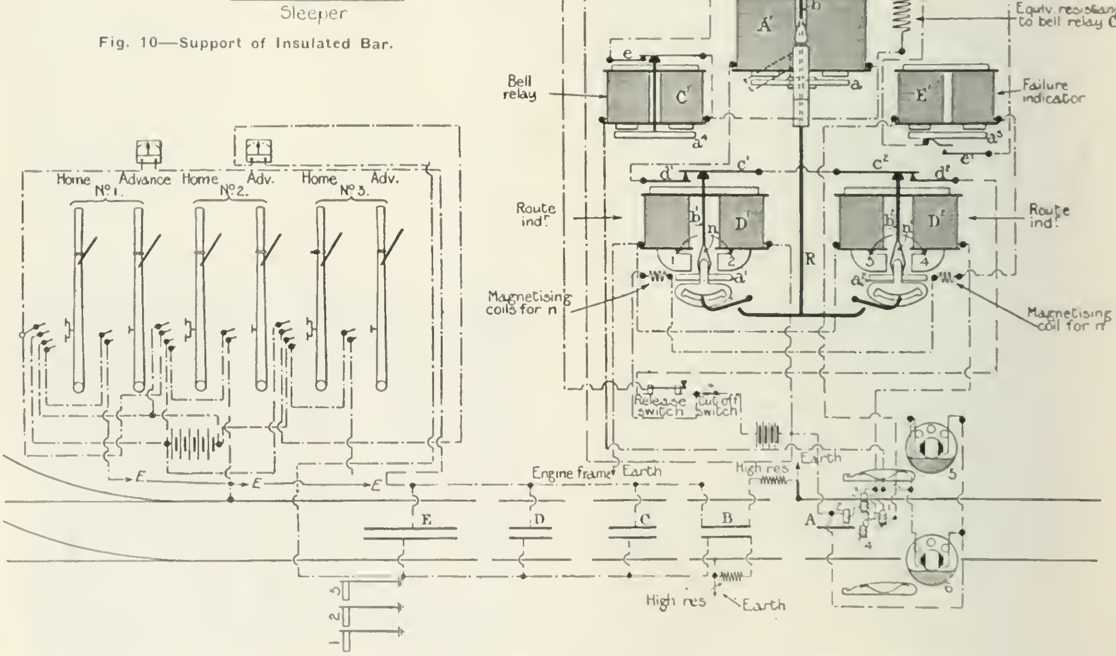


Fig. 9—Electrical Apparatus and Circuits for Raven's Cab Signal; North Eastern Railway.

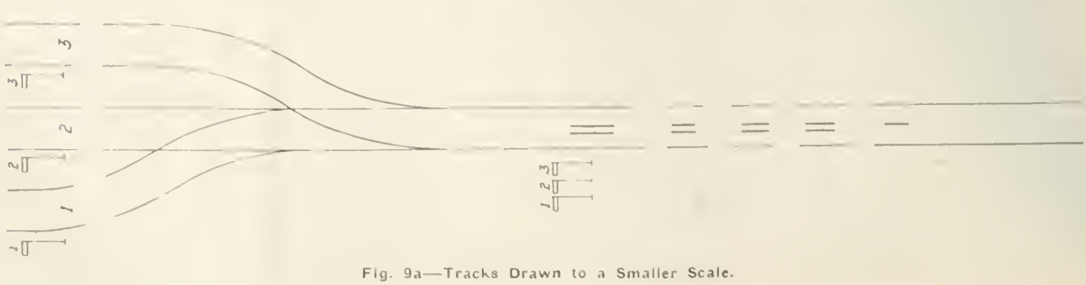


Fig. 9a—Tracks Drawn to a Smaller Scale.

momentary stoppages of the bell, are valuable for indicating the progress of the train toward the stop signal, when conditions of weather prevent the ordinary landmarks from being seen.

III.—The stopping of the warning signal by the return of the semaphore arm to the off position, the stopping of the bell, and the receipt of the route indication constitute a complete off or line clear signal, which, since it cannot be given unless both the stop signals controlling entrance to the next section are off, gives also the exact information now given by the lowering of the line distant signal. The convention under which the route indications are numbered is in strict accordance with the convention under which the line signals are erected. A straight through point is always signaled as 1.

IV.—Either "condition of line" indication received at bar B can be reversed before the engine reaches the stop signal. The number of intermediate points at which these reversals can be obtained is limited only by the number of intermediate bars provided. Additional bars are not costly.

V.—The off signal can be given when the train is standing at the home signal equally as well as when it is traveling, and attention is called to its being given by the audible signal. The signal given when the train is standing at the home signal can be modified by the signalman to indicate a calling on signal, or the equivalent of a flag signal, and this is totally distinct to the off or "line clear" signal.

VI.—Indications are provided in the cabin by which the signalman knows whether his apparatus is in order, and by which he can trace the progress of a train toward the home signal from the bar B, and note whether the signals appear to be given correctly.

VII.—The system, being electrical, admits of the signaling point —the bar B—being put at any distance from the cabin without affecting the efficiency. There is, therefore, no reason why it should be put at the point at which the line distant is now erected. Such signals are usually visible at some distance, and there is no reason why the bar B should not be set at this sighting distance. The increasing speed of trains makes it desirable that the signals given at B should be obtained as early as possible, to admit of easy braking when necessary.

VIII. The line distant signal plays no part in the working of the system, and may be dispensed with if desired.

IX.—A further examination of the system will show that failure of the apparatus on the line will not cause a false off signal to be given. Any failure of the battery in the cabin, or breakage of the line wire puts the bars B, C, D and E into exactly the same condition as A, which can only produce the danger indications. Contact of the line wire with telegraph wires on the same poles is not likely to give a false signal, as the apparatus on the engine requires stronger currents than are to be met with in telegraphy. Failure of the apparatus on the engine provides its own indications.

X. and XI.—* * * The system has been used two winters with no difficulty from ice. The brushes seem to clean the bars at every operation. If films of ice were to make trouble, a daily rubbing with an oiled rag would cure it. The insulation of the energized bars has been found more difficult than the maintenance of the contacts, but the double-shed insulator, now in use more than 18 months, has cured all troubles. * * * It will be seen that the system furnishes the maximum information with a minimum of apparatus. Shocks due to impact have been done away with. * * *

XII.—The system has now been in use experimentally on the North-Eastern Railway for nearly two years, on what is the fastest short-distance train in the world, and on other express passenger trains. No attempt has been made to develop it by trials on slow trains. Under the conditions of use, the apparatus is working perfectly. The directors of the North-Eastern have arranged for the equipment of 20 more of their express engines and of about 14 miles of their main line between Newcastle and Durham.

Dry cells have been found to give the best results on the engine, and have given perfectly good results in connection with the track

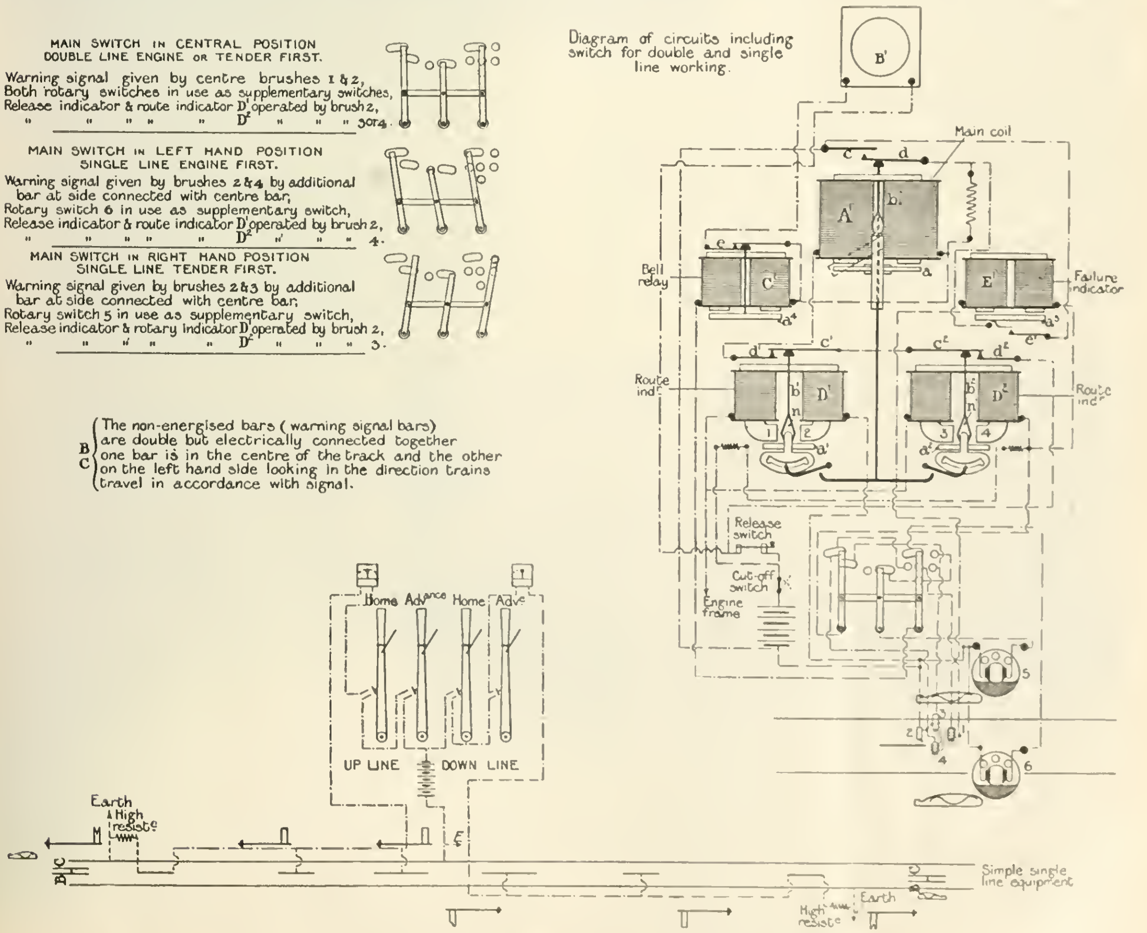


Fig. 11—Raven's Cab Signal Circuits Arranged for Single-Track Operation.

circuits. Six cells are required on the engine, and twelve cells are used in the cabin for the track circuit. The wire for connecting the energized bars with the battery in the cabin is carried on the telegraph poles.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

VII.

The Railroad Steamship Lines on the Atlantic and Gulf Coasts of the United States.

The previous article has pointed out the tendency of transportation companies to consolidate by both land and sea. There is no reason why the two systems of transportation should stay apart, and it is natural that this process of consolidation should overleap the land and demand the combination of both steamship and rail road lines to complete the requisite unity of service. The railroad line with steamship feeders would be benefited thereby and at the same time steamship lines with railroad alliances would be better served. There is a common want and a mutual advantage—each can help the other in its desired extension of service.

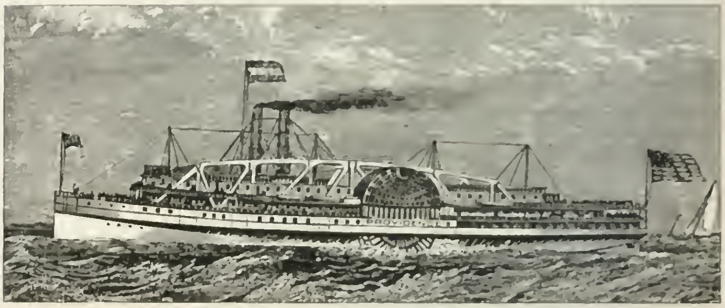
Extension of service does not necessarily mean consolidation of carriers. If it so happens that the desired service can be obtained without consolidation, the consolidation will probably not occur. The railroad that has its terminus in a port with great sea connections finds its wants supplied. Alliances there are unnecessary, and indeed they may be rather more entangling and limiting than beneficial, and are therefore to be avoided. New York, London and Liverpool are not the ports in which we can best study railroad steamship lines. The railroads that reach these ports have practically completed their world connections by reaching a point where these connections have been already established in response to the demands of existing local commerce. The number of ports with such satisfactory connections is small, and in most parts of the world the railroad that reaches the sea finds its wants unsatisfied if it depends upon such sea carriers as may independently seek freight at its terminus. The railroad must extend itself across the seas. It is thus manifest why the railroad steamship line is of a world-wide occurrence. It has its fullest development in America, but it exists also in the Irish, Baltic, Aegean, Yellow and Japan seas.

THE EXPERIENCE OF AMERICAN RAILROADS.

In its larger aspects, the railroad steamship line is coincident with the development of long railroad lines, but it had its American origin on Long Island sound in the early days of railroads in America. This partly enclosed body of water offering a somewhat sheltered route almost directly toward Boston from New York was admirably placed by nature for this combination service, which developed most naturally. The steamboats from New York to Norwich in 1818 connected there with the stage lines to Boston and other eastern points, and from that day to this there has been a varying but generally increased amount of co-operation between the two carriers, which has almost resulted in unanimity of ownership.

The first steamboat line from New York to Providence in 1822 was followed by another in 1827, and connecting stage lines carried the passengers on to Boston. In 1832 there were four of these stage lines, and they competed even more fiercely than the steamboat lines and this competition was keen. This competition between the two groups of carriers promptly worked toward a consolidation of service upon the opening of the railroad from Boston to Providence June 15, 1835. Just at this time Cornelius Vanderbilt put a steamer on this route, and he met the competition of the older line by having a special train take his passengers from Providence to Boston. The boats of the older lines left Providence for New York just after the arrival of the noon train from Boston.

This informal connection between the railroad and the steamboat did not survive, nor was the steamboat's dominance in the relationship to be permanent. Within two years (1837) the Rhode Island Legislature was calling the Boston & Providence Railroad to account for having violated its charter by refusing to some steamboats free access to its wharves for the discharge of through passengers and freight. This fruitless action resulted because the railroad had for some time been interested in some of the steamboats and took this means, though ineffectually, to break the opposition.



Steamer Providence (1866) Fall River Line.

A railroad owned by another company was completed from Providence to Stonington late in the same year, and in the season of 1838 this company made agreements with Vanderbilt and other steamboat owners for a steamboat line connecting at that point for New York. Just at this juncture the Atlantic Steamboat Company, a new corporation, put on a very fast boat to Providence. The Boston & Providence Railroad Company at once put down the fare from Providence to New York to $2 direct and $3 via the quicker Stonington route. The boat of the new Atlantic company was too fast for them and the next step was to offer to purchase Vanderbilt's steamer for $60,000, provided she could beat the boat of the rival Atlantic Company. This she failed regularly to do so the fare by the railroad steamboat line came down to $1. Petty persecutions followed, no special trains would be granted to the passengers of the rival boat when she missed the regular train. But despite these efforts, the rivalry and races were stopped only by the railroad company's purchase of stock in the rival Atlantic Company and consequent strong representation on the board.

Steamer Priscilla (1894) Fall River Line; New York, New Haven & Hartford.

By 1845, upon the completion of the Norwich & Worcester Railroad, the Boston-New York traveler had the option of a third combined water and rail route, that via rail to Norwich, Conn., and thence by boat down the Thames and along the sound, but this did not give any severe competition with the Boston & Providence Company, which was the strong member of the group.

The years 1844-46 were years of active competition with three or four independent steamboat lines running between New York and the Long Island sound terminus of the Boston roads. In 1845 Vanderbilt, Drew and others got possession of the Providence & Stonington Railroad, and Drew took the presidency of the New Jersey Steam Navigation Company, which was the leading boat company of the sound and the successor of the original line. In 1844 there was another combination route opened via the Long Island Railroad from Brooklyn to Greenport, Long Island, whence steamers plied to Stonington & Providence, and also to Norwich to connect with the road via Worcester. This Long Island route, having the longest rail line and the shortest water line, had the advantage over all others in point of time required. In this respect, it had the same advantage over the Stonington route that the Stonington route had over the Providence route. This Long Island line was very popular, was much used for three years and carried the United States mail to Boston, but it was discontinued in 1847 on the completion of the New York, New Haven & Hartford Railroad and the opening of the Fall River Line. The Long Island route was a Vanderbilt interest, and he also had control of the Norwich route. The new steamer "Atlantic," which made its first trip from Norwich to New York, August, 1846, was a vessel 320 ft. long, 1,400 tons, and was described in *Hunt's Merchants Magazine* of that year (v 15:323) as the property of the Norwich & Worcester Railroad & Steamboat Co.

Steamship Colon; Panama Railroad.

It was said to be the acme of perfection, the finest as well as the largest ever built in America.

The Fall River Line (the Bay State Steamboat Co.) commenced business in May, 1847, running in connection with the Old Colony Railroad, which had been opened a few months before giving a through line from Fall River to Boston. The early opening of the steamboat line to complete the service to New York was brought about in the now well known manner of having the steamboat company well represented on the board of the railroad company. At various times during this early period difficulties arose over the division of proceeds between the railroads and the contracting steamship companies. In 1860 the future was foreshadowed and the difficulty settled for the Norwich & Worcester Railroad Company through the company itself taking a large interest in the organization of the Norwich & New York Transportation Company.

In 1860 the Stonington Railroad was extended to Groton, which in that year became the terminus of the steamboat line to New York. The destruction of the terminals at Groton led to the return of the line to Stonington in 1865. In the disturbed period just after the Civil War, there were various rearrangements and reorganizations of lines on the sound, one of which, through the failure of the Merchants Navigation & Transportation Company, left the Stonington road without connections in January, 1867. The company then adopted the thoroughly modern expedient of organizing the Stonington Steamship Company, in which it held 85 per cent. of the stock.

In the same year, 1867, a new route to Boston was opened by a contract arrangement between the steamers and the railroad connecting at Bristol. In 1868 this line and the Stonington line competed until rates went down to a dollar from Boston to New York, but they soon stopped that policy and worked harmoniously until in the hard times of 1877, the Stonington Company opened a new passenger steamship line to connect with Boston via Providence. This precipitated another rate war, during a part of which there were six different combination water and rail routes from New York to Boston, and two of them were operated by the Fall River Line, now in the control of the Old Colony Railroad Company. The rate war lasted until 1881 and was ended by an agreement to divide a part of the traffic among the contestants.

About 1885 the New York, New Haven & Hartford Railroad Company began to strengthen its grip on the steamer lines of the sound and in a decade it had gone a long way toward their absorption. In 1893 the New York, Providence & Boston Railroad was merged and with it went the Providence and Stonington Lines of steamers. Two weeks later a 99-year lease of the Old Colony Railroad followed and with it went the Fall River Line. In 1898 the New York & New England Railroad was absorbed, carrying with it the New York & New London Steamboat Line. In 1899 the New York & Hartford Steamboat Company opened a new line to Providence, calling it the Narragansett Bay Line, but the next year the New York, New Haven & Hartford Railroad got control of the company and withdrew the line.

The monopoly by the railroad steamship lines was, however, hard to maintain. The year after the last purchase just mentioned, the Joy Line, which had before been carrying only freight to Providence, began to carry passengers. The railroad met this by putting on a new steamboat line. The older regular lines were charging $3 to Providence, the Joy Line $1.75 and the new railroad boat line charged $1, and the Joy Line met this with $1.50 round trip.* At this time the rate on the old Fall River Line was still $3 and the traffic was falling. The competition went on until October, 1902, when the railroad with its many steamers and services could protect itself only by making an agreement with the Joy Line. Nor did even this guarantee it in peaceful monopoly, as "every year or so"† new competitors kept springing up. In 1906 this rivalry took the new form of trolley-steamboat competition in an active form at the hands of the Enterprise Navigation Company, which was selling through tickets at low rates in connection with trolley lines from Fall River to Boston.

The checkered experience of the steamboat lines on Long Island sound as they have gradually become more and more nearly railroad appendages is illustrative of the methods that have prevailed the world over, but it is scarcely worthy of the name of ocean transportation.

The Panama Railroad & Steamship Company is probably the first clear example of the oversea line in connection with an American railroad. This railroad, completed in 1855, was almost unique in having no local traffic and in being a connecting link between two sea ports which exist only because of through trade. To improve its traffic this road promptly established a steamship line from New York, and made contract arrangements with the then existing Pacific Steamship Companies plying north to Portland and south to Valparaiso. At times it has operated steamship lines of its own on both oceans, and its traffic contracts have been numerous.

Steamship Momus; Southern Pacific Company.

The year 1870 seems to mark the general beginning of formal

*Railroad Gazette, 1900, p. 499 and 516
†Railroad Gazette, 1906, p. 447.

connections between American railroad lines and transatlantic shipping companies. Before that time coasting lines at various points had come under the control of the railroad companies to benefit the delivery of the railroad freight. This process has gone steadily forward until now many of the lines of coasting vessels in the United States are directly or indirectly controlled by the railroad companies, and most of those which are called independent must apparently have good working arrangements with railroad lines in order to keep out rivals.

About 1870 the eastern trunk line railroads having their termini on the line from Buffalo to Pittsburgh, and down the Ohio to Cincinnati, began to extend their lines to the Mississippi and to Lake Shore points. To secure traffic from across the lakes they put lines of carriers upon the Great Lakes, and on those waters today the independent carriers are in a very small minority. This process began on the Great Lakes shortly after 1850,* when the roads having their termini at Buffalo reached out to the west for traffic by operating or arranging for steamer lines on the lakes. The new western connections won by the expanding eastern railroads gave an increase of through traffic which demanded satisfactory outlet across the Atlantic if the railroads were to prosper. This situation is well described in the words of the Pennsylvania Railroad Report for 1871 (see p. 25): "The main object of the organization of the Pennsylvania Railroad Company was to promote the traffic between this city (Philadelphia) and the west. * * * It was confidently expected on the completion of our railway, that the enterprise and the capital of the citizens of Philadelphia would have been at once enlisted in the marketing of the product brought to their doors, and the means furnished to transport them to the points of consumption. But it soon became evident that this could not be depended upon, and that our cars must pass to New York to meet purchasers of their contents, or the business of the company would be dwarfed to that of a second class railroad, a fact which the interests of the shareholders would not permit."

The situation thus described by the directors of the Pennsylvania was felt keenly by all eastern trunk lines, and they took steps to help themselves out of the predicament. The Pennsylvania organized a steamship company, which operated to Liverpool a line of steamers called the American Line, established in 1871. The majority of the stock of this company was held by the Pennsylvania, which also guaranteed the bonds of the shipping company. The organization of this corporation was similar to that of numerous subsidiary corporations organized by the officials of the Pennsylvania. The venture can scarcely be called a success because of the railroad's needs for more frequent and varied services than the commerce of Philadelphia supported. The reports of the railroad for the next few years very clearly showed this difficulty. As the next step to overcome it, the Pennsylvania secured the United Railroads of New Jersey (leased in May, 1871, for 999 years), giving a direct outlet to New York harbor with its many steamship connections.

In 1884 the railroad company's American Line ceased to run under that name and passed into the hands of the International Navigation Company. Both of these companies were presided over by a director of the Pennsylvania, and this relationship continued until after the formation of the International Mercantile Marine Company in 1902. Intelligent opinion in both England and America held strongly to the opinion that there was friendly and practical relationship between the Pennsylvania Railroad and the shipping company.† It should be remembered that the primary wants of the Pennsylvania Railroad were satisfied by its New York terminal, which accounts for the railroad company's lessened interest in the steamship enterprise.

The Baltimore & Ohio with its terminus at Baltimore, preceded by a year or two the entrance of the Pennsylvania into the shipping business by aiding in the establishment of the Atlantic Transport Line, which grew out of the Baltimore Storage & Lighterage Company, and gave the Baltimore & Ohio a European outlet. As was shown in the case of the Pennsylvania Railroad, ocean service from Philadelphia depended upon the steamship company acting in connection with the railroad itself. This was still more the case at Baltimore, and at such small places as Norfolk or Newport News, a railroad was helpless that did not depend upon some other seaport or furnish its own connections. At first the Norfolk & Western and Chesapeake & Ohio lines were dependent upon New York, through the aid of the Old Dominion and Clyde lines of coasting steamers. Then each of these railroad companies established a line of steamers to Europe. Later the Norfolk & Western gave up its line and lightered its goods across the estuary of the James to the terminals of the Chesapeake & Ohio, to export them by the Chesapeake & Ohio steamers. This steamship company, which is technically a British company with ships under the British flag, was controlled by the Chesapeake & Ohio until June, 1905, at which time the railroad withdrew its interest, but established an arrangement for continuing the service. This steamship line, from the mouth of the James and the Chesapeake, appears, in fact, to have gone through a number of arrangements. In 1900‡ the Southern Railway had been admitted to joint use of it and steamers were despatched to London, Liverpool, Hamburg and Rotterdam. At the same time two of the railroads, the Southern and the Norfolk & Western, had an arrangement with the United States Shipping Co. for the despatch of steamers direct to Dublin, Belfast, Glasgow, Antwerp and Amsterdam.

The ownership of the trans-Atlantic steamship line by the railroad company is not usual on the Atlantic coast, nor has it been from the first, the common method being a freight agreement between a railroad and a steamship owning company. The railroad company builds terminals, which it leases to the steamship company at nominal rates. In the period of the 70s and early 80s it was common for the railroad to guarantee the steamship company a certain amount of freight each month. This practice is not now so common, although the contracts cover periods of from five to ten years, and the railroad guarantees to deliver goods to the steamship line, and the steamship line to take the goods from the railroad and deliver import goods in return. The contracts are not mutually exclusive, but as the railroad controls the terminals, switching charges upon cars from other companies serve as a practical tax upon such shipment. It is easily possible, however, for goods to come by lighters from other railroads and go over the ship's side, although in the city of Boston even this is taxed by a so-called switching charge when the freight comes from the terminal of another railroad company.

This is quite different from the situation in New York, where nearly everything that is shipped is lightered, and each carrier deals with all others on terms of equality. There is also this further difference, that in New York the shipping line being independent of all railroads must provide its own terminal facilities, whereas in other ports they are usually provided by the railroad, which thereby guarantees its outlet. This is plainly evident at present in Philadelphia, where there are several lines operating to European ports in connection with the Reading and Pennsylvania railroads and using their terminals. Boston has such lines, and from Portland, Maine, the Grand Trunk announced in 1903 that there would be four services to British ports, in connection with the Grand Trunk Railway during the ensuing winter, weekly to Liverpool and London; fortnightly to Bristol and Glasgow. These contracts were with three different steamship companies.

The ports upon the Gulf of Mexico usually having small population and little variety of freight are quite as dependent upon formal arrangements between railroads and steamship as are the smaller Atlantic ports. The Atlantic Coast Line, for example, has lines running from Miami to Key West and from Port Tampa to Havana. The vessels, under the flag of the Peninsular & Occidental Steamship Company, are controlled by the railroad company. The small port of Pensacola, served by the Louisville & Nashville, has a line of British steamers in which the railroad company is interested, running to Mexican ports. The company also has a contract with an Austrian steamship company to run a regular line of vessels between Pensacola and southern Europe. This regular service succeeded the occasional despatch of ships which had for eight years past been running between Pensacola, Genoa and Venice. The Louisville & Nashville has also contract arrangements with seven other lines of foreign steamers giving service from Pensacola to Liverpool, Hamburg, Bremen, Antwerp, Havre, Copenhagen, Rotterdam, China and Japan. The railroad took these steps to free itself from the irregular service of tramp vessels.

The Illinois Central Railroad, with its spacious New Orleans terminals, has similar arrangements with lines to some European ports, but in the larger ports of New Orleans and Galveston, the steamers in the foreign trade are more commonly independent than is the case in the smaller ports like Pensacola and Gulfport. The Southern Pacific has long run a line of steamers from New Orleans to New York, and in 1902 a direct line was established between Galveston and New York, thereby shortening the rail haul for western goods, but the New York-New Orleans service was still continued. Since the acquisition of the Cromwell Line passengers as well as freight have been carried between these points by the railroad company's steamers, and three fast passenger steamers have been added to the service, one of which is illustrated herewith.

(To be continued.)

The German Empire more than a year ago imposed what seemed to be a moderate tax on railroad tickets. The result of it has been a diversion of travel from the higher to the lower classes to such an extent that a decrease of about $2,500,000 in the passenger earnings of the Prussian State Railroads alone is attributed to it. Nearly at the same time a new schedule of charges for passengers and baggage was introduced, which on the same railroads reduced earnings about $1,500,000, but this was expected.

*Morrison's "History of American Steam Navigation," p. 573.

†See *Fairplay*, Nov. 3, 1904, p. 681, for a statement of British opinion.

‡See *Railroad Gazette*, Oct. 19, 1900, p. 694.

GENERAL NEWS SECTION

NOTES.

The Pennsylvania has issued rules forbidding profanity in its shops.

The roads in the Southeastern Passenger Association are to grant no further theatrical rates.

The Southern Pacific is increasing the number of stations which bill through to eastern points.

Railroad employees in Louisiana are preparing a great petition to the legislature not to pass a 2-cent-a-mile law.

The Western Transit Company, the lake line of the New York Central, is to open a traffic office in Spokane, Wash.

The Baltimore & Ohio put the nine-hour telegraphers' law in effect on February 17. The law becomes operative on March 4.

The Jim Crow railroad station built by the Midland Valley, in accordance with the constitution of Oklahoma, at Taft, Okla., was on February 14 burned by negroes.

The Interstate Commerce Commission, through United States attorneys, is to prosecute the Southern Pacific Company for alleged large rebating transactions in California.

The Boston & Maine has cut by 10 per cent. the salaries of all employees receiving more than $100 a month, with the provision that none of these shall be reduced below $100.

The Supreme Court of Kansas has declared the freight demurrage law of 1905 constitutional, imposing a penalty of $1 per car per day for delay in furnishing freight cars ordered.

A general wage conference has been called at St. Paul, March 9, at which contemplated wage reductions west of Chicago will be discussed by railroad officers and union delegates.

The Oklahoma State Corporation Commission has ordered that no passenger on a railroad shall be compelled to give up his ticket or pay his fare until a seat has been furnished him.

The Nebraska State Railroad Commission, on February 11, instructed the Attorney-General to prosecute all pass-holders not included in the list of exceptions to the anti-pass law.

The New York Court of Appeals has awarded damages in a case where "this side up" notice on a number of freight packages were ignored by the railroad, to the damage of the contents of packages.

The differential in favor of Galveston over New Orleans on packing house products carried to Havana has been reduced from 2 cents to 1 cent; in July, 1907, it had been reduced from 4 cents to 2 cents.

President Diaz has ordered that all American railroad employees in Mexico must learn to speak Spanish within six months in compliance with the petition of the Grand Lodge of Mexican Railroad Employees.

Both houses of the Virginia Legislature have passed the bill allowing parallels to the Richmond, Fredericksburg & Potomac to be built. This step was recently favored in a long letter by John Skelton Williams.

The New England Car Service Association has voted to dissolve, effective February 29. The railroads which constituted the association will handle the business and hope to save some $40,000 to $50,000 a year.

Two cylindrical cement kilns, 125 ft. long, each with an outside diameter of 9 ft. 5 in. at the widest point, are being shipped from the Vulcan Iron Works at Wilkesbarre, Pa., to Los Angeles. Each kiln is loaded upon three steel flat cars.

Judge Hanford, of United States District Court, on February 15, at Olympia, Wash., handed down a decision holding that the railroad commission at Washington has no authority to fix rates, this right being vested only in the state legislature.

The Wisconsin Railroad Commission has ruled that the railroads of that state are free to close telegraph stations on account of the nine-hour law. It holds that the stations closed thus far do not interfere with the safe operation of traffic.

On the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern, employees whose pay is more than $100 a month are to have it cut 10 per cent.; employees receiving between $50 and $100 a month are to have their pay cut 5 per cent.

A press despatch says that the Georgia Railroad Commission will order the Southern Railway to pay $100 fine for five failures of the station agent of Hiram, Ga., to post late trains. If the railroad does not pay, the Governor will be asked to sue under the law, which places a fine of $200 for such offense.

Colonist rates to the west, to be in effect through March and April, will be $5 higher than formerly from both Chicago and Missouri river gateways. Although stop-overs are not allowed on regular first and second class tickets, they are on these cheap tickets.

The Kansas Railroad Commission ordered the railroads of the state to put a maximum freight tariff which makes a reduction of about 20 per cent. in the freight rates in effect on February 14. The roads have 30 days in which to determine whether they will contest the law.

The railroad commission of Texas on February 18 directed the Attorney-General to bring suit against the Missouri, Kansas & Texas, the Galveston, Harrisburg & San Antonio, and the Texas & New Orleans to recover heavy penalties for failure to run passenger trains on time.

The Railroad Commission of Indiana has given a decision that a railroad may grant lower rates to other railroads than to other shippers. It was shown that to prohibit these lower rates would destroy a market for about 750,000 tons a year of Indiana coal now sold to railroads.

The Union Pacific is to reduce its rates from Missouri river gateways to points in the Northwest to the reduced level in force on the Great Northern and the Northern Pacific as a result of reductions under the 2-cent fare law in Minnesota and 2½-cent fare law in North Dakota.

The Pennsylvania will hereafter use only one engine on passenger trains up the steep westbound grade near Altoona, Pa. The 18 hour Pennsylvania Special Limited will lose six minutes in consequence, but the time will be made up west of the Gallitzin tunnel near the top of the grade.

The Burlington and the Denver & Rio Grande have begun a new joint service for l.c.l. freight from Chicago to Colorado and Utah points. The time over the Burlington from Chicago to Denver is 68 hours, and over the Denver & Rio Grande from Denver to Salt Lake City 48 hours, a total of 116 hours from Chicago to Salt Lake City.

The Central Electric Traffic Association, which has been formed at Dayton, Ohio, is a branch of the Central Electric Railway Association which is made up of electric lines in Ohio, Indiana, Illinois, southern Michigan and northern Kentucky. The new organization is intending to do for electric lines what freight and passenger associations are doing for steam roads.

In spite of the 2-cent clause in the Oklahoma constitution, the Corporation Commission has issued an order exempting the Fort Smith & Western, the Oklahoma Central and the Wichita Falls and Northwestern railroads from the reduced rates. The Fort Smith & Western is to be allowed to charge 2½ cents and the other two roads will be allowed to charge 3 cents.

The Arkansas Supreme Court, on February 10, decided that the state could not compel through trains on the Iron Mountain to stop at Arkadelphia in compliance with a special act passed by the recent legislature. The court held that Arkadelphia was provided with ample facilities, and that to stop through trains there would be an interference with interstate traffic; hence the act was declared void.

The Interstate Commerce Commission, reporting to the Senate in answer to a resolution of Senator Tillman in an inquiry designed to throw light on availability of railroad bonds as securities under the proposed Aldrich currency act, reports that there is a constant tendency toward railroad combination; also that the express companies of the country hold $22,200,000 in railroad stocks and $12,300,000 in railroad bonds.

The Central Passenger Association has resolved not to make summer tourist rates lower than 2 cents a mile, subject to a concurrence of western roads. The Grand Trunk has reserved the right to make a lower rate. Among the difficulties of adhering to this minimum are the competition in certain localities between rail and water lines for summer traffic and the fact that rate fare legislation is threatened unless lower tourist rates are made.

Adversity has its uses. Since the slackening of freight traffic the Pennsylvania Railroad has been extending the use of absolute block signaling in the running of freight trains, and an officer of the road says that he hopes that the facility with which the regulations can be carried out and the satisfaction which the trainmen find in absolute blocking, will be so pronounced that the abandonment of permissive blocking can be made permanent, even after business shall have picked up.

The Ward Line and eastern trunk lines have failed in their effort to make a change in the division of territory for Mexican traffic, and the dividing line remains much as it was; that is, through Buffalo and Pittsburg. The business east of this line to Mexico via New York has been given to the Ward Line, and the business west of this line via New Orleans to the Mexican American Steamship Company. The eastern interests tried to have the line moved west so as to get more of the business.

At hearings held last week before the Public Service Commission of the first district representatives of the Interborough Rapid Transit opposed the proposed order requiring block signals on the local tracks of the subway. They said that the present capacity of the local tracks is from 33 to 36 trains an hour, and improvements were being made which would increase it to 51 trains; the block system and automatic stops would reduce the maximum to 36 trains an hour. Furthermore, that no passenger had ever been killed inside a car on the subway.

Railroad Legislation in Mississippi.

The Governor of Mississippi has sent a special message to the Legislature asking for a 2-cent-a-mile law, with the provision that the railroad commission may increase the rate if it is shown to be unprofitable. He suggests that the law be made effective several months hence. The message also calls for repeal of the fellow-servant law and of the statute relating to contributory negligence, asks the enactment of a law prohibiting railroad blacklists; demands a law prohibiting the drinking of intoxicants on running trains, and asks for new statutes for the regulation of telephone companies.

Representatives of the Southern Railway and the Mobile & Ohio have submitted to the Mississippi House Committee on Railroads a voluntary offer to establish a flat passenger rate of $2\frac{1}{2}$ cents a mile on intrastate business and to issue interchangeable mileage books in 1,000 and 2,000 mile forms at the rate of 2 cents a mile. It is proposed to try the experiment for a year from April 1, with the option of abandonment by the railroad if unprofitable. The representative of the Southern Railway said that these rates embodied the basis of settlement in Georgia, Alabama, Tennessee and North Carolina, and he thought that Mississippi was entitled to obtain by peaceful means what the other states got by fighting. The offer was opposed by the representatives of a number of the other railroads in Mississippi, particularly the Illinois Central.

Appointment at Purdue.

Prof. C. F. Harding has been appointed head of the Electrical Engineering School of Purdue University, Lafayette, Ind.

The East River Tunnels.

The following report regarding the East River tunnels of the Pennsylvania Railroad was made at a recent meeting of the board of directors:

"At the present rate of progress, the four tunnels of the Pennsylvania Railroad Co. now being excavated under the East river from the Long Island and New York City sides will meet within the next three months. This will mean that one of the tunnels will be excavated and iron-lined this month; two additional tunnels will be excavated and iron-lined in March, and the excavation and the iron lining of the fourth tunnel will be completed in April or May. Work will then begin on caulking and lining of the tunnels with concrete 2 ft. thick."

Traveling on a Pass in France.

On the continent of Europe, where the state puts its finger into most pies, railroad traveling is invested with a number of formalities. One of these is in connection with the issue of free passes, on which, like most other things in that country, the French government levies a tax. The said tax is paid by the pass-holder affixing stamps to the value of four cents on the face of each single-journey voucher, and the railroad company does not profit thereby. Other formalities have, however, to be observed by the deadhead. In the first place, only receipt or other commercial stamps must be used. What penalty the unfortunate traveler furnished with a "permit of free circulation" renders himself liable to by the absent-minded employment of an ordinary everyday postage stamp is not definitely stated, but it is evidently a very serious matter. Having pasted the correct adhesives in the spaces provided therefor as the law directs, one must take the pass to the booking office of the station of departure in order that the stamps may be officially canceled. There the voucher must be turned over and signed on the other side. The holder is then free to travel by the train, provided that these operations are completed before its departure.

The Block System in Indiana.

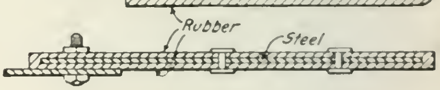
The State Railroad Commission of Indiana which acting under the recent law has ordered the principal railroads of the state to have the block system in use by July 1, 1909, reports that progress is being made already. The number of miles of road now equipped with block signals is 1,891 and the number of miles yet to be equipped, under the order, is 3,423. Lines earning less than $7,500 per mile per year are not subject to the law. The Commission has relieved two roads from complying on account of their light traffic, the Elgin, Joliet & Eastern and the Chicago, Lake Shore & Eastern.

Allowed to Smoke in Shops.

The new General Manager of the International & Great Northern has caused to be posted in the shops and roundhouses at Taylor, Tex., a card giving the employees permission to smoke during working hours and while on duty. Heretofore this was absolutely denied the men. The supposition is that Manager Clarke was of the opinion that smokers would smoke regardless of orders, and that if not allowed to smoke in the shops they would find means to absent themselves.

Flexible Metallic Semaphore Blades.

The Pennsylvania and the Baltimore & Ohio have adopted as standard the flexible metallic semaphore blades for dwarf signals made by Blank & Russell, Wilkinsburg, Pa. The accompanying drawings show the construction of this blade. It consists of a steel rib of clock spring temper, thick enough to be sufficiently strong and

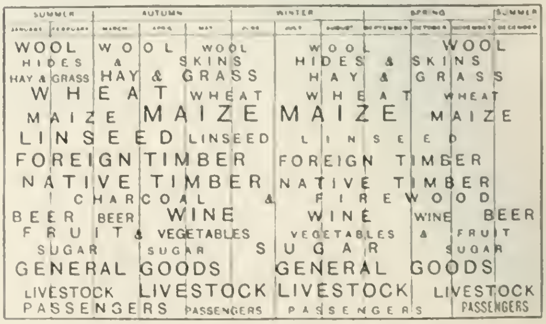


Sections of Flexible Semaphore Blade.

$2\frac{9}{16}$ in. wide x 8 in. long. It is treated in a copper solution to prevent rust and encased in rubber firmly vulcanized to it. It is claimed that this blade will not warp, so its whole face is always presented to the engineman. When struck by projections it bends and afterwards springs back to its original position without damage. Even if the rubber covering should be entirely torn off, the reinforcing rib would be left to give the signal indication. However, they have been tested in exposed places for three years without renewal. It is, of course, impossible for boys or malicious persons to cut or tear the blade from the casting.

Principal Articles of Traffic by Seasons, in Argentina.

The Buenos Ayres & Rosario Railway, which operates 2,361 miles of line in the Argentine Republic, and had gross earnings of $22,822,325 (£4,564,465) for the year shown below, has published the accompanying diagram showing the principal commodities carried, by seasons. The size of the type is intended to indicate the proportion of each class of traffic carried during each period; the most important article is maize (corn).



Traffic Diagram; Buenos Ayres & Rosario.

A Blow to the Tipping System in Business.

A decision has been given by the Appellate Division of New York State, under which it was held that a merchant need not pay for or return goods bought by one of his employees who had accepted a tip from the manufacturer. In discussing the decision, the counsel for many of the largest department stores in New York, including the store which brought the action under which the decision was returned, said:

"The very few convictions obtained under the anti-tipping law proved that law to be impractical as a means of stamping out the nuisance. At the best, it was a small fine for the offender on conviction, and it was found that many were willing to risk this. Therefore, it was determined to refuse to pay for or return $1,555 worth of goods which had been bought by an employee who had received a bribe of $75 from the manufacturer. The grounds for this refusal were that the manufacturer in bribing the buyer was a party to a crime, and that being so, the law says that the parties to a crime cannot get any benefit from it. On appeal to the Appellate Division our view of the matter was held to be correct, and the result, I think, will be to stamp out the practice. It is probable that the value of the goods retained will be given to charity, as, of course, the store does not want to profit by the commission of crime."

Street Railway Fares.

At the same time that a bitter political campaign is raging around the Cleveland and Detroit street railway companies, to bring about universal 3-cent fares, the Lexington & Boston Street Railway Company (Boston Suburban Electric Companies) has demonstrated that it cannot make a living profit out of 5-cent fares, and has raised its rates to the old-fashioned horse-car basis of 6 cents. The Lexington & Boston was built in 1900; it operates 33 miles of track, competing sharply with the Boston & Maine, and has found that its receipts have remained practically stationery, while new financing has been necessary to provide for the upkeep of the property. It has paid no dividends since 1904.

Production of the United States Steel Corporation.

The following table shows the percentage of normal production which the United States Steel Corporation was producing on certain recent dates:

Dec. 31, 1907	28 per cent. of normal.
Jan. 15, 1908	35 " " "
Jan. 31, 1908	40 " " "
Feb. 1, 1908	46 " " "
Feb. 18, 1908	49 " " "

New York City Accidents in January.

The Public Service Commission gives out figures of the January railroad and street railway accidents in New York City, as follows:

Car collisions	170
Persons and vehicles struck by cars	934
Boarding	479
Alighting	416
Contact with electricity	34
Other accidents	1,888
Total	3,921

The following injuries to persons were recorded:

To passengers	1,444
To persons not passengers	570
To employees	486
Total	2,500

Another table gives these statistics:

Killed	44
Fractured skulls	15
Amputated limbs	6
Broken limbs	32
Other serious injuries	91
Total	188

The total number of accidents in December was 3,993 and total killed 51.

Canadian Grain Shipments by Lake.

Fort William and Port Arthur, Ont., during the 1907 season of navigation, shipped by vessel 26,559,685 bushels of wheat in Canadian vessels and 5,838,069 bushels in foreign vessels (all to Port Huron and Buffalo), a total of 32,397,755 bushels, as against 65,172,397 bushels in 1906.

An American Signal Superintendent in England.

Arthur H. Johnson has been appointed Chief Signal Superintendent of the London & South Western, England, succeeding J. R. Annett, retired. Mr. Johnson was born in England, but received his early railroad training in the United States. He was for a time, about 1894, Special Engineer of the Erie, and has been an occasional contributor to the *Railroad Gazette*. From the Erie he went to England, and after two years went to New Zealand, where he was Signal and Telegraph Engineer on the New Zealand Government Railways. For some years past he has been Telegraph Superintendent of the London & South Western. This road has adopted automatic signaling to a greater extent than any other English line. Mr. Johnson is a son of Henry Johnson, the well-known signal engineer, and brother of Sidney G. Johnson, of the Union Switch & Signal Co., Swissvale, Pa.

Atlantic, Pacific and Gulf Ports.

The commerce at the principal customs districts and ports of the United States, calendar years 1897 and 1907 in millions of dollars was as follows:

Ports and customs districts	Imports. 1897	Imports. 1907	Exports. 1897.	Exports. 1907.	Ports and customs districts	Imports 1897	Imports 1907	Exports 1897	Exports 1907
New York	166	820	405	683	All other	71	220	198	428
Boston	86	123	104	105					
New Orleans	14	44	100	165	Total	743	1,423	1,100	1,923
Galveston	1	8	61	197					
Philadelphia	44	81	52	107	Atlantic ports	616	1,107	772	1,175
Baltimore	11	26	99	99	Gulf ports	18	62	181	433
San Francisco	41	54	40	30	Mexican border	4	17	13	41
Puget Sound	8	25	15	44	Pacific ports	51	91	64	94
Savannah	1	2	26	65	Nor. brdr & lake	47	123	70	200
					Interior ports	7	23		..

Organizing a Friendly Union.

At the annual meeting of the Postal Telegraph Co. (Mackay Companies) President Clarence H. Mackay gave the following account of the change in labor organization which the company made last fall. The idea seems capable of extension.

In August, 1907, in several cities part of the employees of the Postal Telegraph Company "struck." They struck without warning, without grievance and without cause. They seem to have struck in sympathy with a strike by the employees of the Western Union Telegraph Company. They did not even formulate their demands until several weeks later. Thereupon the officials of the Postal company, all of whom came from the ranks, became telegraphers again, and with those operators who remained loyal and with clerks from other departments kept the business of the company and of the country going. The trustees do not hesitate to say that a more devoted and expert staff is not to be found anywhere in any line of business.

The strike lasted 12 weeks and then the company took back only the efficient and reliable men. The monetary loss to the company due to the strike only served to demonstrate the soundness of the plan on which the Mackay Companies is formed; namely so wide a distribution of its interests as to minimize the effect of any loss from one particular source.

The Postal Telegraph Company realized, however, that the telegraphers' union was a menace. Telegraphy is a profession, and its messages are so confidential that to divulge them is a criminal offense. Telegraph employees cannot be allowed to give their allegiance to a union in preference to their duty to their business. Accordingly, the company in October, 1907, organized the Postal Telegraph Employees Association, to be open to all its employees who would abjure all unions, to be conducted without dues and without debts and to entitle its members to aid from the company during sickness or disability. This association was enthusiastically received and joined by the employees. It is now thoroughly established, and renders impossible another strike, and further, it strengthens the bond of loyalty and sympathy which always existed between the Postal Telegraph Company and its employees.

INTERSTATE COMMERCE COMMISSION RULINGS.

The Commission, in an opinion by Commissioner Harlan, has announced decision in the case of the Merchants' Traffic Association vs. Pacific Express Company. Complaint was made of a general special rate of $2 per 100 lbs. on milk and cream from St. Paul, Neb., to Denver, Colo., lawfully in force only because of inadvertent omission of defendant to file its mileage scale of milk and cream rates under which the lawful rate between these points would have been 58 cents. After this complaint was brought before the Commission, defendant filed on short notice a mileage tariff making the 58-cent rate. This being satisfactory to the parties, it was stipulated on the hearing that the complaint might be dismissed. The Commission in making the stipulation effective ordered the maintenance of the 58-cent rate for a period of not less than two years, but holds the case under further advisement.

Rulings About Passenger Service.

The Commission on February 15, announced that the railroads in arranging personally conducted tours must keep separate the charges for transportation, meals and hotel accommodations, leaving to the passenger the right to accept the transportation with or without the other accommodations. A railroad is permitted thus to stimulate traffic by providing entertainment to which it may contribute at a point on its lines, but such contributions must be made in a definite sum and be in no way dependent on the number of tickets sold. A passenger traveling on a special limited excursion ticket with stopover privileges who misses connections because of excessive delays of trains, is entitled to have his ticket made good if out of date when he makes the return trip. Passes granted to state railroad commissioners cannot be used in interstate journeys.

Reparation Granted Because of Reduced Rate.

In the case of Minneapolis Threshing Machine Co. vs. Chicago, Rock Island & Pacific (opinion by Chairman Knapp) it appeared that complainant shipped from Dallas, Tex., to Kansas City, Mo., seven carloads of agricultural machinery on which it was compelled to pay a rate of 72 cents per 100 lbs. At the same time the rate from Dallas to Hopkins, Minn., on these articles was 43½ cents. The distance from Dallas to Kansas City is 624 miles, while the distance from Dallas to Hopkins is 1,240 miles, Kansas City being directly intermediate between Dallas and Hopkins. It appears that at the present time the shipments made as above stated would take a rate of 36 cents only.

The Commission decided in this case that the 72-cent rate was excessive and that the 36-cent rate which the defendant now voluntarily affords is reasonable. The defendant was ordered to pay complainant the sum of $641 as reparation.

Powers of the Commission do Not Include Authority Over Rights of Stockholders.

The Commission, in an opinion by Chairman Knapp, has announced decision in the case of John B. Manning vs. Chicago & Alton Railroad and Louisiana & Missouri River Railroad. The complainant alleged that he has for many years been the owner of shares of stock of the Louisiana & Missouri River, which has been merged in the Chicago & Alton Railroad, and that he cannot procure a statement of the earnings and expenses of the Missouri company, and asks the Commission to investigate the matter and require the Alton company to keep a separate set of accounts covering the operation of the Missouri company.

The Commission decided that the powers conferred on it were not intended to be exercised for the purpose of ascertaining whether an individual stockholder has been wronged by such transactions as those in question. The investigation which the complainant desires is not required by considerations of public interest or the proper discharge of official duties. The complaint was dismissed.

Demand for Station Facilities Compromised.

The Commission, in an opinion by Commissioner Clements, has announced decision in the case of John H. Lewis et al. vs. Chicago, Rock Island & Pacific. The complainants prayed for an order requiring the railroad to re-establish its station facilities at Fanshawe, Okla. It seems that defendant had established a station at Fanshawe in 1892, but had discontinued it in 1901. Complainants claim that this resulted in unjust discrimination. At the hearing, defendant agreed to build a spur track at Fanshawe for delivery of freight and to have stopped every day, on signal by flag, one passenger train in each direction. Complainant stated that this arrangement would be satisfactory, and defendant has complied with the understanding in respect to passenger facilities.

The Commission said that since it appears that the public interest, so far as involved, will be subserved by the fulfillment of this understanding, and in the expectation that this will be accomplished by the defendant at an early date, it will not review the fact or express an opinion on the merits of the controversy, but an order will be entered dismissing the case without prejudice.

MANUFACTURING AND BUSINESS.

Robert McF. Doble, Consulting and Supervising Engineer, making a specialty of hydro-electric power development and transmission, formerly of San Francisco, Cal., has moved from Colorado Springs, Colo., to 528 Majestic building, Denver.

At the annual meeting of the directors of the Frost Railway Supply Co., Detroit, Mich., on February 11, the following officers were elected: President, Harry W. Frost; Vice-President, George A. Cooper; Treasurer, Frederick H. Holt; Secretary, James Whittemore; Assistant Secretary, Harry C. Smith.

Among the recent orders taken by the Power Specialty Co., New York, for the Foster steam superheater are the following: Home Electric Light & Steam Heating Co., Tyrone, Pa., 840 h.p. in Heine boilers; Torresdale Filtration Plant, Philadelphia, Pa. (second order), 900 h.p. in Heine boilers; Western Clock Manufacturing Co., LaSalle, Ill. (second order), 300 h.p. in return tubular boilers; Bernheimer & Schwartz Brewing Co., New York, 1,900 h.p. in Heine boilers; Garden City Co., Garden City, L. I., 200 h.p. in return tubular boilers; National Sugar Refining Co., Yonkers, N. Y., 1,134 h.p. in B. & W. boilers. It has also sold independently fired Foster superheaters to the New Jersey Zinc Co., the University of West Virginia; the Abendroth & Root Manufacturing Co., and the Seacoast Canning Co. The latter company has within the past year equipped seven of its plants with Foster superheaters, installing them in return tubular boilers.

Iron and Steel.

The New York, New Haven & Hartford is said to be in the market for 1,000 tons of material for a bridge at Providence, R. I.

The board of supervising engineers in charge of the rehabilitation of the Chicago street railways has, it is said, authorized the purchase of 8,000 tons of rails.

OBITUARY NOTICES.

Asa G. Dailey, formerly Superintendent of Tracks and Bridges of the Michigan Central, died at his home in Detroit February 5.

David P. Barhydt, who died at his home in New York City last week at the age of 92, was for many years President of the Erie & Kalamazoo, one of the first railroads west of Lake Erie; and he was one of the incorporators of the Sixth Avenue Street Railway in New York City, in 1851.

James D. Layng, Vice-President of the Cleveland, Cincinnati, Chicago & St. Louis, died at his home in New York City February 12, at the age of 74 years. Mr. Layng was formerly one of the most active railroad officers in the country and had held important positions for half a century. He had served on a number of different lines but will be most generally remembered as Superintendent and General Manager on the Pennsylvania Lines West of Pittsburgh between 1858 and 1881, and as Vice-President or General Manager of the West Shore Railroad from 1881 to 1899. Mr. Layng was born at Columbus, Pa., August 30, 1833, and was graduated from the Western University of Pennsylvania at the age of 16. He immediately entered railroad service, beginning as a rodman on the Ohio & Pennsylvania. He worked up through different engineering positions on this and other roads until 1856, when he was made Chief Engineer of Maintenance of Way of the Steubenville & Indiana. As the western lines which made up that part of the Pennsylvania system were gradually consolidated, Mr. Layng was promoted to different positions and in 1874 was made General Manager of the Pennsylvania Lines West of Pittsburgh and Erie (?). In 1881 he went to the Chicago & North-Western, but two years later went to the West Shore, then just finished, and he remained with the New York Central lines until his death. When the management of the West Shore was merged with that of the New York Central, Mr. Layng devoted his time chiefly to the "Big Four," of which he had been an officer since 1887, having been President of the Cleveland, Columbus, Cincinnati & Indianapolis before its consolidation with the present "Big Four."

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Iron and Steel Institute.

The Secretary announces that the annual general meeting is to be held at the Institution of Civil Engineers, Great George street, London, S. W., May 14 and 15, 1908. The annual dinner will be held under the Presidency of Sir Hugh Bell, Bart., in the Hotel Cecil, on May 14. The autumn meeting is to be held in Middlesbrough on September 29, and following days. The council will soon award Carnegie Research Scholarships, described in the *Railroad Gazette* of January 24, and candidates must apply before February 29. The awards will be announced at the general meeting. Bennett H. Brough, 28 Victoria street, London, S. W., is Secretary.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Pacific.—Charles Drinkwater, who has resigned as Secretary, will continue in the service of the company as Senior Assistant to the President, with office at Montreal.

Chicago Terminal Transfer.—William T. Nelson and H. H. Hall have been elected Directors, succeeding Fred G. Reighley and Ralph M. Shaw.

Mobile, Jackson & Kansas City.—George R. Sheldon, A. P. Walker and John W. Simpson, of New York; John McLeod, of Philadelphia, and Wallace B. Rogers, of Laurel, Miss., have been elected Directors, succeeding Charles E. Levy, R. W. Jones, Jr., former President of the suspended Oriental Bank of New York City, Edmund K. Stalle, J. W. Whiting and Richard B. Scandrett. Brayton Ives, President of the Metropolitan Trust Company of New York, is Chairman of the Board, and the other Directors are: L. S. Berg, President; W. D. Stratton, Vice-President, and Alexander McDonald.

Southern Pacific.—W. F. Ingram, heretofore in the service of lines controlled by the Southern Pacific in Mexico and Arizona, has been appointed Assistant Auditor, with office at San Francisco, Cal.

Operating Officers.

Erie.—G. W. Kirtley has been appointed Superintendent of Car Service. C. C. Riley, Superintendent of Transportation, has resigned and the office has been abolished.

Fort Smith & Western.—W. M. Bushnell, hitherto Assistant General Freight Agent of the Chicago & Alton, has been appointed General Manager of the Fort Smith & Western and the St. Louis, El Reno & Western, succeeding W. E. Crane, resigned; office at Fort Smith, Ark.

Illinois Central.—J. C. Dailey, Superintendent of the Chicago division, has resigned. See International & Great Northern.

International & Great Northern.—J. C. Dailey has been appointed General Superintendent, office at Palestine, Tex.

Mexican Central.—J. D. Melville has been appointed Superintendent at Cardenas, in place of A. C. Hobart, assigned to other duties.

Missouri Pacific.—E. F. Kearney has been appointed Superintendent of Transportation in place of T. E. Byrnes, resigned, office at St. Louis. John Cannon, who has been succeeded by M. M. Richey at Little Rock, has been appointed Superintendent of the Missouri division; office at De Soto, Mo., in place of J. W. Dean. Mr. Dean will take the place of Mr. Kearney as Terminal Superintendent at St. Louis.

New York Central & Hudson River.—C. I. McCoy, Passenger Trainmaster of the Hudson division, will also assume the duties of Trainmaster of the Putnam division in place of W. W. Currier deceased.

New York, New Haven & Hartford.—J. D. Gallary has been appointed Trainmaster of the Providence division, and J. W. Carr, Trainmaster of the Western division.

St. Joseph Valley.—G. F. Moore, General Manager, with office at La Grange, Ind., has resigned and has been appointed an Inspector of Accounts for the Interstate Commerce Commission, with headquarters at Washington.

Southern.—D. W. Newell, hitherto Superintendent at Rock Hill, S. C., has been appointed Superintendent at Jacksonville, Fla., in place of J. A. Baumgardner, who has been made General Agent at Charleston, S. C. W. R. Hudson has been appointed Superintendent at Birmingham, Ala., in place of E. E. Stoup. W. J. Bell, hitherto Superintendent of the Macon division, has been appointed Trainmaster at Macon, that division having been consolidated with the Atlanta division.

Traffic Officers.

Missouri Pacific.—C. E. Styles, Assistant General Passenger Agent, with office at Kansas City, has resigned. Mr. Styles entered the service of the company 38 years ago at Atchison, Kan., and has served in many different positions in the passenger department.

Benton Quick has been appointed General Baggage Agent, in place of A. G. Brigham, office at St. Louis, Mo.

Engineering and Rolling Stock Officers.

Cincinnati, New Orleans & Texas Pacific.—J. P. McCuen, Superintendent of Motive Power of the lines in the "Queen & Crescent Route," has resigned, the resignation to take effect March 1. Mr. McCuen entered the service of the Queen & Crescent as Road Foreman on March 1, 1882; served as Division Master Mechanic at Chattanooga 1886-1887; was promoted to the position of Division Master Mechanic at Monroe, La., in 1887, and in 1892 was made Division Master Mechanic at Birmingham. On January 1, 1895, he was appointed Superintendent of Motive Power, with headquarters at Ludlow, Ky., which position he has held up to this time.

New York, New Haven & Hartford.—Appointments of Master Mechanics for each of the seven divisions of the company's lines, as reorganized, are announced as follows: New York division, J. M. Collins, office at Harlem river, N. Y.; Shore Line, P. C. Zang, office at New Haven, Conn.; Providence, G. A. Moriarity, Providence; Boston, J. Hocking, South Boston. Old Colony, D. R. Killinger, Taunton, Mass.. Midland, J. B. Gannon, East Hartford, Conn.; Western, H. C. Oviatt, New Haven, Conn. Messrs. Collins, Killinger and Gannon, heretofore at East Hartford, Roxbury and New London, respectively, are the only ones who have to go to new headquarters.

LOCOMOTIVE BUILDING.

The New York Central Lines have asked bids on 200 locomotives.

The Standard Oil Company is said to be in the market for 20 contractors' engines to be used on Staten Island, N. Y. This has not yet been confirmed.

CAR BUILDING.

The New York Central Lines are figuring on passenger coaches.

The New York, Ontario & Western has been figuring on new passenger equipment.

The Keweenaw Central has ordered one smoking car, one baggage car and one express car from the Pullman Company.

The Idaho, Washington & Northern has ordered two passenger cars, one smoking car and one baggage car from the Pullman Company.

The Kiangsu & Chekiang has ordered two first and second class combination passenger cars, two straight second class cars and six third class passenger cars from the Pullman Company.

The Grand Trunk Pacific, as reported in the *Railroad Gazette* of February 7, 1908, has ordered 2,200 Grand Trunk standard box cars and 200 Hart convertible ballast cars from the Canada Car Company, and 500 standard box cars from Rhodes, Curry & Company. These are the cars to be received from these two companies during 1908 under a contract between the Grand Trunk Pacific and these companies covering a period of years.

The Panama Railroad is asking bids, up to February 24, on 300 thirty-ton box cars and 100 forty-ton Hart convertible cars. F. C. Nordsiek, 21 State street, New York, is Assistant Purchasing Agent. The box cars will be 40 ft. long and the Hart convertible cars 35 ft. long. Bodies and underframes will be of wood. The gage of track is 5 ft. The special equipment for all cars includes:

Bolsters	Body (box cars) Simplex; truck Simplex
Brakes	Westinghouse
Brake beams	Simplex
Brake-shoes	Streeter steel back
Couplers	Box cars, Tower; convertible cars, Chicago
Doors (box cars)	Side, Security; Locks Nat. Mall. Castg. Co.
Draft rigging	Miner tandem
Journal boxes	McCord
Roofing (box cars)	Drake & Wiers Co.
Side bearings	Woods' or Miner
Trucks	Arch bar

The Canadian Pacific, as reported in the *Railroad Gazette* of January 17, has ordered 400 steel Roger-Hart convertible ballast cars of 100,000 lbs. capacity from the Dominion Car & Foundry Co., to be built at the Blue Bonnets works. These cars will be 36 ft. 10 in. long between end sills, 8 ft. 7¼ in. high over all, and 10 ft. wide over all; 35 ft. 3 in. long inside as a gondola car, 4 ft. 1¾ in. high from rail to top of floor, and 8 ft. 8 in. wide inside measurements. The tops and underframe will be steel. The special equipment includes:

Bolster, body	Steel, built in the car frame
Bolsters, truck	Simplex
Brake beams	Simplex
Brakes	Westinghouse
Couplers	Tower
Dust guards	Harrison
Journal bearings	Canadian Bronze Co.
Journal boxes	McCord
Paint	Metallic
Side bearings	Susemihl
Springs	Canadian Pacific standard
Trucks	Barber, cored, with channel cross tie and with brake-beams hung to steel columns

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BURRARD-WESTMINSTER BOUNDARY RAILWAY & NAVIGATION.—Organized to build lines as follows:

Vancouver, B. C., to Fraser river bridge, New Westminster, thence via Port Moody to the proposed Vancouver, Westminster & Yukon Railway bridge at Second Narrows, Burrard Inlet and thence to the place of commencement in Vancouver.

From the proposed Vancouver, Westminster & Yukon bridge to north arm of Burrard Inlet and to Howe Sound.

From Fraser river bridge at New Westminster to the international boundary line between Semiameo Bay and Sumas.

From False Creek, Vancouver, to Point Grey, thence to the Fraser river bridge, New Westminster.

From Port Moody to Stave river and the east boundary of Mission Municipality. Tupper & Griffin, Vancouver, B. C., Solicitors.

CHESTERFIELD & LANCASTER.—This company, which has just finished its road from Ruby, S. C., via Mount Croghan, Gue... and Pageland to Croburk, 21 miles, has projected an extension from that point north to Monroe or Charlotte, N. C., 20 to 40 miles.

FAIRCHILD & NORTHEASTERN.—This company, which last year added five miles of line to its road, expects to finish its extension to Owen by June. It will then have a line from Fairchild, Wis., via Greenwood to Owen, 38 miles. Work is now under way on a change of track near Owen, which is to be finished this summer.

NORTHERN ELECTRIC.—This company has finished work on its extension from Chico, Cal., west to Hamilton, 18 miles, with the exception of the drawbridge over the Sacramento river. The line is now in operation over a temporary bridge. During this year the company will probably build an extension from Marysville, Cal., to Colusa.

NORTHERN DAKOTA.—Grading is to be started in April or May of this year on this proposed line from Edinburg, N. Dak., west to a terminal not yet named, about 21 miles. It is expected to have the line finished by August. Contracts will shortly be let for 60,000 ties. Thomas D. Campbell, President; E. Thorwaldson, Vice-President, and D. F. Bull, Secretary and Treasurer, Edinburg.

OREGON ELECTRIC.—This company has work finished on its line from Portland, Ore., via Tualitin and Wilsonville to Salem, 50 miles, with the exception of some ballasting now under way. An extension is projected from Portland to Forest Grove, 25 miles, for which surveys have been made. Guy W. Talbert, Manager, Portland.

PANHANDLE SHORT LINE.—This company has projected a line from Dalhart, Tex., south via Hereford and Midland to San Antonio, with a branch from Midland to Deepwater at Rockport on the Gulf. Grading contract let to Miller & Jefferson for work from Dimmitt south to Lamb county, 60 miles. Grading finished from Hereford to Dimmitt, 32 miles. There will be a number of bridges. Additional contracts are shortly to be let. W. G. Ross, President, and A. D. Goodenough, General Manager, Hereford, Tex.

PERKIOMEN TRACTION.—Rights of way are being secured by this company for an electric line through Perkiomen Valley, Pa., about 11½ miles. I. H. Bardman, Schwenkville; H. T. Hunsicker, Ironbridge, and J. H. Dager, Norristown, are interested.

PITTSBURGH, CANONSBURG & WASHINGTON (ELECTRIC).—Grading started in November, 1907, from Washington, Pa., via Canonsburg, Thompsonville, Castle Shannon and West Liberty to Pittsburgh, 31 miles. Contract from East Canonsburg to Van Eman, two miles, let to W. H. Murdoch, Pittsburgh; from Thompsonville to Clifton, 1½ miles, to W. J. Payne & Sons Co., Pittsburgh, and from Clifton to Castle Shannon, two miles, to Samuel Gamble, Carnegie, Pa. There are to be bridges at East Canonsburg, Van Eman, Thompsonville and Clifton. F. Uhlenhaut, President, Pittsburgh. The line is being built by the Pittsburgh Railways Company.

PUBLIC BELT RAILROAD.—Contract has been let to the Orleans Engineering Co., of New Orleans, for building part of this double-track line around New Orleans, La. The proposed route is from the upper Parish line along the river front to Kentucky street, around the rear of the city to upper Parish line, thence along the protection levee to the point of commencement, 22 miles. Single-track has been laid from Parish line to Montegut street, 10 miles. W. J. Hardee, City Engineer, is Chief Engineer, and Hampton Reynolds, Assistant Engineer in charge. Work is also under way on storage tracks and bridges at various points.

SACRAMENTO VALLEY & EASTERN.—Grading has been finished on this line from Pitt near Kennett, Cal., via Pitt River and Copper City to Del Mar, 11 miles. It is expected to have the entire line finished by March 1. T. J. Deerborn, Chief Engineer, Kennett.

ST. JOSEPH, SAVANNAH & NORTHERN.—This company has located its line from St. Joseph, Mo., north to Savannah, 15 miles. Construction work is expected to be begun this spring. T. B. Campbell, M. Tootle and F. J. Wheeler, of St. Joseph, are interested.

SAN DIEGO & ARIZONA.—An officer writes that this company has not yet finished its location surveys for its proposed line from San Diego, Cal., east to Yuma, Ariz., 200 miles. A small amount of grading has been done between San Diego and National City; also some in the mountains. Over $1,000,000 has been spent in securing rights-of-way and terminals in San Diego and National City. The company has taken over the franchises and property of the San Diego Eastern, projected over the same route. John D. Spreckels, San Francisco, is the principal promoter, and W. Clayton is Vice-President.

SAN DIEGO EASTERN.—See San Diego & Arizona.

RAILROAD CORPORATION NEWS.

CHICAGO, CINCINNATI & LOUISVILLE.—The United States Circuit Court at Cincinnati, Ohio, on February 14 appointed James P. Goodrich, Chairman of the Republican State Central Committee of Indiana, receiver of this company, on application of George A. Fernald & Co., bankers, of Boston. This action is reported to be a friendly one. The application for a receiver was due both to inability to raise money and to the fact that gross earnings have fallen from $116,000 in October, 1907, to $64,000 in January, 1908. There is said to be a floating debt of $1,750,000. The road was formerly part of the "Great Central Route," but was separated from the Cincinnati, Hamilton & Dayton and the Pere Marquette after their receiverships.

HUDSON & MANHATTAN.—Harvey Fisk & Sons, of New York, have recently offered $5,000,000 of an issue of $15,000,000 two-year 6 per cent. convertible collateral notes of the Hudson Companies at 98½, yielding over 6½ per cent. These notes are secured by first mortgage 4½ per cent. convertible bonds of 1957 of the Hudson & Manhattan Railroad at the rate of $1,500 of these bonds for each $1,000 in notes outstanding. These bonds are convertible after 1912 at par into common stock at $110 a share. The notes are convertible at maturity into these bonds at par. An article describing the present status of the Hudson & Manhattan Railroad, one of whose lines under the Hudson river is to be opened to traffic next Tuesday, will be found in another column. The Hudson Companies is the company formed to build and equip the Hudson & Manhattan Railroad. It has a paid up capital of $21,000,000 and owns over $5,000,000 worth of New York City real estate, largely at Sixth avenue and Thirty-second and Thirty-third streets, where the uptown underground terminal will be built.

HUDSON COMPANIES.—See Hudson & Manhattan.

ILLINOIS CENTRAL.—There is a plan favored by the Harriman party to issue $30,000,000 equipment bonds on $40,000,000 worth of unmortgaged equipment to be used as collateral pending arrangements for permanent financing.

KANSAS CITY, MEXICO & ORIENT.—President Stilwell has sent a letter to stockholders asking that while the officers of the company are again undertaking the sale of bonds and stock in Europe, the stockholders subscribe either to one-year 6½ per cent. joint notes of the two construction companies which are building the railroad, each $1,000 note being secured by $2,000 in first mortgage bonds of the railroad company; or to first mortgage bonds of the railroad company, with a bonus of 40 per cent. in preferred and 40 per cent. in common stock; either of these subscriptions to be made at par. The funds thus obtained are to be used in pushing construction as fast as possible. Mr. Stilwell concludes as follows:

"I cannot urge on you too strongly the necessity of completing the 67 miles of track necessary to connect the road between the Red river and Benjamin. This will give us a line in operation from Wichita, Kan., to Sweetwater, Tex., and will enable us to secure a great deal of through business. We have experienced very trying times and it has been difficult to carry on construction work during the past 90 days, but we have continued to do so, and I hope our stockholders will now come to our assistance and enable us to build this 67 miles so necessary to the success of the enterprise. This will give us 434 miles of continuous track in this one section which ought to show earnings of $20,000,000, or much more than we have invested in the entire line up to the present time."

NATIONAL OF MEXICO.—The directors at a meeting held in the City of Mexico on February 14 decided to postpone action on the dividend on the first preferred stock, although it was announced that it had been fully earned. In 1907, 2 per cent. was paid. The first payment, 1 per cent., was in August, 1906.

NEW ORLEANS, MOBILE & CHICAGO.—President Berg of the Mobile, Jackson & Kansas City, says that his company has obtained about $1,500,000 under the plan of reorganization with which to pay off floating debt, improve the property and provide new equipment. (Jan. 10, p. 71.)

NEW YORK, NEW HAVEN & HARTFORD.—Total operating revenue for the six months ended December 31, 1907, was $29,500,000. Operating income (after taxes) was $7,450,000. There was a deficit after fixed charges and dividend payments of $153,000.

TEXAS & PACIFIC.—The annual interest payment to be made March 1 on the $24,661,770 second consolidated income bonds has been reduced from 5 to 3½ per cent. From 1901 to 1907 inclusive, 5 per cent. was paid. In 1901 4 per cent. was paid, and in 1900 1½ per cent.

TOLEDO & CHICAGO INTERURBAN.—James D. Mortimer has been appointed receiver of the Toledo & Chicago Interurban Railway, which operates about 40 miles of road from Fort Wayne, Ind., to Waterloo.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 9. FRIDAY, FEBRUARY 28, 1908.

President Roosevelt is somewhat out of touch with the commercial interests of the country, but we presume he takes cognizance of the fact that earnings of manufacturing industries and railroads alike are lower than they were a year ago at this time, and that urgent need of economy confronts every manager. What was the object, therefore, in including in his recent letter to the Interstate Commerce Commission the following statement?

"If the reduction in wages . . . is caused by misconduct in the past financial or other operations of any railroad, then everybody should know it, especially if the excuse of unfriendly legislation is advanced as a method of covering up past business misconduct by the railroad managers, or as a justification for failure to treat fairly the wage-earning employees of the company."

How long does the President suppose the wage-earning employees of a wicked railroad would stay in its employ if it reduced wages below the figure which these employees could obtain elsewhere? And if economic conditions are such that the supply of labor exceeds the demand, how long does he suppose wages will remain at the plane to which they have been forced in a long series of years when the demand exceeded the supply? Between January 1 and June 30, 1907, the *Railroad Gazette* reported 81 cases of wage increases, involving 67 roads, although no special effort was made to obtain a complete list. Did anybody investigate these increases, on the ground that the vested owners of the properties—the employers of labor—were not treated fairly thereby? We imagine that such investigation would have proved futile; demand was forcing wages up, and the increases had to be paid if men were to be secured and traffic moved. The converse of this (as seen by everybody except Mr. Roosevelt and Mr. Gompers) becomes true when demand ceases, and labor seeks employment. But the President is not opposing natural laws unarmed; he has a pretty formidable club. His letter may be paraphrased as follows: If you reduce wages, you thereby become subject to a governmental inquisition on the assumption that you are unable to continue overpaying your employees because your property is overcapitalized. Choose, therefore, between your present wage scale and an inquisition which will damage your credit!

Low prices in the stock market, idle freight cars and business depression do not delay the maturity of financial obligations which are outstanding against railroads any more than they do those outstanding against individuals. According to a table given in the *Journal of Commerce* there are maturing during the next five months a total of $35,948,000 in bonds and $36,880,460 in notes of steam railroads, the notes including a few of the larger equipment trust instalments. These figures do not include $15,000,000 notes of the Interborough Rapid Transit Company maturing in May, $16,500,000 notes of the Underground Electric Railways of London maturing in June, or $10,818,000 bonds of a subsidiary of the Manhattan Elevated, of New York City, maturing July 1, 1908. The principal railroad note issues maturing are Missouri Pacific, $6,000,000, already refunded; Rock Island, $6,000,000, maturing in April; Erie discount notes, $5,000,000, maturing in April, and Pennsylvania equipment trust instalments estimated at $6,000,000, maturing in June. The largest bond issues are $6,000,000 Delaware & Hudson 6 per cent. bonds maturing this month, $4,700,000 Great Northern 5 per cents maturing in April, and $4,993,000 Oregon Short Line sevens maturing July 1. The Erie has also $2,500,000 in sixes and fives maturing on that same date. The present great difficulty of raising new railroad capital is resulting in the production of some novel forms of corporate securities. The means by which the Missouri Pacific refunded its $6,000,000 two-year 5 per cent. notes which matured February 10 was by an issue of the same amount of two-year 6 per cent. collateral convertible notes. These notes were secured by $12,000,000 Kansas & Colorado Pacific 30-year 6 per cent. mortgage bonds dated February 1, 1908. It is these bonds into which the notes are convertible at par. We are informed by the bankers that these are the first convertible notes ever issued. It is interesting to observe the various ways in which they are made attractive to investors. They are a direct obligation of the Missouri Pacific. They are secured by twice their par value in new mortgage bonds on 1,450 miles of the Missouri Pacific system. They are also convertible into these bonds. Both the notes and the bonds are 6 per cent. issues. The bonds are guaranteed by the Missouri Pacific. This Missouri Pacific issue was soon followed by another convertible note issue. The Hudson Companies, the construction company which is building the Hudson & Manhattan Railroad, the first of whose tunnels under the Hudson river was opened on Tuesday of this week, have recently put out $15,000,000 two-year "secured" 6 per cent. notes with first mortgage bonds of the Hudson & Manhattan Railroad as collateral. The notes are convertible at maturity into these bonds at par. There is a further interesting feature of this collateral convertible note issue secured by bonds. The first mortgage bonds of the Hudson & Manhattan are themselves convertible at par after 1911 into common stock of the Hudson & Manhattan at $110 a share. Thus we here have notes convertible into bonds which are themselves convertible into stock. Other methods which seem to be the favorites at the moment for railroads which are looking for new funds are the issue of mortgage bonds on some part of a big system which either is not bonded at all or has a low bond issue or the issue of equipment notes secured directly on equipment and either sold outright or used as collateral for loans. The Baltimore & Ohio, for instance, last week sold $6,000,000 one-year 5 per cent. notes secured by $8,000,000 Pittsburgh, Lake Erie & West Virginia refunding bonds. The Union Pacific is reported to be planning to issue mortgage bonds on the 1,650 miles of its lines which were on June 30, 1907, free of lien. The sale in January of $30,000,000 New York Central Lines equipment notes is the largest piece of recent railroad financing. The Illinois Central may issue the same amount of equipment notes on some $10,000,000 worth of unmortgaged equipment, but these are likely to be used as collateral for borrowings instead of being sold.

THE COMPLEXITIES OF RAILROAD PENALTY.

In these parlous and somewhat topsy-turvy times, when the big stick of the federal executive and the rods of state legislation are falling upon the backs of the just and the unjust, it is interesting and in the end may be instructive to study the variations of railroad penalty—past, present and proposed—and also its diversity of victims. We are seeing some unprecedented anti-railroad forces in more or less active play. Some primal laws of political economy, recognized alike in the academic classroom and in practical experience, are to be suspended if authority can do it. There is to be one law for the corporation, another for its working units, with the stockholder, whether innocent on the one hand or, in the legal phrase, guilty of "contributory negligence" on the other hand, shouldering the ultimate burden. Under such conditions the incidence and distribution of penalties, their justice or injustice, and the complications that attend them become, as subjects for analysis, something better than a merely intellectual exercise.

Starting with the railroad corporation itself, how vast its variations in history! One corporation projects itself on the screen as speculative from its first inception and speculative in high degree. Or, from the start, it may have been conservative or well-nigh so. Or, again, it may have risen from the low plane of speculation to the upper plane of honesty, or reversed the process and descended. It may have been solidified by a reorganization or it may have been inflated. In the swift progress of railroad consolidation in this country and others many of these changes have been lost sight of. Investors, as well as non-investors, are apt to be forgetful. The great railroad system of to-day is outwardly an entity, but historically made up of units the original status of which has, generally speaking, disappeared in the march of railroad events. Some picturesque features are still held in memory, but only by the older generation. One not far beyond the bounds of middle life may recall the Credit Mobilier in Union Pacific or the Gould "Chapters of Erie" as crystallized in the narrative of Charles Francis Adams, or the 80 per cent. stock dividend of New York Central. But most of the details of railroad history, and nearly all the details of consolidation, have for the ordinary observer and the ordinary investor sunk below the horizon, save as they appear in the form of a long lease of component or subsidiary lines or some special guarantee of bonds or the mortgage quality of bonds as applied to parts of a system. The big railroad of to-day is a composite, broadly speaking.

When one comes then to the application of penalty to past railroad misconduct, whether that penalty is to be exercised under actual law or merely used as a moral force for the regulation of wages, one may well inquire what are the scope and limitations of such a policy. How far does it go back, of what class of offences is it to take moral or statutory jurisdiction, are its methods to be personal or corporative? Will it reach back to the scandals of the Credit Mobilier, or will it stop with Harriman? Will it "go for" the speculative railroad systems alone, or will it include those which have been relatively sane and the investment field of the trustee and the widow? Will it strike at the work of the high financiers who a few years ago, in the case of certain big western lines, financed their stock into bonds, sold out and retained control by a holding company? or will it merely consider present conditions of earning power? Will it, as a test of threatened wage reduction, apply the hydrometer to each railroad corporation and make that the test of equitable earning power?

So much for the corporation considered as the target of penalty. Turning next to the stockholder, we find him in as many diverse situations of responsibility as the railroad system. But excluding him as the mere speculator who takes his risk and is not entitled to much mercy, and treating him as the honest investor he offers us still many investing personalities. He may in a few cases be the now white-haired original investor in a new and successful railroad project, but in that character, as regards steam railroad enterprise, he is not now common. His railroad shares selling in the market at the time of his death on a four or five per cent. basis have passed to others. It may be in fee to direct heirs. It may be to trustees authorized to make up the trust from funds of the estate on a market valuation. It may be that at the same valuation the shares have been sold. But whether held or sold, two points are to be emphasized for the conservative investor in the dividend-paying railroad stock. First, that it has been bought or held on a low interest rate return, and, secondly, that it has been acquired or held under the reasonable assumption that old policies of the government, state or national, would protect it, and that radical policies would not assail it. Such an innocent investor had a right to assume, did assume, and the precedents of federal policy gave him the right to assume, that natural law rather than artificial checks would adjust wages just as it would affect earnings or dividends, that there would not be one rule for earnings and profits and another for wages, and that hard times would distribute its burden on both parties and not load them upon one on the basis of some vague and indeterminate official interpretation of railroad "misconduct." Saying nothing of the federal proposition, as a matter of public policy, does it not invade a basic right of property?

One can push the analysis of the confusing situation still further. It can be asked, for example, how far railroad "misconduct" bears upon the rights of bondholders or holders of leased line stocks, and whether they, too, may not, under certain conditions, come under the federal theory of direct or indirect penalty in the form of fiscal loss? Then there are the street railway corporations, few of them interstate, to be sure, but liable to be the victims of reflex action from the federal capitol playing upon state railroad commissions and legislatures. But this is a look ahead, though not necessarily a far look. For the moment the new executive dicta striking into the vast complexity of corporate relations to wages and into primal rights of property are big enough when limited to steam railroads alone. Time will show whether or not they are more serious and abiding than the political gestures that end with a presidential voting day.

WHAT ARE WE GOING TO DO ABOUT ACCIDENTS?

We print this week three contributions commenting on Mr. Boardman's open letter to newspaper editors, printed in the *Railroad Gazette*, January 31, under the caption "What Are We Going to do About Railroad Accidents?" One of our contributors is Mr. Cease, editor of the *Railroad Trainman*, who says that there has as yet been no evidence submitted to prove that the railroad (labor) organizations have interfered with the enforcement of discipline, that they have advised their employers, or in an arbitrary or unfair manner have intimated to them who should be employed.

Well, let us see. Discipline looks forward as well as backward, and its use in preventing things from happening is a great deal more important than its function of punishing people for things that have happened already. No further instance of this principle is necessary than consideration of what happens to a private in the army who talks back to the sergeant, or of what is done with a sentry who falls asleep at his post, quite regardless of the actual effect which either of these infractions of discipline may have. Now what is the procedure when a railroad officer tries to enforce discipline before trouble comes, instead of after? In building up or in maintaining any organization, the first question is that of the personnel. How is the personnel of appointments in railroad work determined?

The relations between the railroad and its employees are commonly set forth in the form of a contract for which the superintendent, locally, and his employees, locally, have no direct responsibility. This contract makes the superintendent presiding officer of the court of first instance, from which there are unlimited appeals as to fact, interpretation of agreement, etc. This applies to discipline, rates of pay, appointments, or promotions. At such investigation board, the trainman or the employee investigated is represented by a man trained in such work, whose business it is to make as much capital and gain as much as possible for his clients. It is his object to make exceptions, to pick flaws, and otherwise to hinder any prompt and efficient measures to remedy a condition by disciplining the man at fault. When a run becomes vacant the fact is advertised and, other things being equal, seniority determines the right to that position. By "other things being equal" is meant not the judgment of the superintendent as to the qualifications of the man, but tangible facts against his records which can be proved and substantiated. This means that the opinion of the superintendent as to the ability or efficiency of the man in question counts for nothing. He is merely there in a judicial capacity, with power to keep out men who have already made mistakes that prove their lack of qualification for the position. He becomes, therefore, a judge of the past, and his authority to provide against trouble in the future is greatly restricted.

The superintendent has not the authority to enforce discipline which, for instance, is considered absolutely necessary for the commissioner of police in New York. The investigations become wrangles, compromises, deals, in which the employee feels that he is being attacked by the railroad and defended by his organization. Disregarding for the present the question of punishment for infractions of discipline which have made trouble, it is clear enough that this arrangement ties the hands of the superintendent desiring to place his personnel on a basis of efficiency only, and requires him to base his action on an entirely different set of facts, the principal one being that trouble with the unions is costly and has got to be avoided whenever it can be. We have a case in mind where there were thirteen brakemen in line for promotion on the basis of seniority. Numbers 5 and 7 (according to the time of service) were two experienced conductors from other roads who were first-class railroad men and entirely competent to take charge of a train as conductor. On the other hand, numbers 1, 2, 3, 4 and 6 were all young men who had been in the service of the road less than two years and who were unable to pass an examination under which they were required to take a time card and figure themselves over the road with an assumed extra train at a speed of 30 miles an hour; a very simple proposition for an experienced trainman. Numbers 5 and 7, the two experienced men who had come from the outside, were promoted, but the Brotherhood of Railroad Trainmen appealed from the decision of the superintendent, claiming that the rights of its men were being ignored, since the men promoted were members of the Order of Railway Conductors. The case was appealed to the general manager, who felt obliged, in the interests of harmony, although against his own judgment, to reverse the action of the superintendent, sending Numbers 5 and 7 back on the list, and promoting Numbers 1 and 2—an action exactly opposed to the kind of discipline that looks ahead and prevents accidents.

Here is another instance. As is well known, the Order of Railroad Telegraphers does not permit the members of the order to teach students; consequently agents or operators who are members of this organization openly refuse to take orders from superintendents to give any instructions whatever to young men to learn their business. If we revert again to the army for an instance, we find this kind of attitude described by the term "insubordination," and punished promptly and severely. What does the editor of the *Railroad Trainman* suppose would happen to a group of corporals in the army who refused to instruct their squads when ordered to do so by the lieutenant? Yet are we not right in assuming that if a railroad telegrapher should be discharged for a similar refusal, his organization would sustain the insubordination to the last ditch, even to the point of a strike? We have another case in mind, somewhat parallel, occurring where two railroads were consolidated. The employees of one road were dissatisfied with the positions of their names as placed on the seniority list by the superintendent, and they appealed to the general superintendent and then to the general manager. The question was not one which affected the company very directly or tangibly, and so the general manager, fearing a strike, reversed the action of the superintendent. Of course the employees of the other part of the consolidation did not like this decision, and they appealed to the general manager to reverse himself, which he declined to do. The four train service organizations, represented by their grand chief officers, then appealed to the president of the road and obtained a reversal of the decision. At time of writing, we understand that the first set of employees is now working up another appeal, and it is expected that the general manager will again be called upon to reverse himself and come back to his first decision. Whether he does or does not do so, it is very clear that the position of the superintendent, from whom the case was originally taken, is humiliating, and that the situation is certainly not conducive to good discipline. Under such circumstances as these a superintendent naturally hesitates to discharge a man who is a member of a strong organization unless he has a clear, tangible case that he can prove against him. The fact that to the best of his knowledge and belief the man is untrustworthy, is not enough. His position is closely comparable to that in which the chief of a track gang would find himself if he were allowed to remove broken rails but not cracked ones.

On a large railroad, with 10 divisions, for example, there are at least 100 chairmen of division organizations, and some four or five general chairmen. The latter, as a rule, are paid by the year to look after the interests of the members of their organizations and are not engaged in actual railroad work. The 100 division committeemen are engaged in railroad work, but their principal interest lies in looking after their associates. It is the practice for every member of the organization who is disciplined either by dismissal or suspension to take up his case in writing with the committee, and probably 98 per cent. of all the applied cases of discipline are brought to the attention of the division officers by the local committees. If there is any loop hole in the investigation, or if there are any differences in the testimony, a pretext for an excuse is thereby furnished, and if no possible excuse can be found, the plea of sympathy is then set up for the delinquent. The members of the committee are all selected for their special power in pleading, they are what are known as good railroad lawyers. If the division people fail with the local officers, the general chairmen, who have no other occupation, will take the question up with the higher officials.

It must be said in all fairness that there are times when these committees do secure evidence which was not brought out when the discipline was first applied. There have been numerous cases where they have seen justice done to their associates, but it is impossible to confine committees to the pursuit of entire justice. They take up the plaints of the just and the unjust alike, and the superintendent knows well that enforcing discipline means a struggle while the young employee who has recently entered the service is very much impressed with the knowledge that his labor organization has in its membership thousands of men, with a million or three million dollars in the treasury to defend its members when they get into trouble. It would be strange indeed if he did not feel that his union came first and his railroad second. It would be untrue to human nature if he did not possess the conviction that a discipline case was a sort of feud between two strong clans, one composed of the officers of the road and the other of the members of his brotherhood, and that his clan duty was clear—and the worst of it is that the man most affected by this is the superintendent, the officer on the ground, who knows the facts and has more power than anybody else to make travel safe or unsafe. Of course he hesitates to enforce necessary discipline when he has reason to fear that his decision will be overruled, and that continued appeals will lead his superiors to regard him as unfit to handle labor.

The point is, that discipline to prevent accidents should look forward and not backward. While the labor agreements do not prevent a superintendent to dismiss a man for the harm he has done, they make it exceedingly difficult to dismiss him for the harm he is likely to do.

Train Accidents in January.[1]

Our record of train accidents occurring on the railroads of the United States in January includes seven collisions and 10 derailments and one boiler explosion, 18 accidents in all. This record is not published in full except in the cases of the few accidents which are especially prominent—in the present instance three collisions and one derailment. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—is given at the end in the shape of a one-line item for each accident, showing date, location, class and

[1]Abbreviations and marks used in Accident List:

rc........Rear collision.
bc........Butting collision.
xc........Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.........Broken.
d.........Defective.
dr........Defect of roadway.
eq........Defect in car or engine.
n.........Negligence.
unf.......Unforeseen obstruction.
unx.......Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman).
ms........Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.......Cars burned while running.
Pass......Passenger train.
Ft........Freight train (includes empty engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

number of deaths and injuries. The items of which details are given are indicated in the tabular statement by the use of italics. This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager.

The collision at Vinegar Bend was reported in the newspapers as having involved a passenger train, but it did not; it was on a logging road, and we are informed that each of the trains consisted of an engine and some empty cars; one was a log train and the other a work train. The log train had been brought to a stop before the collision occurred. Neither was it true that a trestle bridge was demolished. Four employees were killed, nevertheless.

The collision at Crockett, Va., occurred at 2.25 a.m. at a water tank, a westbound freight train, with two engines, which was standing there, being run into by the eastbound Chattanooga-Washington Express. Two engines and the mail and express car were damaged, and two postal clerks and one passenger were slightly injured. The collision was due to the freight train being on the time of the passenger train on the main track without proper protection. The passenger train was running 4 hours and 15 minutes late, exactly as had been stated in the order. Both of the enginemen on the freight were young, and they offer no rational explanation. The telegraph block system which had been in service on this district about three months had just been discontinued by reason of a decrease in business and in order to reduce expenses.

The collision at Cameron, N. C., is reported as having been due to an error made by a telegraph operator in copying a train order. One of the trains was to wait at Southern Pines until 12.15 a.m., but the order was delivered to the other train reading 12.50 a.m.

The cause of the derailment near Hiram, Ga., on the 7th was not discovered. The second section of the southbound Florida Special was derailed at a trestle bridge, the engine being overturned just as it had passed over the bridge. Four of the cars fell 20 ft. to the ravine below. One of the car bodies was broken in two, and in this car most of the serious injuries occurred. The engineman, a travelling engineer, a fireman and one passenger were killed and 62 passengers and 13 employees and five Pullman employees were injured. At the time of derailment the train was running about 40 miles an hour. Close investigation following the accident failed to develop any cause for it. The track and equipment were in good order.

TRAIN ACCIDENTS IN THE UNITED STATES IN JANUARY, 1908.

Collisions

Date	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd.
5.	C., B. & Q.—C. Gt. W.	E. Dubuque	xc.	P. & Ft.	2	1
10.	*Ala. & Miss.*	Vinegar Bend.	bc.	Ft. & Ft.	4	5
11.	*Norfolk & Western*	Crockett.	bc.	P. & Ft.	0	3
11.	Buff. & Susp.	B., R. & P. Jun.	bc.	Ft. & Ft.	1	1
14	Chic., R. I. & Pac.	Caldwell.	bc.	Ft. & Ft.	1	0
18	*Seaboard Air Line*	Cameron.	xc.	P. & Ft.	2	20
22.	Denver & Rio Grande	Huerfano.	bc.	Ft. & Ft.	1	2
29	Boston & Albany	Cheshire.	xc.	P. & Ft.	1	9

Derailments.

Date	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	No. persons reported Inj'd
2	Boston & Albany	Westboro	Pass.	b. wheel.	0	4
6.	Great Northern	Wolf Creek.	Ft.	b. flange.	2	0
†7	*Southern*	Hiram, Ga.	Pass.	unx.	4	80
†9.	Southern Pacific	Rucker, Cal.	Pass.	unx	2	0
13.	Illinois Central	Holly Springs.	Pass.	cow.	1	3
19.	Southern	Corydon	Ft.	unx.	3	2
19.	Central of Ga.	Macon	Ft.	ms.	1	0
20.	A., Birm. & A.	Tyrone.	Ft.	acc. obst.	2	5
20	Louisville & Nashville	Frankfort.	Pass	unx.	0	3
21	A., T. & S. Fe.	Quenemo.	Pass.	unx.	0	6

Other Accidents.

Date	Road.	Place.	Kind of train.	Cause	Kil'd.	Inj'd
13	Erie	Rutherford.	Ft.	boiler	1	3

In the reports of the electric car accidents published in the newspapers in January we find no account of any fatality.

Pressed Steel Car Company.

The gross sales of the Pressed Steel Car Company during the year ended December 31, 1907, were $36,400,000, the largest in the company's history, though little larger than in 1906. Operating expenses, including "liberal charges on account of renewals and up-keep of plant and machinery," increased more than gross sales, so that the net profits, not including dividends from subsidiary companies, were $2,900,000, against $3,100,000 in 1906. No dividends were paid by subsidiary companies last year, as all of them needed their surplus earnings to add to working capital. In 1906, on the other hand, the Pressed Steel Car Company received a dividend of $225,000 from the Pennsylvania Car Wheel Company. For depreciation and renewals there was $365,000 set aside in 1907 and $350,000 in 1906. The 7 per cent. dividend on the $12,500,000 preferred stock which has been continuous through the nine years since the organization of the company, was paid, leaving a surplus of $1,668,000, which is equal to 13.3 per cent. on the $12,500,000 common stock. The surplus earned in 1906 was $2,157,000.

The percentage of profit realized last year was lower than in some previous years for two main reasons. During March work at both the Allegheny and McKees Rocks plants was stopped for several days, owing to the greatest flood since 1832 in the Ohio river. Several weeks passed before output was again normal. Most of the machines were badly damaged and some had to be entirely rebuilt, all of which expense was charged to operating cost. The other cause was higher wages and lower efficiency of labor during the first half of the year. As a result of the great demand for labor in the Pittsburgh district the company had to choose new men out of the newer foreign population who represented a lower average standard of efficiency than those who formerly came to the district. This had a distinct effect in lowering profits. In this connection, President Hoffstot remarks that the slowing down of business which came at the end of the year, although it decreases profits, has some redeeming features, for it makes the supply of labor larger than the demand and thus makes it possible both to choose better men and to get better work out of the whole force. During the last six months the company has been able without any lowering of efficiency, substantially to reduce labor costs, so that cars built in the latter part of the year cost less to build than those built previous to the decrease of business, when the demand for labor equaled or exceeded the supply.

Another favorable feature is that when work is being done at low pressure, time and attention can be devoted to economies and development along new lines. The company's policy in regard to prices is not to artificially maintain prices which under existing business conditions would be unsubstantial and unreal, but to reduce prices to a point which will create and restore a normal demand. Mr. Hoffstot believes that the policy of maintaining the same prices during periods of depression as in prosperous times retards rather than helps the speedy return of normal conditions.

Additions and betterments costing $268,000 were made during the year, over two-thirds of which went for a new water purifying system, additions to the planing mill and wooden car shops, and new machinery for the passenger car equipment of the McKees Rocks plant. The rest of the expenditure was used in the Allegheny plant for additional power. Here also a water purifying plant is to be put in if the one at McKees Rocks, which is not yet finished, is successful.

The Pennsylvania Car Wheel Company earned less than in former years; what it did earn was added to working capital. Its smaller earnings were due to an increase in the cost of pig iron and coke greater than in the price received for car wheels. No statement of earnings is given for any of the subsidiary companies, including the Canada Car Company and the Western Steel Car & Foundry Company. In 1905, the last year in which figures for this last company were reported, its gross sales were $7,563,194. In that year a 6 per cent. dividend was paid.

Generally speaking, the report, like that of most industrial companies is inadequate. The only figures shown, except those included in the condensed balance sheet filling one page, are the two of gross sales and net profits. Publicity is one of the most important tendencies of the times and is becoming more and more important. There are, of course, certain facts in regard to the operation of a manufacturing company whose business is sharply competitive which ought in justice to it never to be shown, but there is a golden mean possible between the present meager information given by this and other similar companies, and injurious publicity.

The steel passenger car department is just finishing an order for 85 steel passenger train cars for the Pennsylvania Railroad. Although the all-steel passenger car is as yet a pioneer and cannot be relied on as a fixed source of revenue, the company believes that these cars will before long be standard in this country. Mr. Hoffstot takes occasion at this point to decry the hostile public sentiment toward railroads. A changed attitude toward railroad securities, he believes, would make it possible for all railroads to offer the best equipment and the greatest safety and thus speedily result in replacing wooden passenger cars with fireproof steel cars. This department of the company has been so arranged, however, that semi-fireproof and wooden passenger cars can be turned out when steel passenger cars do not require its full capacity.

The following table gives for each of the nine years of the company's life the gross sales, net profits including dividends from subsidiary companies, dividend payments and surplus for the year.

	Gross sales	Net profits	Dividends	Year's surplus
1907	$36,443,304	$2,907,920	$875,000	$1,667,920
1906	36,158,586	3,881,884	875,000	2,158,884
1905	19,337,826	1,106,901	875,000	56,901
1904	4,198,268	707,111*	1,250,000	2,037,111†
1903	20,601,249	2,768,897	1,500,000	1,008,897
1902	33,883,519	4,578,114	1,375,000	2,903,114
1901	23,032,191	1,927,925	1,375,000	409,290
1900	22,510,115	2,075,181	1,625,000	1,200,181
1899	11,198,212	2,237,000	875,000	612,000

*Loss. †Deficit.

The uptown tunnel of the Hudson & Manhattan Railroad was opened last Tuesday afternoon, when a train carrying officers of the companies concerned, the Governors of New York and New Jersey, and other distinguished men, was run from Nineteenth street and Sixth avenue, New York, to Hoboken, N. J. At midnight of the same day the line was opened to the public. For the present, cars will be operated on three minutes headway during the rush hours, the time for the three miles now in operation being 12 minutes, including five stops. At other times, they will run on five minutes headway. These twin tubes are the first of the several tunnels under the Hudson river to be opened for service. This line also is the oldest of the projects, its history going back 30 years. Its checkered career was summed up in our issue of last week, in the description of the completed tunnel. As mentioned in that article, the southern tubes of the company are nearly finished and will be opened in the summer. Farther north are the four-track Pennsylvania tunnels, which will be ready still later. The line just opened will have no immediate result in relieving existing lines of the burden of taking care of the enormous daily movement of people within New York City, as the great part of this traffic is between the upper part of the city and the southern part of the island. However, when the connecting line is built from Sixth avenue, under Ninth street to a connection with the Interborough Rapid Transit subway near Astor place, it is to be expected that many people living between Fourteenth and Thirty-third streets, west of Fifth avenue, will take this route in going up and down town and so relieve the older subway of some of the traffic originating between Astor place and Forty-second street. The great value of the new tunnel lies, of course, in making the journey from Hoboken and Jersey City to Manhattan quicker and surer. The extent of this traffic was suggested last week in the article mentioned. It is now being taken care of by ferries, which are subject to delays by fog and storm, and, during most of the winter, by floating ice. The completion of the various Hudson river tunnels will therefore result in extending westward the area available for residence of people who come to business daily in New York.

NEW PUBLICATIONS.

Principles of Reinforced Concrete Construction. By F. E. Turneaure and E. R. Maurer. New York: John Wiley & Sons. 317 pages, 6 in. x 9 in.; 130 illustrations. Price, cloth, $3.00.

To quote from the preface, "the authors have endeavored to cover, in a systematic manner, those principles of mechanics underlying the design of reinforced concrete, to present the results of all available tests that may aid in establishing coefficients and working stresses, and to give such illustrative material from actual designs as may be needed to make clear the principles involved." The book opens with a brief historical review of the use of reinforced concrete and then takes up its properties, dealing first with the materials and methods of mixing and the strength of the whole after setting. In dealing with the material the standard assertion is made that "Portland cement only should be used." It is curious that in spite of the unanimity of opinion upon this point among all authorities of the subject, none of them state the reason why, or give any data showing the difference of action between Portland and natural cement when used in reinforced construction.

In discussing the physical properties of concrete, the authors go very elaborately and thoroughly into the elasticity, and show that, contrary to preconceived ideas, there is no change in the characteristics of concrete in this respect when it is reinforced, and that it does really crack when stretched beyond its elastic limit, and that it is the steel reinforcement that holds it together, preventing the cracks from becoming visible and the concrete from failing. Great emphasis is, therefore, placed not only upon the extensibility of the concrete but its adhesiveness to the steel.

In the third chapter there is a full theoretical discussion of the method of resisting the stresses imposed, including the general stress distribution in a homogeneous beam, the common theory of beams, the formulas for working and ultimate loads and the parabolic formulas. This chapter also includes a mathematical discussion of double reinforcing, flexure and the strength of columns.

This is followed by a presentation of the results of many important tests, which are analyzed and correlated, with reference to the theoretical principles that have already been set forth. Then comes a consideration of working stresses and economical proportions, with a collection of such formulas and diagrams as may be needed for general use.

The final chapters deal with building construction, arches, retaining walls, dams and miscellaneous structures, all of which are illustrated by examples taken from practice and then analyzed mathematically in accordance with the principles previously enumerated.

Proceedings of the Traveling Engineers' Association, 1907. 340 pages; 6 in. x 9 in.; 10 illustrations.

The association meeting was held at Chicago, in September, 1907. The subjects presented were all connected with the operation of the locomotive, as follows: The Best Means of Locating the Fault of a Poor Steaming Engine without Removing the Draft Appliances; Advantages of Hot Water Washing and Filling for Boilers; Best Methods of Eliminating the Smoke Nuisance on Soft Coal Burning Engines; Air-Brake Requirements to Effect a Proper Train Control; Superheated Steam and the Best Methods of Getting Good Results; Waste of Energy in Railroad Operation; Lubrication of Cylinders Using Saturated and Superheated Steam; Reduction of Coal Consumption and Increase of Locomotive Efficiency; Relation of the Road Foreman to Indifferent Enginemen; Advantages of the Automatic Stoker and the Performance of the Automatic Stoker on the Iowa Central.

The report on the mechanical stoker is interesting in that it states, in outline, the work that has been done by the Monarch and Hayden stokers. Satisfactory results have apparently been obtained with both, so far as maintenance of steam pressure is concerned. In the matter of economy of coal consumption, some definite information is given, and, in the report of the work done on the Iowa Central a marked saving is shown by the use of the stoker. Taken on the basis of the coal consumed per 1,000 ton-miles, the schedule shows that for runs without the stoker there was a marked increase in the amount of coal consumed. For example, on engines with the same cylinder and firebox dimensions, the coal consumed was 181 lbs. and 206 lbs. per 1,000 ton-miles without the stoker and 143.7 lbs. and 166.6 lbs. with the stoker; an average saving of nearly 20 per cent. The engines used in the two tests had 20-in. by 26-in. and 22-in. by 26-in. cylinders respectively. It was probably on the basis of such a showing as this that the report concluded by expressing the opinion that "the stoker has come to stay, as it can do all that is claimed for it if the care is taken of it that it is entitled to."

Another paper of value, the subject of which has been discussed with all the variations imaginable, is The Waste of Energy in Railroad Operation. This time the discussion is confined to the locomotive, and there is a staggering array of causes of waste, divided under the headings of coal, heat, steam, power, time at roundhouse and time on the road. The paper concludes with the statement that "in view of the many ways in which energy may be wasted it may seem surprising that there is really any left." Then it must be borne in mind that "while one or two of them alone would make a small item, nevertheless a man must be alert and watchful to keep them down to a minimum for waste is a prolific creature and unless watched and controlled increases and multiplies to such proportions as to ruin good men's careers and wreck good roads."

In the other papers listed the subjects were well handled in a practical manner, and were up to the standards of the previous proceedings of the association.

Machine Shop Work. By Frederick W. Turner, Instructor in Machine Shop Work, Mechanic Arts High School, Boston, Mass. Chicago: American School of Correspondence. 190 pages; 6½ x 9½ in.; 248 illustrations. Price, cloth, $1.50.

This book contains part of the series of papers used by the publishers in their correspondence course of machine shop instruction. These papers have already appeared, for the most part, in Vol. III relating to the Foundry, Forge and Machine Shop of the set on Modern Engineering Practice that was issued two or three years ago. This statement holds for the whole book with the exception of the chapter on the Milling Machine, which has been re-written and extended for the present volume. Of course it cannot be expected that the whole science of machine shop practice can be taught or even touched upon extensively within the limits of a book of the size of this one, but it can serve, as indicated in its preface, as a practical working guide for those who are employed in shops. Naturally, where such brevity is demanded, much has to be taken for granted, and the reader is assumed to know many things that can only be learned by actual experience. This appears from time to time by reference to certain things of whose use and construction there is no explanation, and in this it frequently falls just short of giving very specific instructions. It is, however, valuable in its suggestiveness, and for the reasons that are given for the performance of certain operations in a certain way, and the use of certain methods. The book is concise in its language and is made to cover the ordinary ranges of work with hand tools, the lathe, planer, drill, milling and grinding machines; and, while it does not attempt to enter upon a description of the construction of these tools, it does give a very clear idea of the class of work that may be expected to be done on each.

The Slide Rule. By Charles N. Pickworth. London and Manchester: Emmott & Co. New York: D. Van Nostrand Co. 105 pages; 7 in. x 5¾ in.; 24 illustrations. Price, cloth, $1.00. Tenth edition.

It is characteristic of the slide rule that it is used either very persistently and constantly or not at all. The engineer who has once acquired the slide rule habit, uses it for any and all varieties of calculations, fully aware of its inaccuracies but knowing that these inaccuracies lie well within the limits of permissible error. The probability is that many would use the instrument who do not now do so were the principles of its construction and manipulation understood. The book under consideration is intended to furnish just that information and will do so if it is carefully studied. Of course the best way to acquire the needed information and skill would be to read the book with a slide rule in hand.

It starts in with the simplest of propositions, the adding together of two numbers of a single digit each, and then shows how identically the same thing is done when the two logarithms of the same numbers are added, the result being a multiplication of the two original numbers. In the same manner the simple act of a subtraction becomes a division. Nothing is taken for granted and each step in the process is explained with painstaking elaboration, leaving nothing to conjecture, and nothing for even the most stupid to desire. Having explained in the fullest detail this simple principle of construction and operation, the author goes on to show the methods to be followed in solving certain definite problems, such as proportion, multiplication, division, combined multiplication and division, involution and evolution, and the solution of examples in technical computation, such as the weights of metals, falling bodies, centrifugal force, steam engine problems, screw cutting, strength of shafting, moments of inertia and a mass of trigonometrical applications.

The book closes with a description of the log-log slide rule and other special rules that have been designed with a particular object in view. Taken all in all, the book is a complete, and therefore a valuable, guide to the use of the common slide rule, and withal it is so simply written and the explanations are so clear and comprehensive that it cannot fail to be understood by even the most indifferent of students; and, if it can but be placed in the hands of those who do not use the instrument, it cannot fail to lead many of them to adopt it as a time and labor saver for all ordinary and many extraordinary calculations.

Report of the Proceedings of the Fifteenth Annual Convention of the International Railroad Master Blacksmiths' Association, 1907. 244 pages; 6 in. x 9 in.; 11 illustrations.

The convention was held at Montreal in August, 1907, and some of the papers have already been reviewed in the *Railroad Gazette*. The subjects presented and discussed were: Tools and Formers for Bulldozers and Steam Hammers; Forging Machine and Bulldozer Work; Discipline and Classification of Work; Flue Welding; Case Hardening; Best Fuel to Use in Smith Shop; Piece Work; Frame Making and Thermit. In addition to these topics the proceedings contain a number of others reprinted from previous proceedings. These are: The Clean Shop; Relative Importance of the Blacksmith Shop to the Cost of Rolling Stock Maintenance; The Foreman Blacksmith; Case Hardening; Uniform Methods; Treatment of Tool Steel; Heating for Hardening and Annealing; Annealing; Track Tools; Scrap Materials; Iron vs. Steel and Shop Discipline.

Subject Matter Index of Mining, Mechanical and Metallurgical Literature for the Year 1902. Edited by M. Walton Brown, Secretary of the North of England Institute of Mining and Mechanical Engineers. Newcastle-upon-Tyne, England. Published by the Institute. 180 pages; 6 x 9¾ in. Price, paper, 12 shillings.

This is an index, for 1902, of articles which appeared in 993 journals, proceedings of societies, government reports, etc. A large number of separate books are also indexed. The publications selected are from countries all over the world. The index is arranged according to subjects, each being minutely subdivided. They include: Geology, mining technology, metallurgy, machinery, navigation, railroads, legislation, etc. An index of authors is included.

CONTRIBUTIONS

What Are We Going to Do About Railroad Accidents?

Cleveland, Ohio, Feb. 5, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your open letter to newspaper editors, under date of Jan. 30, 1908, captioned, "What Are We Going to do About Railroad Accidents?" while interesting and timely, lacks proof to substantiate the statement made by you that holds the railroad employer responsible for railroad accidents, because he does not enforce discipline and holds the employee responsible because he, through his organizations, will not permit of the enforcement of discipline.

In answer to the inquiry propounded by the *Evening Post*, New York, which had the question of railroad accidents under discussion, "What Are You Going to Do About It," you answered for the railroad managers as follows: "We are doing more than ever before; are making progress, but cannot be successful until we are allowed to control our employees." In the employment and discharge of enginemen and train crews, the trade unions have rather more authority than the employers, and except perhaps on the Reading and the Chicago, Burlington & Quincy, which have paid millions for the privilege, dangerous men cannot always be weeded out. Nevertheless, many railroad officers do less than their full duty in organization and vigilance, and are legally and morally guilty of criminal negligence. The force of public opinion, which the newspapers aim to express and often influence, together with the enforcement of the present laws is probably the only hope for a better condition.

The statement made by you is simply a repetition of others that have been made from time to time but, as yet, there has been no evidence submitted to prove that the railroad organizations have interfered with the enforcement of discipline, that they have advised their employers, or in any arbitrary or unfair manner intimated to them who should be employed.

The enforcement of discipline is entirely in the hands of the railroad employer. He makes his rules and he can and does enforce them. The organizations have not by threat, intimation of trouble, or by unfair or arbitrary performance, insisted on the retention of any employee who justly has been disciplined. The railroads employ whom they please. In order to protect themselves against inexperienced employees, the railroad organizations will not accept an employee to membership until he has served an apprenticeship of from six months to one year.

The railroad organizations naturally prefer the employment of members of their organizations, the first reason being that there is assurance that the employee knows something of the duties of the service. The "student" does not and until he does he is a dangerous fellow servant, and consequently not as desirable a fellow employee as one who is experienced.

When you say "In the employment and discharge of enginemen and train crews, the trade unions have rather more authority than the employers," you are in error.

We will welcome a statement from any railroad manager, giving specific instances that will prove the often repeated charges that railroad organizations interfere with discipline, the employment or dismissal for cause of men, or that they have prevented the safe and proper operation of any railroad property.

This statement has been made in *The Railroad Trainman*. Courteous treatment has been assured any operating officer who will come forward with his bill of particulars, and *The Railroad Trainman* will give him, or as many of him as there may be, full opportunity to state his case and show wherein the Railway Associations have hampered him.

There has never been anything offered to back up the statements made, and I request for the Brotherhood of Railroad Trainmen that the *Railroad Gazette* make request that every railroad operating officer come forward with a bill of particulars setting forth in clear, unmistakable language, just when and how he has been prevented from safely operating his property or enforcing proper discipline.

So far as the Brotherhood of Railroad Trainmen is concerned, and I feel that the other railroad organizations will voice the statement, it welcomes anything of the kind and is anxious for the opportunity to meet every question offered, with your permission, in the *Railroad Gazette*, taking it for neutral ground, and let your readers judge the questions for themselves.

Let us get at the bottom of these assertions. Let us have a clearing up of the statements that have been made concerning the interference of the railroad organizations with the right of the railroad managers safely to operate their properties.

It might be just as well to say in this connection that the conductors and trainmen have had a splendid organization on the Burlington for many years, and that the Reading is very well organized. Your comparisons, therefore, are not well selected.

Inasmuch as you have taken up this matter and made answer of your own, for the railroad managers, in all fairness we ask you to kindly continue the discussion and let us get the facts. Let us tell the public the truth not only about the "interference of the railroad organizations," but while we are at it, it might be well to introduce other questions that affect the safety and efficient operation of railroad properties.

I trust that the *Railroad Gazette* will throw open its columns for signed articles, showing just how far this great abuse has been carried.

D. L. CEASE,
Editor *The Railroad Trainman*.

New York, Feb. 15, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with interest the proof of Mr. Cease's letter, and could give him all the specific instances he wished, if it were not for the effect which this might have on our present friendly relations with our employees. But I can cite the following actual cases, omitting places and dates, which have come under my personal observation:

(1) A locomotive engineer was discharged for running by a disc signal at red at an approach to a drawbridge, running into the open draw, the engine and two or three of the cars going into the river, the engineer and fireman saving themselves by swimming. Investigation disclosed that neither engineer nor fireman could have been looking for signal as brakeman back on box car in middle of freight train saw signal at red, and bystanders also saw signal at red as train was approaching. The B. of L. E. appealed from decision of the Division Superintendent to the General Manager, the Committee of Engineers claiming that both engineer

and fireman saw disc signal at white and claimed statements of their men should be taken against other witnesses. The General Manager confirmed the decision of the Division Superintendent. The case was appealed from one official to another, going up to the highest official of the road, the decision of the Superintendent being sustained up to the last appeal, the engineers meanwhile trying to force their man back at all hazards.

(2) An engineer was discharged for burning a crownsheet of his engine because of low water, the engineer being dismissed after investigation by roundhouse foreman and Master Mechanic. The engineer claimed he would not stand for the decision, appealed to the General Superintendent and then to the General Manager, the decision of the Master Mechanic being sustained. He then took his case up with the Grand Chief Engineer of the B. of L. E., who notified the General Manager that the organization would not stand for the decision, and that it would have a state inspector inspect the boiler of the engine, and it surreptitiously sent an inspector to examine the boiler. This case is still pending, the Grand Chief Engineer claiming that he is going to force it to the end, and that this man shall be reinstated regardless of the facts, which cannot be controverted, as the General Manager of the road in question had the Master Mechanic of another road send its inspector, who made an investigation and a full report confirming the original report of the Master Mechanic who discharged the engineer.

(3) A conductor who refused by telegram to pick up a car when ordered to do so by despatcher, claiming that because he was on through freight he did not have to pick up this car. When the Superintendent wired him to either pick up this car or take his time at the end of the run, he answered that he would take his time. The brotherhood organization struggled for a long time trying to get this man back in the service, claiming that his action was entirely correct, and that the Superintendent had no business to instruct him to do something that was not customary. This case was appealed to the General Manager, by the organization, the action of the Superintendent being sustained.

(4) An engineer on a passenger train collided with another passenger train standing between switches at a station, running clear through the first coach and half way through the second, killing over 40 persons, there being straight track for a distance of over five miles, the marker lights of the standing train burning brightly on a clear night. The engineer being dismissed from the service, the organization appealed from decision of the Superintendent, because it was shown that the flagman was out only about 1,000 ft., the organization of engineers claiming that the collision was the result of the carelessness of the flagman in not being out the full flagging distance, and this case has been appealed from time to time, the organization claiming strongly that the engineer was not to blame.

GENERAL MANAGER.

Feb. 16, 1908.

To the Editor of the Railroad Gazette:

Referring to the article in your issue of January 31, with respect to railroad accidents, which I read with a great deal of interest. Every thinking railroad operating officer to-day is greatly concerned about this question. In addition to the accidents that result in loss of life and property, practical officers know of continual slips that "might have" resulted in serious accidents.

It is unquestionably practicable to at least lessen the number of train accidents. On nearly all large systems, the labor organizations have committees who take up nearly every case of discipline. On many of the roads the organizations pay a traveling chairman, whose time is devoted to investigation grievances real or alleged, appealing the discipline from officer to officer, and endeavoring to strengthen the loyalty of the employees toward the organization rather than toward their employers, the railroads. On many of the roads it is a common practice for committees to appeal cases of discipline right up to the Vice-President and President. I have personal knowledge of two instances where the dismissal of conductors for having over-run meets, resulting in serious loss of life, was appealed from the Superintendent to General Superintendent, to General Manager and finally to the President. In both cases the collision occurred 1,000 to 1,500 ft. beyond the switches, and the evidence showed that the conductor could have stopped the train had he been on the alert. I have no doubt many similar cases can be furnished by operating officers on other roads.

On some lines, I am sorry to say, the decisions of the Superintendent are frequently overruled. It is only human nature for a Superintendent, knowing that his decision is likely to be overruled, and that continual appealing by committees is liable to make those in charge regard him as unfit to handle labor, to forego necessary discipline or make it milder than the case warrants. I have read recently a number of results of alleged surprise tests, showing that almost 100 per cent. of the men obeyed the signals, etc. Every practical man will agree with me that if the tests resulted as stated, the men had been advised in advance where and when the tests would be made.

A strictly divisional organization, with the right of appeal in questions of discipline limited to the General Superintendent, together with a continual and properly conducted system of surprise testing, and greater care in the selection of men, will do more than anything else to minimize the number of train accidents. On the road I am connected with, every officer from the Superintendent down is required to make continual surprise tests, submitting a report of them monthly, and it is the intention to transfer to a less active sphere of usefulness such officers as have not the moral courage or backbone to make these tests.

GENERAL MANAGER.

The Draft Gear Line.

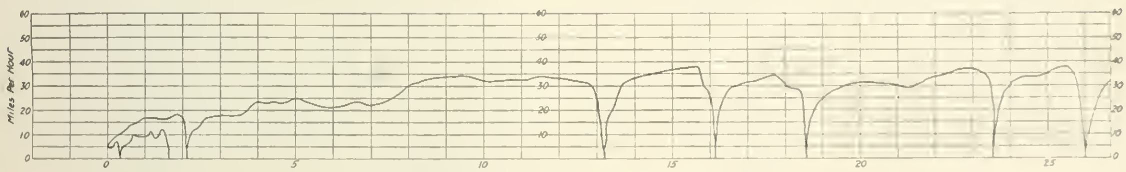
Feb. 15, 1908.

To the Editor of the Railroad Gazette:

One of the points the standing committee of the Master Car Builders' Association is asked to pass upon in connection with its report on friction draft gear is the so-called line of resistance, the committee being asked to "recommend the most desirable resistance during each ¼-in. compression." This opens up a sea of imagination and theory that is possibly going to flood the committee, as it has sent out to motive power and car men a circular asking for opinions and suggestions.

If there is any hard and fast rule to guide in this matter, it has so far escaped the mechanical engineers who have figured on this thing, for out of any hundred of these men you might select there would be almost, if not quite, a hundred different opinions, all backed up by more or less technical argument, and all more or less right.

The writer does not pose as a mechanical engineer, and is not versed in the science of determining the work done and other items that flow so glibly from this school of students, but there is a parallel in railroad mechanics for determining the proper line, and it is submitted as being the only thing so far discovered that sheds any real and practical light upon the subject. Every railroad owns one or more speed recorders, attached most generally to private cars, and from these can be obtained a graphic record of the speed of trains and the line made in starting and stopping. There is a marked similarity between the service of stopping a train and stopping a car; in fact, the relation between the two is so intimate that it is impossible to disassociate them. Why not, therefore, consult these speed recorder tapes for evidence?



Speed Diagram to Illustrate Drawbar Stresses.

The drawing shown here is taken from the catalogue of the Boyer Speed Recorder, and perhaps is as accurate as any that can be made. It shows a run of 26½ miles of a train at varying speeds, and making stops from 20, 30 and 40 miles an hour. The lines are similar in every case, and if they were inverted would give you some idea of a draft gear line based upon actual practice. If anything is to be deducted from this showing it is that a draft gear should offer to the load a low resistance until the actual stopping is to be effected, and then the line should show a sharp and continuous rise to its ultimate capacity.

X. Y. Z.

[If that portion of the record showing a stop near the thirteenth milepost be taken as typical of the resistances required to stop the train it will be found that their total amounted to 1.85 per cent. of the weight of the train. They include the frictional resistance of the brakes, air, journals, etc., provide the stop was made on a level track. If now the stop were to be made from a speed of 30 miles an hour, as indicated on the record, in 1,625 ft., the approximate total resistance against a car weighing 160,000 lbs. would be about

2,960 lbs. But if this were to be uniformly distributed throughout the entire train, then there would be no compression of the drawbars at all, while if the whole resistance were to be set up from the front end there would be an accumulated pressure at that point equal to 2,960 lbs. less journal and air-resistances, for each car, or for a 25-car train of something between 62,500 lbs. and 74,000 lbs., which the draft gear at the front end of the first car would have to withstand. At the same time, this gear must necessarily support the whole tractive effort of the locomotive, so that the lesson to be learned from an inspection of stop records seems to be somewhat more difficult than would appear at first sight.]—EDITOR.

Steel Car Design.

New York, Feb. 25, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

On page 238 of your issue of February 21, I find that a slight omission in the second column makes the formula read incorrectly. About two-thirds from the top of the page, in the right-hand column, the formula for compression is given as $12{,}000 - l \div r$; whereas it should read $12{,}000 - 70\ l \div r$, where l is the length and r the radius of gyration. As it is printed in the paper it is incorrect and would not give satisfactory use in practice.

O. R. HENDERSON.

The Location of Brake-Shoes.

Feb. 20, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Commenting on the article on brake-gears and slid-flat wheels, in the February 7 issue of the *Railroad Gazette*, I would suggest three objections to the plan of hanging brake-shoes at the height of the centers of the wheels: (1) The brake hangers would be short, resulting in wide variations of their inclinations as the shoes wore. (2) There is greater danger that the brake pressure will force the journal away from the bearing far enough to allow waste or grit to get between them. (2) The pounding between the shoes and heads, the heads and hangers, and the hangers and bearings become severe with a high shoe, while it can be practically avoided with a sufficiently low one.

By inclining the hangers at the proper angle, the shoe pressure can be increased on the forward wheel of the truck and diminished on the rear one. This simple, inexpensive and highly effective method of increasing the efficiency of brakes seems not to be appreciated, though it is perfectly successful when properly designed.

G. E.

The Value of Railroad Records.

New York, Feb. 17, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I read with extreme interest that the Brotan locomotive, described in your issue of Feb. 14, consumes, per 1,000 ton miles, 563 lbs. of coal, and that the standard Austrian locomotives under the same conditions consume 699 lbs. of coal. On the Atchison, Topeka & Santa Fe the coal charged against all the locomotives in freight service on the Eastern division, in Kansas, averages about 200 lbs. per 1,000 ton miles, but on special test runs where every pound used was carefully measured, the actual consumption from train start to train delivery was about 80 lbs. per 1,000 ton miles. Tabulating these different results, we have:

	Per 1,000 Ton Miles.
Competitive standard Austrian practice	699 lbs.
Brotan locomotive in competitive trial	563 "
Coal charged to Santa Fe freight locomotives	200 "
Actual coal consumed on trial run on Santa Fe	80 "

Question. How much coal ought a locomotive to consume per 1,000 ton miles on a level track in good weather?

What were the conditions that increased the normal consumption from 80 lbs. to 699 lbs.?

HARRINGTON EMERSON.

Commerce Regulation in Theory and in Practice.*

There are fortunately only a few subjects of government that cannot well be left to the municipality or state. Yet there are some that can only be dealt with by the central government. At the head and front of these stands interstate commerce. The manufacturer to-day could not sell his products if he were restricted by as many different laws as there are states in the Union. A man shipping a carload of oranges from California to New York would have to send along with the freight a caboose full of lawyers. Our forefathers recognized the necessity of some central control over interstate shipments when they placed the commerce clause in the constitution. The difficulty to make a uniform law to cover this immense subject is seen by the fact that our present Interstate Commerce law, time and again, when laying down a rule, qualifies it by the phrase, "Under substantially similar circumstances and conditions." We read that in the time of Cicero, there was a law that those who forsook a ship should forfeit all property therein, and that the property should belong to those who stayed with the ship. Once in a dangerous tempest all passengers left the ship but one sick man who was too weak to leave with his mates. By chance the ship came to port. The sick man took possession and claimed benefit of the law. All the learned men of the time agreed that the sick man was not in the reason of the law, which was to encourage sailors to save vessels in distress.

I mention this simply as an example of the universally acknowledged fact that all laws should be construed in the manner which will best carry out their reason and spirit. And if this principle of interpretation is true of any law ever passed by man, it is true of the Act which regulates the commerce of this country. We have a good law. It would perhaps be impossible to obtain a better one. Its avowed object is to effect reasonable rates and stop discrimination. All constructions placed thereon should be to that end. These objects, mark you, are co-ordinate, that is, of equal importance. I sometimes think the Act, in its perfectly laudable desire to prevent discrimination, effects a rate which is not only unreasonable but discriminatory. Let us take, for example, the 30-day clause. The theory of this, of course, was to prevent midnight tariffs in favor of large shippers. But how does it work in practice? A bridge is to be erected across a stream near the little town of "X." Perhaps there never was a pound of steel shipped to this place before in the memory of man, and perhaps there never will be again. There are no rates, save the almost prohibitory class rates. The railroad stands willing to publish immediately a commodity rate to "X," which is reasonable and non-discriminatory. But the law says, No. Wait until that rate has been posted for 30 days before you may profit by its terms. The shipper is compelled to hold forwarding of his goods or else pay an unreasonable rate. I submit that this interpretation of the law effects the very thing it was intended to guard against, namely, unreasonable rates.

So again in the matter of the sum of locals versus through rates, we have an example of an impractical interpretation of the law. Suppose the rate from A to B is 10 cents. From B to C is 10 cents, making a combination of 20 cents. The through published rate from A to C is 25 cents. All these rates are properly published and filed with the Commission. Section 6 of the Act says, "every common carrier subject to this Act shall file with the Commission, agreed by this Act, and print and keep open to public inspection schedules showing all the rates, fares and charges for transportation between points on its own routes, and points on the route of another, carried by railroad, by pipe line or by water, when a through route and joint rate have been established. If no joint rate over the through route has been established, the several carriers in such route shall file, print and keep open to public inspection, as aforesaid, the separately established rates, fares and charges applied to through transportation." You will note the statute tells you how to publish a through rate and how to publish a combination rate, nor is it silent as some claim it is, as to which rate shall take precedent over the other. The text of the Act clearly states that charges made for any service rendered or to be rendered in the transportation of passengers or property as aforesaid, or in connection therewith, shall be just and reasonable, and every unjust and unreasonable charge for such service, or any part thereof, is prohibited and declared unlawful. It seems to me where the published combination of locals is lower than the published through rate, the shipper should have the advantage of the lower rate. This has been the universal and undisputed custom since the early days of railroading. Neither has this custom ever worked an injustice nor do we see how it could. Since such is the case, does it not seem unreasonable to so arbitrarily construe the law that the higher rate shall be charged. This impracticable construction is working an injury to-day to commerce.

So it will be seen that any law dealing with as necessarily a practical thing as commerce must in a sense be elastic. The great advantage of the unwritten constitution and unwritten law of England is its elasticity. Each case is regulated by the surrounding conditions. When a legislature endeavors to include all sorts of conditions, in the confines of the law, it is attempting the impossible. The legislatures of several of our states have lately passed laws and I believe Congress is at present considering a law which would make 50 miles per day a reasonable rate for moving freight. I contend that you cannot arrive at a reasonable time by any arbitrary standard. What would be a reasonable time on a 50-mile shipment would not be proportionately reasonable on a 3,000-mile shipment. Again, what would be reasonable on a carload of coal would not be reasonable on a carload of watermelons. Because it is reasonable that it should take two days to haul a car of iron from Philadelphia to New York, a distance of a hundred miles, it does not follow that it would be reasonable to allow a railroad

*From an address delivered Feb. 25 before the Traffic Club of New York, by Charles S. Belsterling, Traffic Manager of the American Bridge Company.

company 60 days from New York to San Francisco, a distance of 3,000 miles. And looking at the question from the railroad standpoint, what would be a reasonable time under ordinary conditions would be unreasonable under other conditions. It is horn book law that negligence is the "want of cars under the circumstances," and no legislature in the world can measure negligence by a yard stick and a Waterbury watch.

The matter of the equipment that a railroad should furnish its patrons is more capable of being regulated by a general rule than the one just mentioned. If there were always an abundance of cars, the distribution would be comparatively simple, but most of us know that there are times of insufficient car supply.

A railroad in its original conception was simply the highway on which tracks of iron or other materials were laid. The vehicles were the means of transportation and were to be supplied by the shipper, excepting, of course, the engine and its fuel. The impracticability of such a custom was soon apparent, and to-day the law compels the railroad company to not only supply the highway, but also the instrumentalities of transportation. All freight tariffs are figured with this in view. Certain industries grow to enormous proportions. Large numbers of cars are required to carry on the business. The railroad company itself had not sufficient faith in such particular business to spend millions of dollars for the necessary equipment. The industry, in order to live, reverted to the original idea and secured its own cars at enormous outlays of moneys. I do not suppose there is any man, save a demagogue or an anarchist, who would question the right of the owner to provide his own cars, yet I fail to see by what theory of law the fact that a shipper has cars of his own should deprive him of a fair and equitable share of the general equipment of the railroad company in its distribution of cars. You must not overlook the fact that millions of dollars that these concerns have invested in private equipment is to-day totally unproductive. At times of car shortage they certainly should have their proportionate share of the general equipment of the road. That they have cars of their own works no hardship on the other shippers. In point of fact, by depriving him of his proportionate share in the distribution of the general car supply, you are taking away from the private car owner a right that he would have had had he not put a dollar in an investment which inured to the benefit of the general shipping public.

So I have mentioned a few instances of the difficulty of regulating practice by theory. There must be elasticity in all the laws pertaining to commerce. When I advocate an elastic law I do not mean an indefinite one, but a law that will allow an honest shipper to move freely without suffering unwarranted injury. There is no greater fallacy than that rigidity of rules will compel honesty. A law, like anything else, when too rigid is apt to be brittle. Especially is this so when applied to trade. Commerce and liberty can go hand in hand. Give us laws; without law there can be no liberty. But just as truly with too much law there is no freedom. It has been said, "commerce is sometimes destroyed by conquerors, sometimes cramped by monarchs; it traverses the earth, flies from the places where it is oppressed and stays where it has liberty to breathe; it reigns at present where nothing was formerly to be seen but deserts, seas and rocks; and where it once reigned now there are only deserts."

Theory is too straight laced. Practice is often too loose as it is very apt to run along the lines of least resistance. It looks to the ends and cares very little for the methods. What we need is the golden mean: where theory will listen to the lessons that practice can teach and practice be guided by the less impetuous and cooler brain of theory.

The Subway Car.

The following report on the subway car of the Interborough Rapid Transit Company of New York City is part of a report to the Public Service Commission of the First District, State of New York, by Bion J. Arnold, Consulting Engineer. It is a full and careful investigation of the general problem of the best type of car for use in rapid transit subways.

The following is the concluding paragraph of Mr. Arnold's letter of transmittal, dated February 18, 1908, to the Commission:

"After studying the conditions surrounding the operation of cars in the present subway, I have reached the conclusion that the present car, when provided with an additional side door located near each end, thus making four doors in each side of the car, will best meet the conditions of the present subway, and that, when these cars are properly operated through the stations as rapidly as the signal system, when modified as recommended in my report of January 18, 1908, will permit, a marked increase in the capacity and comfort of the subway will be realized."

The report follows:

That part of the subway which is of greatest interest to the traveling public is the design and operation of the car. The passenger is mostly concerned about the convenience with which he can get to and from the car which carries him, the ease with which he can enter or leave this car, and the comfort, speed and safety with which it transports him to his destination.

THE PRESENT CAR.

The car equipment at the present time consists of 500 composite cars in which some wood is used, 300 all metal, strictly fireproof cars, and 50 additional all metal cars which have been ordered and are now being delivered, making a total of 850 cars. All of the cars are practically the same size, with seats and doors similarly arranged. Each car is 51 ft. 2 in. over all in length and 8 ft. 7 in. in width and is provided with 52 seats, 16 of which are cross seats near the center of the car, with the other 36 seats placed longitudinally near the end. The cars are as long as the curvature of the tracks will admit, and as wide at the top as the clearance on critical curves will allow. All the cars have closed vestibuled platforms, with sliding doors, instead of the usual gates. The accompanying drawing indicates the seating plan and general dimensions of the car.

The operation of these cars in actual subway service has disclosed certain fundamental defects in design which should be remedied before the subway can furnish the speed, comfort and capacity which the passenger has a right to expect.

PRESENT SERVICE SUPPLIED.

The distinguishing feature of the subway is the intimate connection between the local and the express tracks. Of the four parallel tracks extending between Brooklyn Bridge and 96th street, the two center tracks are used for express trains running on a time-table which requires a schedule speed of nearly 25 miles per hour. Between Brooklyn Bridge and 96th street these express trains stop only at 14th street, Grand Central Station and 72d street, and they are scheduled to make this run of nearly 6½ miles, including the three intermediate stops, in 16 minutes. During rush hours, however, on account of excessive station waits and the resulting caution signals, which require reduction in speed, this run usually takes 18 to 20 minutes, and often much longer.

The local trains are scheduled to make this same distance between Brooklyn Bridge and 96th street in 26 minutes, the additional 10 minutes being due to the four extra intermediate stops made by the local trains between express stations. In actual service during rush hours the local trains usually require from 28 to 30 minutes, and sometimes more, the delay being caused by the long station waits at the express stations.

At each express station the passenger has the privilege of transferring from the local trains to the express trains, and vice versa, and, to facilitate this transfer, the five express stations are arranged with island platforms between the tracks, so that the passengers can leave the trains of one service, cross the platform and directly enter the cars of the other service, and this privilege is much used and even, to a great extent, abused.

Owing to the excessive use of this transfer privilege, many passengers, in traveling from their starting points to their destinations, are loaded and unloaded twice, and a large number of them three times, so that many of the passengers use the car doors four times, and some six times, while in an ordinary railroad without the transfer privilege the car doors are used but twice by each passenger. On account of the excessive use of the doors, the present type of car, which ordinarily gives satisfactory service, has proved to be extremely inadequate for the subway.

Some of the express stations have been built with separate local platforms, but, on account of the confusion resulting from the use of two platforms serving one train, these local platforms have been abandoned and closed up, except at the 96th street station.

The express station platforms are nearly all 350 ft. long, and at present serve 14 of the 16 doors on one side of an 8-car express train, thus leaving the first and the last doors without platform service. Most of the local platforms are 200 ft. long, and are arranged to serve 8 of the 10 doors on one side of a 5-car local train, the first door and the last door of these trains being out of service at all times.

At the time my study of the subway began (October, 1907), the schedule or time-table on which the cars were run called for 30 trains per hour during the rush-hour periods upon both the local and the express tracks south of 96th street. Owing to the excessive delays of the trains at the station platforms, the schedule was not maintained, invariably falling to less than 27 trains per hour at Grand Central Station, during the morning and evening rush. Recent improvements, however, have made it possible, except on very busy days, to get 30 trains an hour through the limiting stations on both the local and the express tracks.

Each express train consists of 8 cars, and each local train of 5 cars, and each car contains 52 seats. Under these conditions, the number of seats per hour which pass a given station are (30 x 8 x 52) or 12,480 seats on the express tracks, and (30 x 5 x 52) or 7,800 seats on the local tracks. Actual records show that during the rush hours the cars often carry twice as many passengers as there are seats, and that during the height of the rush period there are times when three times as many passengers are carried on some express cars as there are seats, although the latter condition exists only for short periods of time on very busy days.

Since the opening of the tunnels to Borough Hall, Brooklyn, on January 10, 1908, a schedule has been prepared calling for 40 express trains per hour between 96th street and Brooklyn Bridge during the rush periods, this schedule having been adopted in order to provide the Brooklyn extension with 20 trains an hour, corresponding to a 3 minute headway. The delays of the trains at the station platforms, however, have seriously interfered with the carrying out of the improved schedule, and, although there are parts of the system where 40 trains per hour are supplied during certain periods of the day, this rate is not maintained at the critical part of the rush hour period, the time when it is most needed. In other words, as soon as the demand for seats increases beyond a certain limit, the supply of seats begins to decrease.

ANALYSIS OF DELAYS AT STATION PLATFORMS.

The present arrangement of loading and unloading passengers through the same end doors of the cars is the chief cause for the inefficient operation during the rush hour period. The crowded condition of the car entrances and station platforms under the present arrangement results in passengers leaving the cars in single file and with considerable difficulty and discomfort. The unloading under such conditions usually requires from 15 to 30 seconds, and in extreme cases 50 seconds during the most congested period at the principal points of transfer.

Passengers desiring to board the cars must wait until the unloading has been practically completed, unless they wish to force themselves against the outcoming passengers, and this loading must be effected quite frequently through an entrance obstructed by passengers waiting to get off at nearby stations who prefer to hold their positions and thus obtain an earlier and easier exit. It will be seen, therefore, that the streams of outgoing and incoming passengers not only meet, but do so under peculiar and trying conditions, as the same doorway is used for both entrance and exit.

An analysis of the average time required by an express train at a station platform during the height of the rush hours shows the following figures:

		Average
1.	To open doors of cars after train has stopped.............	2 secs.
2.	To unload an average of 163 passengers through 11 doors (15 to 50 seconds)............	20 "
3.	To load an average of 206 passengers through 11 doors (15 to 30 seconds)............	20 "
4.	To close the car doors and give the signal by means of bell rope to motorman............	13 "
5.	Total average time of express trains at station platforms between stopping and starting during the height of rush hours	55 secs.

DEFECTS IN PRESENT ARRANGEMENTS.

Two of the defects which stand out prominently in the operation of the subway are, first, the excessive use of the transfer privilege, and second, the use of the same end doors in the cars for both the entering and the leaving passengers.

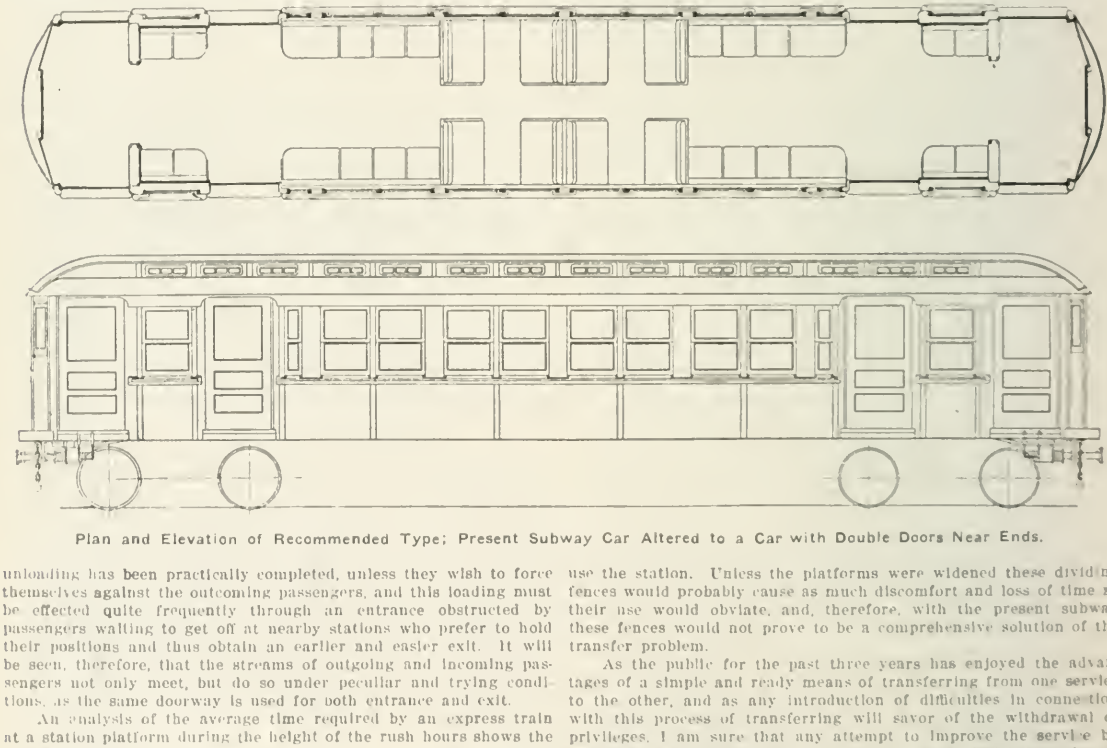
Apparently the only permanent way to improve these conditions is either to reduce or abandon the transfer privilege, or to change the car.

There are several ways in which the transfer privilege could have been reduced or curtailed. For instance, at Grand Central Station and at 14th street, where the greatest amount of transferring is done, separate platforms might have been arranged to serve the local and the express trains, but this would have made it necessary for all passengers wishing to transfer from one service to the other to climb the stairs from one platform to the mezzanine walkway which connects all platforms, and go down again to the level of the platform serving the other train. As the maximum time that can now be saved by transferring from a local train to a northbound express train at Grand Central Station is 4 minutes, and the average time saved by transferring at 14th street is about 6 minutes, and, as it would require on an average 2 minutes of this time to make the transfer on account of the necessity of climbing up and down the stairways, it will be seen that much of the present unnecessary transferring at these two points might have been discouraged by the use of separate platforms.

It is also possible to divide the island platforms longitudinally at certain express stations by means of a central iron fence, which could be provided with gates, to be closed at such times as it would be absolutely necessary to discourage the present practice of excessive transferring. These gates could be closed, for instance, at the times during rush hours when a local train and an express train both occupy the station platform, so as to make it possible to rush from one train to another, but they could be open at all other times. With the present narrow platforms, this dividing fence would add considerably to the platform congestion, and thus would interfere with the prompt handling of the passengers, who must necessarily use the station. Unless the platforms were widened these dividing fences would probably cause as much discomfort and loss of time as their use would obviate, and, therefore, with the present subway these fences would not prove to be a comprehensive solution of the transfer problem.

As the public for the past three years has enjoyed the advantages of a simple and ready means of transferring from one service to the other, and as any introduction of difficulties in connection with this process of transferring will savor of the withdrawal of privileges, I am sure that any attempt to improve the service by rearranging the station platforms so that those desiring to change from local express service, or vice versa, would be delayed, would meet with strenuous objection, and, with the present subway, would not be justified. While it may be contended that such convenient means of transferring at so many points should not have been provided, it is my opinion that this principle, having been established, cannot now be withdrawn, and that the only remedy, therefore, is to change the cars.

It has been suggested that even with the present car the passengers could be made to enter at one end door and leave at the other end door, but when it is considered that passengers leaving the train at the express stations under this regulation would be forced to push their way past every standing passenger throughout the entire length of the car, and that this discomfort to all would be constantly recurring during the rush hours, it can be understood that this solution of the difficulty would be neither popular nor efficient. Furthermore, if the entering passengers were to be confined to the use of one door in each car, and the leaving passengers

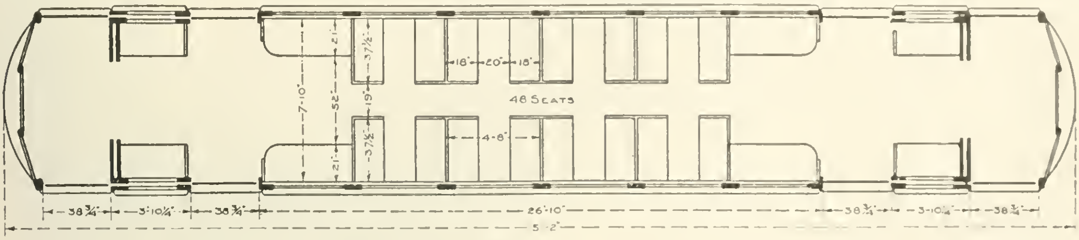


Plan and Elevation of Recommended Type; Present Subway Car Altered to a Car with Double Doors Near Ends.

to the other, the number of entrances to the train would be cut from the present number of 14 to a maximum of 8 doors, and the exits likewise reduced. This would be a disadvantage, particularly at 14th street, where the great majority of passengers using the car doors of the local trains are leaving passengers, and those using the express trains are entering passengers. Moreover, since the present station platforms are not long enough to serve the doors at the extreme ends of an 8-car train, it would be impracticable to establish a circulation in the end cars.

The present car works very well during periods of light and fairly heavy travel, but as soon as it is called upon to carry upwards of 100 passengers, the single-end doors become a decided disadvantage, and their inefficiency in handling large crowds seriously interferes with the prompt movement of the trains. It might be subway officials are of the opinion that it is impossible to confine the waits to the 45-second limit suggested in that report. Their efforts, however, in improving the service have resulted in cutting these station waits down from an average of 65 seconds to an average of 55 seconds.

In the preliminary report referred to, I pointed out the fact that if the wait at the station platform could not be limited to 45 seconds by efficient methods of handling the passenger traffic, it would be necessary to consider an improved type of car which would accomplish this result. As the station waits have not been thus limited by the subway officials, and, further, as it is their opinion, as expressed in their reply to my preliminary report, that it will be impossible to always limit these waits with the present type of car to the 45 seconds, it is necessary to consider a car de-

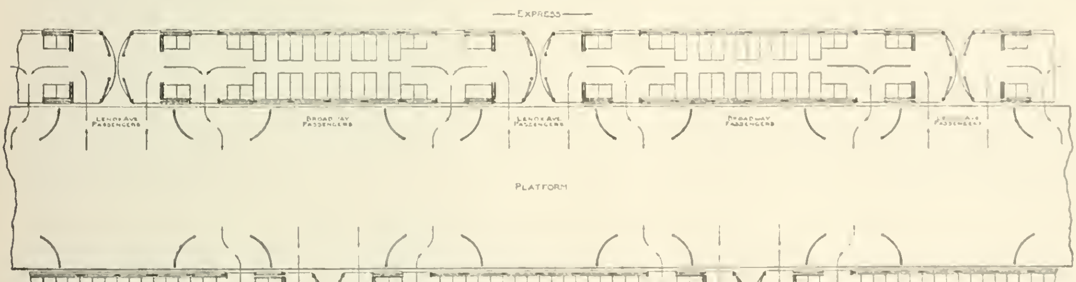


Recommeded Future Car for Present Subway; Car with Double Doors near Ends, Combining Cross and Longitudinal Seats, Seating Capacity 48; More Compact Seats Than in Present Car.

maintained that all of the passengers who *should* be carried in the cars can enter and leave the present end-door cars within the time to which the station waits should be limited, and that any further loading of the cars should be prohibited and prevented. If there were other ample and equally as good means of transportation paralleling the subway, this regulation of the amount of loading would be a practical solution of the difficulty, but until other subways are built, the people will demand transportation in the present subway even at the sacrifice of comfort, and, therefore, every effort should be made to give transportation to as many as possible. As the limit of capacity under present circumstances will be the maximum carrying capacity of the car, it is essential that a type of car be used in which this limit can be easily and quickly reached.

In order to accomplish this purpose it is clear that the ease of loading will be greatly increased when the entrance is cleared to a great extent of passengers waiting to leave the car. Passengers signed so that it will considerably reduce the present platform delays.

In my study of the signal system I found that the trains can be run *between* stations on a headway of 90 seconds, or at the rate of 40 trains per hour. However, on account of the delays at the station platforms and also on account of the arrangement of the signals on the tracks approaching the stations, it is just possible under present conditions to pass 30 trains an hour *through* the busiest stations during rush hours. Changes in the signal system were pointed out which would make possible a headway of 105 seconds (34.3 trains per hour), even with the present car, and still allow a station wait of 50 seconds. If the platform delay can be reduced to 35 seconds and the signal system improved as suggested, then it will be possible to get the trains through the limiting stations in 90 seconds, thus maintaining a headway of 1½ minutes, corresponding to the capacity of 40 trains per hour, which is the



Arrangement of Guiding Rails on Subway Station Platforms, to be Used in Connection with Recommended Type of Altered Car.

could be handled with greater ease and comfort by having separate doorways for exit and entrance and the process of unloading and loading should take place simultaneously, thus reducing the station wait now required by nearly or quite one-half. To state the case briefly, the principal defect in the present car is due to the fact that a definite and ready circulation of traffic is not provided for and that owing to the lack of sufficient doors properly located, the maximum carrying capacity of the car cannot be easily and quickly reached.

POSSIBLE IMPROVEMENTS.

In my preliminary report reference was made to the excessive time required by the express trains at the station platforms during rush hours, which the record showed to be 65 seconds at that time (November, 1907). Suggestions were therein made with the idea of limiting these station waits, if possible, to 45 seconds. Many of these suggested improvements have been put in operation, but the maximum rate at which the signal system between stations will allow trains to pass.

To secure the desired capacity of 40 trains per hour without making any changes in the signal system, will require that the station wait be limited to 20 seconds. To thus limit the time required for unloading and loading the passengers and for opening and closing the car doors and transmitting the starting signal to the motorman to 20 seconds, means an entirely different type of car than that used at present and a rearrangement of the stations, as this result could not be accomplished without the use of a large number of doors along the entire length of the car and suitable gates for preventing an excessive number of passengers reaching the car at any one time. In other words, if the present arrangement of signals is retained, the only possible way to secure an increase in the capacity of the subway from 30 trains per hour to 40 trains per hour is to scrap or use elsewhere the entire subway car-body equipment and build new cars at an expense of at least $35,000,000, and to rearrange the present platforms which is practically prohibitive.

If on the other hand, the signal system can be improved in such a way that even the present trains can be passed through the stations on a headway of 105 seconds (1¾ minutes) it will require only a comparatively simple alteration in the car to reduce the allowed stop of 50 seconds to 35 seconds and thus secure the 15 seconds' saving which will make the desired 90-second headway possible. The most economical and efficient as well as the quickest way, therefore, to secure a capacity of 40 trains per hour in the subway is to improve the signal system (as recommended in my report of January 18, 1908) and at the same time alter the present cars sufficiently to limit the platform waits to a maximum of 35 seconds. It should be understood that this 35 seconds is a limit which, if exceeded, would at once affect the headway, and that the average platform delay should be somewhat less than this limit in order to provide a leeway for operating exigencies.

To secure this result it is evident that the loading and the unloading must be carried on at the same time. Some improvement should also be expected from the use of pneumatic door-handling equipment and an electric door signal. These changes should easily bring the actual wait at the station platform down to the following figures:

1.	To open doors after train is stopped	2 secs.
2.	To unload 163 passengers through 14 doors, and to load 206 passengers through separate doors, both processes being carried on at the same time	20 "
3.	To close doors and give signal to motorman	8 "
4.	Total average time of trains at express stations during rush hours should not exceed	30 secs.

ARRANGEMENT OF SEATS.

From the foregoing discussion it is plain that in order to run 40 trains per hour through the subway, it is essential that more door openings be provided than are found in the present cars.

There are a number of different types of cars which will provide extra doors, thus reducing the station waits and increasing the present number of cars which can be run through a station during rush hours. Each type, however, will allow for a number of different arrangements of the seats, and therefore before taking up the most desirable location of these extra doors, it will be well to discuss the arrangement of seats in order to determine how best to utilize the additional carrying capacity provided by the increased number of trains.

Before determining upon the proper arrangement of the seats, the question of policy submitted to your Honorable Commission in my preliminary report of November 26, 1907, must be decided. In that report I requested a decision as to whether the capacity of the subway should be limited to the number of passengers who could be carried if the cars contained the maximum number of seats, or whether it would be preferable to sacrifice somewhat the possible number of seats, thus providing a relatively larger amount of standing room and correspondingly increasing the total carrying capacity.

Not having been instructed by you on this subject, in order to complete my report upon the subway car I take the liberty of suggesting the following policy for your consideration:

It seems to me that it should be the aim to eventually provide a seat for every long-haul passenger, but until this can be at least approximated by the construction of additional subways or other transportation lines, it will be necessary to furnish transportation for all, even though existing conditions compel many passengers to stand during rush hours. While it seems at present impracticable to provide seats for all except during non-rush hours, every possible improvement that tends in this direction consistent with justice to the subway company should be made, in order to gradually reduce the proportion of standing passengers to those seated, and no change should be allowed which will reduce the total number of seats per hour now provided by the subway cars.

It has just been pointed out that the maximum number of cars per hour can be secured only by the introduction of additional side doors in the cars. Although these extra doors may slightly reduce the seating capacity per car, their use should so limit the station waits that the total seating capacity carried by a station within a given time is not reduced from the present number of seats. In other words, the rule should be that the increased number of seats made available by the extra cars must be at least equal to the total number eliminated on account of the space occupied by the extra doors.

Owing to the overcrowded condition of the subway it will be necessary for the present to utilize the extra carrying capacity made available by the additional cars for standing passengers, until such a time as additional subways can be built. If these subways are built sufficiently in advance of the demand for subsurface transportation, a part of this extra space can eventually be fitted with seats and thus approach nearer to the condition of a seat for every passenger.

If 40 trains of eight cars each are passed through a station each rush hour, each car having additional doors to provide for the more comfortable and rapid handling of the passengers, it will require but 40 seats per car to provide the same number of seats that are at present supplied by 30 eight-car trains per hour. The new cars, therefore, should not have less than 40 seats. Any greater number of seats than 40 per car will indicate a corresponding increase in the total number of seats available.

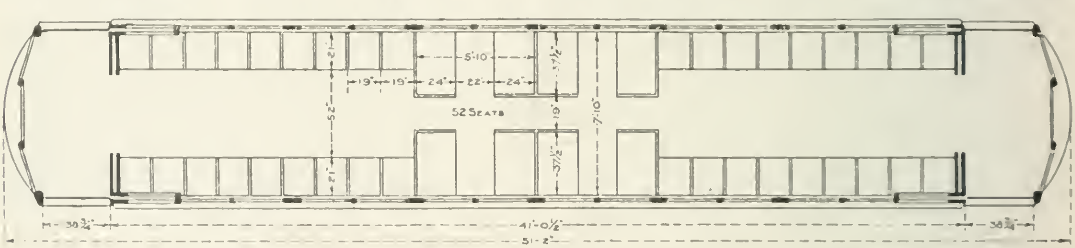
The number of seats which can be placed in a car depends upon the type of seat, and there are three kinds of seats which by common use have become standard practice in cars of the subway type.

The longitudinal seat usually occupies a space 19 in. in length along the side of the car. This type of seat has long been in use in surface cars, in many elevated cars, and the ends of the present subway cars.

The cross-seat of the "back-to-back" type has been adopted for use in the center of the cars on a number of elevated urban roads and for the present subway car. As the elbow of the passenger occupying the seat next to the aisle can encroach upon the aisle space, only 18 in. in width is required for each passenger. The space between the seat cushions varies from 14 in. to 30 in., a fair average being from 18 to 20 in.

The cross-seat of the "walk-over" type is being quite generally adopted by the interurban electric roads and by a number of city lines. A width of 17 in. per passenger makes the seats 34 in. wide, although in some instances, such as the new cars now in use in Chicago, the seat is 36 in. wide. The distance from the center to center of back varies from 27 in. to 36 in., a fair average for a properly designed seat being about 30 in.

The advantages and disadvantages of the various kinds of seats are pointed out in discussing the possibilities of seating arrangements in the different types of cars which are most suitable for subway conditions.



Plan of Present Subway Car, Showing Arrangement of Seats and Single Doors at Ends.

TYPES OF SUBWAY CARS.

A successful car for the present subway should possess as many as possible of the following requirements:

1. Separate entrances and exits.
2. A space which can be cleared so as to be ready to quickly receive the passengers boarding a car.
3. Convenient means of circulation inside a car.
4. Standing room space contiguous to the exits.
5. As many cross seats as practicable.
6. Exit and entrance doors sufficiently removed from each other to allow for the car's stopping convenient to guiding rails on the platforms.
7. Doors located so as to minimize the danger from open spaces at curve platforms.

The various cars may be classified in accordance with the number of doors in the sides of the cars as follows:

Cars with center side doors and end doors.
Cars with two quarter side doors.
Cars with three doors near center.
Cars with multiple side doors.
Cars with double doors near ends.

Each one of these types may have seats of either the longitudinal, the cross "back-to-back," or of the "walk-over" style, or a combination of two or more styles, as will be shown more in detail as the cars are described.

CARS WITH DOUBLE DOORS NEAR ENDS.

Without weakening the present car, or adding materially to its weight, it is possible to introduce additional side doors, one near each end of each side of the car and as near as practicable to the present end doors, the distance between the doors being at least sufficient to furnish a pocket for the sliding doors.

It will be seen by referring to the accompanying drawing that these additional doors can be added without disturbing the present seating arrangement of the car to any great extent. It is true that the introduction of these doors will make it necessary to remove eight seats from each car, but the operation of the cars in actual service will make it possible to pass so many more cars through the subway that the loss of eight seats in each car will be more than offset by the additional seats in the added cars, and the extra standing room, so convenient to the separate exit, is a feature which will decrease the station waits, and thereby increase the schedule speed.

This proposed change in the present car has many advantages, which even a casual study will reveal. The new doors can be used for exits, and the present end doors for entrances, thus providing at once the means of carrying on the process of unloading and loading simultaneously and without the present conflict which during rush hours has become so objectionable.

This car provides a separate space for leaving passengers to collect around the exit doors without blocking the space which should be provided for the passengers entering the car. The result will be that passengers will move in and out much more quickly than at present, and the movement of passengers into the car will facilitate the movement of passengers out of the car.

With this car it would be possible to keep the platforms clear of standing passengers, particularly at the time of approaching a station where considerable additional load is to be expected. With the present cars it is impossible to keep the platform clear, as the passengers readily make the excuse that they are getting ready to leave the train at the next station. With a clear platform there should be none of the discomfort now experienced in boarding a crowded car; the passengers will pass rapidly into the empty car vestibule, and can move at once into the space which has been vacated by the leaving passengers.

There should be no hesitation on the part of a passenger in the selection of an entrance with this type of car, as is so often the case with the multi side-door car. Under these circumstances there is no reason why a rate of flow of passengers in and out of the car amounting to at least five passengers per car per second should not be expected with this car with double doors near the end, and this rate is fully as good as the experience in Chicago would lead us to expect from the multi side-door cars, even with eight doors distributed the entire length of the car.

While this type of car provides for setting up and maintaining a circulation, this circulation is not obtained at the expense of comfort to the through passengers, as the circulation is confined to the two ends of the car, and it is therefore not necessary for a passenger boarding a train at one station and getting off at another to pass through half the length of the car, with the attendant discomfort to both himself and to all of the other passengers in the car.

Both the exit and the entrance doors are directly under the eye of the guard, who is thus in a position to accentuate the circulation, and, therefore, the rapidity of handling the passengers, by opening the exit door slightly in advance of the entrance door, which can easily be done by either mechanical or pneumatic means.

This car lends itself readily to the introduction of platform railing at all of the more important station platforms. These railings can be arranged as shown in the accompanying diagram, which will indicate at once the advantages of collecting the passengers who are waiting for a train at definite loading points, thus leaving the remaining parts of the platform free and ready to receive the unloading passengers. This particular double-end-door car fortunately allows for an arrangement of platform railings in such a way that loading points can be provided for the Broadway passengers separate from those set apart for the Lenox passengers. Should the distance between the doors as shown be considered too close for ease in stopping at the proper points, the distance could be increased by moving the supplemental doors one seat nearer the center of the car.

The standing room in this car can be increased during rush hours by folding up the two seats between the doors, and, while this practice is not to be commended, there will be times, and particularly on heavy days, such as Mondays, when this feature could be utilized.

The present cars can be changed to conform to this arrangement for an expense of about $2,000 for each steel car, and about $1,500 for each composite car.

For the present subway this car seems to me to possess more advantages and fewer disadvantages, both from the standpoint of the public and the operating company, than any other type, and its use will increase the capacity of the subway sufficiently to fully justify the expense of altering the present cars into cars of this type.

RECOMMENDATIONS.

My recommendations, summarized, are as follows:

First.—That every car used in regular passenger service in the present subway be provided with two additional side doors located near the ends, approximately, as shown in the drawing already mentioned. I recommend this car for the following reasons:

A. The double door space at each end of the car will greatly reduce the present station waits.

B. The separate exits and entrances will remove the present uncomfortable conflict at the car doors.

C. The present cars can be altered to this type of car without detracting from their structural strength, or materially altering the present seating arrangement.

D. The result in increased carrying capacity due to changes will abundantly justify the investment.

E. This is the only type of car with additional doors that will not necessarily increase the present trouble due to curved platforms.

Second.—That all cars be provided with pneumatic or other means for quickly opening and closing the doors, and with signals, which will automatically indicate to the motorman when the last door is closed.

Third.—That all new cars bought in future be of metal and provided with seats more economically arranged, as shown in the accompanying plan.

Fourth.—That when the cars of the double end-door type are put in service, a system of platform railings, similar to that shown in the accompanying plan, be provided to direct the passengers.

Fifth.—That for future subways a wider car should be considered. This car may be a multi side-door car, if separate platforms can be arranged for each class of trains, and if the stations can be designed to control the flow of passengers at the entrance to the platform, instead of directly at the car doors. If, however, it is found that it is impracticable to design stations with sufficient room for waiting passengers independent of the station platforms, it will probably be found that the best car for future subways is a wide car of the type with double doors near ends.

Sixth.—That if it is found that future subways cannot be built without the occasional use of curved platforms, the cars for these future subways should be designed so as to allow the station platforms to extend under the car in such a way that the necessity for sliding platforms will be obviated.

[The part of the report given above covers the general discussion of the problem, a description of the recommended type to which the present subway cars should be converted and Mr. Arnold's general recommendations. The report also includes an extended discussion of the various types of subway cars and the various kinds and arrangements of seats in them. This will be published in a later issue of the *Railroad Gazette*.—Editor.]

Perkins of the Burlington.*

Charles Elliott Perkins, who was for some 20 years president of the Chicago, Burlington & Quincy Railroad, was a strong personality with a marked and effective individuality. He was honored, respected and beloved, and his character, which was typical of the age which produced him, is for all time inseparably connected with the history and the development of the Middle West during the past 50 years.

As a railroad builder he was perhaps as great a strategist as any man this country has produced; and yet his name will never be connected with those who, in undertaking daring things, have brought ruin to themselves and their associates. With all of his personal courage and his unwavering faith in the future of the West, he was a man who recognized his position of trusteeship for others. There was a very strong line of division, as he viewed things, between his rights as an individual and his duties as a trustee and guardian for others' interests. This very quality made him a careful and safe guide, and made the railroad, the development of which he presided over, a wonderful example of careful and sound financing, and well able in times of stress and money panics to weather the fiercest storms.

In 1901, when the sale of the Burlington was made to interests representing the Great Northern and Northern Pacific roads, he showed not only his business sagacity, but his determination to protect to the fullest extent the interests of all the stockholders. Before negotiations had been opened for the purchase of the road he had learned that a considerable portion of the stock had been bought in the open market. In fact, to his surprise, as well as that of other directors of the company, many of the so-called "widows and orphans" and little stockholders of the company in Massachusetts who had held the stock for years, had parted with their holdings to the syndicate which was making the purchase. As soon as Mr. Perkins

*From an article by Frederic A. Delano, President of the Wabash Railroad, and formerly General Manager of the Chicago, Burlington & Quincy, in *Appleton's Magazine* for March.

saw what was going on, he at once entered into negotiations with the syndicate, taking the position with his own directors that it would not do to let this syndicate acquire a majority of the stock and leave the minority stockholders to take what they could get. The result, as is well known, and now a matter of railroad history, was that a proposition was made by the purchasing syndicate and submitted to all stockholders alike, and finally accepted and ratified by upward of 97 per cent. In other words, regardless of his own personal ambitions, for it must have been a keen disappointment to him to part with the control of a property with which he had grown up, he concluded an arrangement for the sale of it which was as fair and as liberal to the interests which he felt it his duty to protect as it was possible for such an instrument to be.

Mr. Perkins saw the state of Iowa grow from a population of some 675,000 in 1860 to a population of 2,232,000 in 1900; he saw the Burlington road develop, and actually and personally superintended the construction of much of its mileage, from a railroad of a few hundred miles to one of more than 8,000, opening for development 14 states, and yet, such was his modesty and such his insistence on remaining in the background that he was far less in the public eye than many men who have achieved only a fraction of what he did. He belonged to the class of men which, in the nature of things, must grow fewer as time goes on—men who have great constructive gifts and who have had the opportunity to develop and work in a new country, free and untrammeled by precedent or conventionality.

Starting out from a small position in the railroad he became paymaster and assistant treasurer, and soon the general superintendent. But the road of which he had charge extended only from Burlington to Ottumwa, 76 miles, and as it grew and developed he grew and developed with it. When it was merged with the Chicago, Burlington & Quincy, then wholly an Illinois corporation, with a mileage of some 210 miles, he was for a time put in charge, as vice-president, of the Burlington & Missouri River Railroad, in Nebraska, which extended then from Plattsmouth, Neb., to Kearney and was being developed in a wholly new country. This was only a temporary assignment and he retained his headquarters at Burlington. In 1881 he was made the president of the united company—the Chicago, Burlington & Quincy.

With the increased importance and responsibility of this position, he was one of the most influential and best-known railroad men in the western country. During the prosperous years which followed, the road was extended to ramify through a very large area of Nebraska and beyond it into the states of Colorado, South Dakota and Wyoming.

The Burlington became the leader of the granger roads and its stock a favorite investment for trustees and others. The management of the road was successful and efficient, and the property well maintained. It was naturally so under such a leadership. Indeed, to have grown up and to have done creditable service in the "Burlington school" was as good a diploma as a railroad man could ask for. The graduates of this school have carried its influence far and wide throughout the country. Included among them are four railroad presidents, Edward P. Ripley, of the Santa Fe; Howard Elliott, of the Northern Pacific, and George B. Harris, now President of the Burlington. [The fourth is Mr. Delano himself.—Editor *Railroad Gazette*.] Paul Morton, of the Equitable Life, is a Burlington graduate, so is W. C. Brown, the Senior Vice-President of the New York Central lines. Out of many men of prominence may be mentioned a few such as C. M. Levey, Third Vice-President, and H. C. Nutt, General Manager of the western end of the Northern Pacific; George W. Holdrege, General Manager of the Burlington lines west of the Missouri, T. E. Calvert, now Chief Engineer of the Burlington system. Among those who have passed on may be mentioned T. J. Potter, once the Vice-President of the Union Pacific, and Henry B. Stone, who left the Burlington to become the President of the Central Union and the Chicago Telephone companies.

All through American railroad service are to be found men trained by Mr. Perkins to be "thorough" railroad men. Thoroughness was something that he insisted upon. Mr. Perkins never liked to hear a man spoken of as "a good operating man," "a track man," "a motive power man." He wanted "railroad men", that is to say, all around and efficient "business" men. He believed that fundamentally a railroad was a commercial enterprise and should be governed accordingly both in its management and its relations with the public. He dealt with the fundamentals, with the underlying principles of railroading, and to serve under and in close contact with him was an inspiration. He was quick to form his judgment of men, and when he decided that he could place his faith in one, his method of developing him was to give him large responsibilities. To those who knew him not he was at times brusque, for he could assume an almost fierce manner. He was a big man physically, and untiringly active. Both his father, the Rev. James Handasyde Perkins, and his mother, Sarah H. Elliott, were of Puritan stock, and he had many of the Puritan qualities, mellowed perhaps by the western environment in which he grew up, for in 1840 Cincinnati, where he was born, was pretty close to the frontier.

He received a common school education, and being the oldest son in a minister's family, it was necessary for him to go west at the age of nineteen, not only to become self-supporting, but, in the then familiar language of Horace Greeley, to grow up with the country. He went to Burlington, Iowa, in 1859. Leading business men in our larger cities often wondered that Mr. Perkins was content to remain in a small town, for he retained his residence in Burlington until the end of his life. They marveled that he did not come to live in some great city where he might be in closer contact with men of equal prominence and ability, but, in this particular, Mr. Perkins showed his character as clearly as in any other. It was his thought that a man could do his work better if freed from the diversions and distractions of the city life. He preferred to keep a little apart from these conditions and exactions of the city, and remained in his country home—a home where he was surrounded by every possible comfort, yet where he avoided every evidence of display and magnificence.

He was a profound student of the problems of every-day life, and, while not a university man, he was a man who, by close reading, had trained his mental qualities to an exceptional degree. There was scarcely a single broad question of policy concerning the duties of an officer of the railroad, the functions of the railroad or its relations to the public, upon which he had not prepared "memoranda"—papers which were comprehensive and thorough in the fullest degree. Then, again, he liked to associate with men who were thorough, painstaking and forceful. He loved to have young men about him and to discuss and argue with them on every conceivable topic. He liked opposition if it was intelligent and backed up by sound reasoning. Needless to say, he hated hypocrisy and demagoguery in any form.

A contemporary of Mr. Perkins in railroad administration, himself a man of notable ability, said of him recently, that he knew of no man in the profession of better intellectual capacity and training, no man so well equipped to understand all the problems, technical, economical and commercial. High praise this, for a man who had acquired this equipment wholly by his own labor.

People who knew him best in the community where he lived and along the line of the railroad which he managed for so many years, knew that he appreciated in a way that few railroad executives have appreciated, the true importance of the good will of the community with which he did business. He laid the greatest possible stress, in the organization which he developed, on the importance of local self-government. While he appreciated fully the advantage of supervision by centralization of authority, he recognized and always preached the importance of letting the man on the ground have the authority, the tools and the men to do with.

The railroad over which he presided was not only recognized as a model of honest management and careful capitalization, but it also enjoyed an almost unexampled popularity and even affection in the communities along its line. His idea of keeping a community satisfied was to give all the service which it could reasonably demand, and yet he did not tamely submit to harsh treatment or exactions. Indeed, few men ever fought more stubbornly for the rights of their stockholders against some of the senseless legislation resulting from the wave of popular hostility in the Granger movement and afterward. He should have the credit, more than any other one man, of supplying the initiative and the arguments which finally secured a decision from the United States Supreme Court in favor of the railroads in the "Nebraska Rate Case." His logical mind, his capacity for reasoning closely and clearly, and for analyzing complex questions made him alike a strong advocate and a powerful combatant.

It is not to be supposed that this man's career was one unbroken procession of triumphs. He had his trials and his sore disappointments, as many another, bearing them so manfully withal that few ever knew of them; but in his railroad career, perhaps, his hardest experiences were the repeated disappointments in carrying out his ambitious plans for the development and extension of the Burlington road. Without criticising his associates and directors, who took what they thought to be a safer and more conservative course, he was keenly disappointed that he could not make them appreciate the grand opportunities which lay before them; first, in the purchase of the then bankrupt Northern Pacific, and later in the purchase of the Oregon Short Line. Finally, of course, the loss of control of the property by his friends was a severe disappointment, but, after all, to his reasoning mind, only a natural sequence of the failure to grasp opportunities which had been offered and had been allowed to slip.

With all of his great qualities as an administrative and executive officer, so successful in his achievements, Mr. Perkins was even more. He was a great, large-hearted, generous man, doing in a quiet way many things for his friends and neighbors. He was capable of inspiring in his associates loyalty and devotion to a remarkable degree, and yet he was exacting in his demands for thoroughness and accuracy, while generous in his approval of work well done. His life-work is a sufficient monument to him, but the business ideals and the inspiration which he gave to many a man who came under his influence will perhaps mean even more in the long run.

After all, the most encouraging thing that can be said is that Mr. Perkins' methods and his success were not absolutely unique, for he was a product of American civilization, a thoroughly typical American. In these days when sensationalism runs riot and public attention is constantly directed to everything unfavorable, it is worth while to remember that there are such men, and to realize that business methods are fundamentally sound, for the reason that men in business believe, and fortunately so, that corporations must be fairly conducted in order to survive.

Picked Up on the Road.

BY GULF.

Every one ought to have read the discussions on track stresses on curves that have been published during the past year, if only from curiosity to see how men are seeking the solution, though it must be admitted that the mathematics of the case has many will-o'-the-wisp features. Mathematics is an exact science, but its usefulness depends on correct premises. When we have an equation of two unknown quantities that are treated as variables, the construction of the line by the assignment of a known value to one of them is an easy matter, but when it comes to solving an equation involving a score or more of unknown quantities, the case assumes different proportions. If we could know the value of all of the variables that enter into and affect the pressures of the wheel on the rail, then there is no doubt that a mathematical solution of the result could be obtained. But who knows the values of these elements? For example, who really knows the simplest one of the lot—the height of the center of gravity? Then, who knows just what position a four-wheel truck will assume on a curve, and what effect gage widening has on that position? If you don't even know that, how can you make even a wild guess at the position that will be taken by a consolidation locomotive; and how dare you assume that that position will be the same at all speeds? Will the centrifugal action that shifts the center of gravity affect the position? I don't know. Do you?

Now, everybody knows that in rounding a curve one wheel must slip to make up the difference in the length of the rails. Which wheel slips? Is the slip all on one wheel, or is it distributed between the two? Is there any difference in the slip of the front and rear wheels of the same truck? I don't know. Do you?

What is the coefficient of friction between the wheel and the rail when both are worn? Rather, how much will it take to slip a worn wheel laterally? Doesn't it jump up in the air to a point that rather tends to take your breath away? I have been told confidentially that an attempt to measure the matter on a consolidation locomotive running at 10 miles an hour resulted in putting the measuring apparatus out of commission, with a good big margin to spare, and that this didn't happen until a load of 30,000 lbs. had been exceeded. Won't it take more to slip a wheel toward the outside of the rail than in? Anyhow, can you guess what the coefficient of that resistance—whether frictional or something else—may be on a worn wheel? I can't.

How much of this thrust is due to side bearings sticking; how much to engine stiffness, and how much to speed?

Now, with such an array of ignorance before us, what possible basis does a mathematical calculation have to stand upon? It looks like attempting to solve a problem in calculus before the value of the common numerals had been learned. It reminds one of the answer given by a certain superintendent of motive power to a question as to the method he used in calculating the strength of his main rods. He said: "I calculate a little and guess a good deal." From the lessons of past experiments, it looks as if an engine or car rarely behaved twice alike in going around the same curve at the same speed, so that the only thing to do is to take a cut across lots, drop the calculations and measure up the results. We ought to do this often enough to be sure that we have the most destructive effects, and then we ought to act accordingly.

History occasionally repeats itself, and the old invention has a habit of bobbing up serenely as a novelty. I suppose that ever since the first mail bag was dropped from a passing express some one has been scheming to do the same thing with passengers, and inventing ways for picking them up is just as attractive. Cars have sometimes been cut loose from a moving train and allowed to come to a standstill, as in England, and it is not so many years ago that one genius proposed a sort of window-shade affair, in which a coil of rope was to be wound on a drum on a standing car and was to have a projecting loop caught by a hook at the rear of a passing train. The aforesaid drum was to be fitted with a spring, which should be gradually wound up as the rope was paid out, and the resistance to this winding was to start the car and bring it up to train speed. Then the rope was to be wound in, the car coupled to the rear, the passengers transferred to the "car ahead," others for the next stop were to be put in and the car cut off again. This was to be repeated all along the line. Could anything be simpler? But somehow or other the scheme never became popular, probably because of the rope. So now we have another rapid transit car—a "wonderfully simple and very practical invention"—which is, in effect, a car with a number of side doors, attached to the through train. Then there is to be another just like it on a side track. As the express approaches, the side track car starts and runs alongside, and when the doors are exactly opposite, "the cars are to be coupled, the platforms lowered, vestibules fixed and the transfer quickly made," the car cut off, and there you are. We are not informed of the length of side track needed for the transfer at 60 miles an hour, or how the various little details of the arrangement have or have not been worked out. But we are all anxious to put money in it, for we have seen it stated in a reputable paper that "when it becomes generally known that this great improvement in railroading is possible, there will be a universal demand made by the public for its introduction!" The principle is old enough. Away back, fifteen years ago, a newsboy made a practice of transferring from an express to a local on a four-track line, so the paper said, and kept it up until he was stopped. But that boy was a gymnast and had nerve. And now we await the trial trip of the gymnast car.

Colonel Yorke on the Great Western Audible Distant Signal.

The cab signal in use on a section of the Great Western Railway of England, in place of visual distant signals (which have been abandoned) and which was described in the *Railroad Gazette* of November 15, 1907, was the subject recently of a paper by Mr. W. Dawson, read before the Institution of Civil Engineers, and of a discussion following the reading. From this discussion we reprint the remarks of Lieutenant-Colonel H. A. Yorke, Chief Inspector of the British Board of Trade, as reported in the Bulletin of the International Railway Congress:

I think you will all agree with me that this is the most important development of signaling that has been attempted in this country for some years past; and I venture to suggest that the thanks of the community and of the railroad world at large are due to the Great Western Railway, for their enterprise in inaugurating and continuing experiments in this direction. The device under discussion represents the most serious, or at any rate the most continuous, attempt that has been made, as far as I know, to solve the problem of audible signaling on railroads in this country. It has been watched with the greatest interest by the officers of the Board of Trade, and I may say that, through the courtesy of the Great Western Railway, I have been personally kept informed of all the details of apparatus from its inception. I have seen it when it was tried merely in a siding outside the signaling works of the company. I have seen it tried tentatively on the main lines. I have seen it on the Henley branch, and finally on the Fairford branch, where it is now more or less permanently installed. So far as their experience of it goes, the Board of Trade officers have been able to express satisfaction with the results obtained up to the present time. The innovation may seem perhaps somewhat startling to some railroad engineers, the innovation being the substitution of an audible signal for a visible signal, but audible signals are already in existence on railroads in the shape of the detonator, which was introduced in the year 1840, and has done good service since that date. The difference between the appliance now under discussion and the ordinary detonator, seems chiefly to lie in the fact that the audible signal in this case is carried on the engine instead of being placed on the ground, and the driver therefore has the advantage of carrying the signal with him instead of having to hear a momentary explosion. As I understand it, this appliance has resulted from the efforts of railroad companies, and the Great Western Railway Company in particular, to discover some apparatus for fog signaling on railroads as a substitute for the fogmen. The Board of Trade have for many years past been pressing railroad companies to endeavor to seek for some apparatus of this nature. Not that we have any reason to doubt the reliability of our fogmen. I believe our fogmen do their duty in the most devoted manner, and when present on the ground, are quite reliable. I cannot at present call to mind any accident which has been due to the neglect of a fogman when on duty, to his absenting himself from his post; or to his failing to put the detonators on the line when necessary. On the contrary, I believe they constantly expose themselves to danger in carrying out the responsible duty which is put upon them. But the danger of fog arises from its coming on suddenly. At such a time fogmen are not always immediately available to take their posts at the signals to which they are allotted, and then follows a dangerous period. It is to meet that danger that the Board of Trade have always pressed railroad companies to endeavor to find some reliable fogging apparatus. The requirements of a fog-signal are of course well known. It should be absolutely reliable, or at least as reliable as the fogmen are at the present time; it should be always available. It should give a positive as well as a negative indication, it should be easily understood by a driver and it should be placed at such a distance from the stop signal, that the train can be brought to rest before it reaches that signal after the driver has received the communication from the fogging apparatus. It seems to me that the only way in which to ensure compliance with these requirements, is to keep the apparatus in constant use. Unless it is in constant use, it is liable to be neglected, and the maintenance of it might not be sufficiently attended to. Supposing that it were put out of use in the summer months in the anticipation that it was not required, and that fog came on unexpectedly in the autumn, the apparatus would not be available and difficulty and danger would arise. I have always regarded it as essential that any fogging apparatus, to be reliable, should be in constant and daily use. It is then under the observation of the drivers and the signalmen and all the officers of the company, and then it is known to be at all times available. But if it is always in use, and if it is placed alongside the distant signal (which is the most suitable place for it) it seems that the introduction of such an apparatus means the duplication of the signal, that is to say, there would be an audible signal as well as a visual signal, and such a duplication might be disconcerting to a driver. He would get in the habit of regarding one signal and ignoring the other; he might prefer to observe the audible in preference to the visible, or the visible in preference to the audible; but he would get in the habit of attending only to one. In that case, the second signal becomes superfluous, and might as well be taken away, and it would seem that the one to remove would be, not that which is distinguishable at all times, whether the atmosphere be clear or foggy, but that which is only of service under favorable atmospheric conditions. A signal which is sufficiently reliable for the conducting of traffic during time of fog must, it seems to me, be equally serviceable for use when the atmosphere is clear. If, therefore, we are going to pin our faith to an audible signal in time of fog, why should we hesitate to pin our faith to the same apparatus when the atmosphere is clear? The present apparatus, as I say, arose from the desire of the company to find a suitable fog-signal, but if placed alongside or in substitution of the distant signal, it has a further advantage, inasmuch as it enables a distinction to be made between a distant signal and a stop signal. There has always existed in England an anomaly in signaling, inasmuch as at night-time, the red light is used on distant signals as well as on stop signals. That has never seemed to me to be entirely satisfactory. If such an apparatus as this should be found to be reliable and be introduced into this country, it will enable that difficulty to be overcome, and the distant signal would at all times be easily distinguishable from the stop signal. Mr. Jacomb-Hood suggested that the time is approaching when possibly we might dispense with semaphore or visible signals altogether. I think that is looking rather far ahead. At present I should prefer to see this apparatus tried only in substitution of distant signals. It is doubtful whether it would ever be suitable for stop signals, as these must indicate the exact spot where the driver has to bring his train to rest, and an audible signal on an engine does not meet that requirement. But when all is said and done, the opinion of the drivers is one of the most important factors in all signaling questions, and I suggest that the company should endeavor to arrive at the feeling of the drivers in regard to an audible signal such as this carried on the engine, and to ascertain whether in the driver's opinion it is a better signal, than a fixed signal alongside of the line. There are debating societies among railroad men, and institutes where men can meet, and I think it would be a good thing if the drivers were encouraged to discuss the utility of this apparatus among themselves.

Express Locomotives—State Railroads of Sweden.

The standard express locomotive that has formerly been used on the State Railroads of Sweden has been known as the Class Cc and has rendered very satisfactory service until recently, when the weight of trains has been so increased that it has been very difficult to maintain the schedule without either double heading or using the company's 4-6-0 two-cylinder compounds. The objection to this substitution lay in the fact that these engines had a rated speed limit somewhat below that called for by tho express train schedules. Consequently an Atlantic locomotive was designed by the Bureau of Motive Power Design for the State Railroads at Stockholm in order to meet the increased requirements of the service, which sometimes called for the hauling of 12 sleepers. After considering the relative merits of the four-cylinder balanced compound and the simple engine, the latter was chosen and an order placed with the works of Nydquist & Holm, of Trollhattän, Sweden, for an engine of which the following aro some of the principal dimensions:

Cylinder diameter	19¾ in.
Piston stroke	24 "
Driving wheels, diameter	75 "
Steam pressure	170 lbs.
Tubes, ordinary diameter	2 in.
" superheater, diameter	5¼ "
" ordinary number	111
" superheater number	18
Tubes, length	23 ft. 8 in.
Heating surface, firebox	126.[illegible] sq. ft.
" tubes, superheater	341.04 "
" tubes	962.88 "
total	1,430.87 sq. ft.
Superheater surface	352.88 "
Grate area	27.97 "
Weight on driving wheels	67,980 lbs.
" front truck	40,920 "
" rear truck	23,540 "
total	132,440 lbs.
Tractive power on basis of 65% of steam pressure	1[illegible],650 "
Tractive power on basis of 85% of steam pressure	17,[illegible] "

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = [illegible]$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 7.42$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 934.[illegible]$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 51.16$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 8.87^{*}$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 47.59$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 92.56$$

Volume of two cylinders = 8.51 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 168.13$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 3.29$$

Tube heating surface equated to firebox heating surface (Vaughan formula), sq. ft. 248.54

Total equated firebox heating surface, sq. ft. 375.49

$$\frac{\text{Total heating surface}}{\text{Equated heating surface}} = 3.81$$

*Per cent.

The two tractive powers are given because, according to the Swedish formula only 65 per cent of the boiler pressure is used in estimating it. In all the comparisons, however, that calculated on the 85 per cent. basis is used so as to make it comparable with American practice.

The boiler has an internal diameter of 59½ in. and the rather remarkable length between tubesheets of 23 ft. 8 in., an increase beyond even the most advanced practice of the United States. The foundation ring is of cast steel and rests upon the frame by four lugs. These lugs are of a peculiar shape and are grooved on the sides to take pads having corresponding projections. They are bolted to the frames so that a rigid attachment is secured for the boiler both laterally and vertically and yet it is free to move fore and aft under the influence of its expansion and contraction due to changes of temperature. The only notable feature about the boiler itself is to be found in the fact that the first course is welded instead of being riveted for the longitudinal seam, which was done in order to simplify the connection with the front tubesheet and thus make it easier to secure a tight joint.

The superheater is arranged in accordance with Schmidt's latest design, with its pipes placed in enlarged fire tubes in the upper part of the shell. The steam leaves the boiler in the ordinary manner by way of an enlarged T head which is divided into two chambers in such a way that one of them is in direct communication with the dry pipe and the other with the steam chest of the cylinders. Steam reaches the second chamber from the first by way of eighteen 1¼ superheater pipes placed in the enlarged firetubes. The course is the usual one back toward the firebox, through a return bend and thence to the smokebox, making two round trips through the four pipes, finally reaching the second chamber of the T head and the cylinders in a highly superheated condition. A damper is placed in the smokebox by which the firebox gases may be prevented from passing through the large tubes and coming in contact with the superheater tubes when there is no steam in them, thus avoiding possible overheating. This damper is also so connected with the blower that it is always shut when the latter is in use.

The smokebox is very large, being about 80 in. long, and the old spark extinguisher at the base of the stack is replaced by a mantle of perforated plate set between the exhaust pipe and the base of the smokestack, by which less resistance is offered to the passage of the gases than in the old method.

The grate has a slight slope down to the front, but otherwise is of the standard pattern.

The cab appliances are the same as in the later types of State Railroad locomotives, with a few additions that are only used in the United States for experimental purposes. These include a pyrometer, made by Steinle & Hartung, that is placed in the steam chest and shows, by means of a dial in the cab, the temperature of the superheated steam. There is also a steam gage to indicate the steam chest pressures; an apparatus for cleaning the tubes by steam and a mercury controlling gage.

The steam turret is of comparatively new design and is made in one piece with the throttle stem stuffing box on the back head of the boiler, and will be seen to have a dry pipe connection to the dome. The advantage of this arrangement lies in the small space occupied and the accessibility of the whole to the engineman.

The design of the engine differs in many respects from that of the ordinary European locomotive, and, with the exception of the cylinder location and the crank axle, shows a decided leaning towards American practice. The frames are of the bar type, flattened at the front to a thin slab to give more room for the cylinders and simplify their fastenings.

The cylinders are between the frames and are cast with half saddles and valve chests, are made reversible and interchangeable and are bolted together and to the boiler in the American manner.

The main rods connect to the front driving axle, which, being cranked, is of nickel steel, while the others are of open hearth steel. All the rotating weights are fully balanced in each wheel, and, in addition, 30 per cent. of the reciprocating forces are equally distributed over the driving wheels. The crank pins for the side rods are set diametrically opposite the inside cranks for the main wheels in accordance with the usual practice.

The driving boxes are of a novel design in that they are provided with adjustable side bearings for taking up the side wear, and thus maintain a smooth working engine for a longer time than is possible with the ordinary boxes. The adjustment is effected by means of two vertical bolts with countersunk heads on the top of the box and double nutted beneath the oil cellar, which, in turn, supports the side brass that abuts solidly against the upper brass through an intermediate liner. The truck journal boxes are of the ordinary form but are placed outside the wheels in order to secure better accessibility to springs and bearings, and at the same time give more room between the frames for the cylinders. All boxes, wheel centers and engine and truck frames are of cast-steel.

The pistons are of cast-steel and are supported by an extended piston rod with bearings and stuffing boxes in the front cylinder head. This is in accordance with current practice in Europe, where it has been found that large pistons with three rings, working under highly superheated steam, wear the cylinder unduly unless they are given this support.

The piston valves were designed by Mr. Carlquista, the designing engineer of the State Railroads, and are operated by the Heusinger von Waldegg, or Walschaerts gear, the usual screw working on the reach rod by means of a hand wheel of European practice being used.

The springs and spring suspension closely resembles that in use on American Atlantic locomotives, though, at the rear driver, the springs are underhung by means of an extension of the jaws of the boxes. This effects the three-point suspension system, where the truck carries the front end on a swiveling or swinging center bearing and the driving and trailing wheels are equalized together on each side of the engine. Further than this; especial attention was paid to so proportioning the springs that a soft and easy motion will be secured.

Single bar guides are used because of the lack of room for a lower one.

The cab is of wood, instead of plate for the purpose of avoiding the slamming noise that is apt to occur at high speeds with a metal construction. It is provided with a wind-splitting front so as to reduce the atmospheric resistances.

As the machine is built for high speeds, equalized brakes are applied to all the wheels, including those of the truck. Those on the drivers and trailers are worked by a vacuum cylinder at the rear of the engine while those on the truck are operated by a separate cylinder connected to the same suction pipe and vacuum receiver but capable of being cut in or out at will. The brake valve is so arranged that only the train brake is applied by a partial movement of the handle, as a normal condition of operation. But, for the requirements of a quick stop, a further movement of the handle brings the locomotive brakes into action also. The brakeshoes are attached to the head by a key which facilitates replacements when they are required. The vacuum ejectors discharge the steam to the atmosphere through a muffler on top of the cab so as to avoid the usual long discharge pipe leading to the stack.

The engine is provided with a speed recorder of Haussbalter's latest design, indicating the speed at three-second intervals. Lubrication of the valves and pistons is obtained by means of a Michalk's oil compressor, driven by an eccentric pin on one of the trailing wheels, thus forcing the oil to place, a provision that has been found to be necessary when using superheated steam.

At present the tender is of the standard type used on the old passenger locomotives, because the existing turntables are not large enough to accommodate a longer wheel base than these call for; but, as soon as the contemplated changes in turntables have been made, a larger tender will be used. Several runs were made with the new engine in order to obtain a comparison of its performance with the old Class Cc, or eight wheelers. Two weights of trains were taken, one having a weight equal to the maximum load of the smaller Class Cc engines, and the other one suited to the new locomotive. These heavier trains were hauled with the Cc engines double heading and the fuel consumption compared with that of the single superheater engine doing the same work.

The tests were run between Malmo and Nassjo, a distance of 167

New Express Locomotive for the Swedish State Railroads.

miles, giving the following results for three trips with the light trains:

Engine.	Train weight, net tons, Excluding engine & tender	Train weight, net tons, Including engine & tender.	Consumption Coal, lbs.	Consumption Water, gals.	Saving effected by superheater Coal, lbs.	Saving effected by superheater Water, gals.
Superheater	231.0	334.3	7,590	5,839	5,390	2,110
Cc	225.5	310.8	12,980	7,949		
Superheater	258.5	360.8	5,610	4,165	3,300	978
Cc	253.0	353.3	8,910	5,143		
Superheater	242.0	344.6	6,930	5,522	5,940	2,325
Cc	242.0	322.3	12,870	7,847		

According to this comparison based on ton-miles, the new engine consumed 46.5 per cent. less fuel and 21.5 per cent. less water than the Class Cc.

In a trial with the heavier trains weighing 400 net tons without engines and tenders, which were run as specials, over the same track, making one round trip with the superheater engine and one with the Class Cc double-headed, the schedule was laid out for an average speed of 34 miles an hour, but, owing to delays, considerable lost time was made up by both trains so that the actual average speed with the superheater engine was 42 miles an hour, and that with the Class Cc, 39 miles an hour. The maximum observed speed with the former was 65 miles and with the latter 62 miles an hour.

The coal consumption per 1,000 ton-miles, weight of engine and tender included, was 113.29 lbs. for the locomotive with the superheater, and 211.78 lbs. for the smaller engines, showing a saving of 46.6 per cent. in coal and 49.5 per cent. in water.

It will be noticed, of course, that the light engines were at a disadvantage with their comparatively small boilers, short tubes and restricted grate area, so that they had to be forced to maintain speed and burned 116.5 lbs. per sq. ft. of grate per hour as compared with 84.7 lbs. in the superheater engine. Further than this, it should be borne in mind that only about 80 per cent. of the tractive power of each engine is utilized at the drawbar of the second engine. So that comparisons from an engineering point of view are weak, though when considered from that of the traffic department it can readily be shown that a considerable saving can be effected with the new type of engine.

The highest power developed by the superheater engine was 1,095 h.p., and was done at 48 miles an hour with a 40 per cent. cut-off.

The temperature of the superheated steam averaged about 454 deg. Fahr., though on two occasions it rose to 490 deg. Fahr., or a maximum superheat of about 180 deg. Fahr.

The illustration shows the curves of the drawbar pull of the two classes of engines at various speeds and also the train resistances, exclusive of engine and tender, for three trains consisting of 12, 10 and seven bogie sleeping cars respectively. They show that the locomotive with superheater can haul a train of 333 net tons, that is to say, locomotive, tender and seven cars, at a speed of 31 miles per hour on a continuous 1 per cent. grade or 64 miles per hour on a level, while the speed of the lighter engine will be limited to 17 and 56 miles an hour respectively.

In the case of a 10-car train the superheater engine can haul it up the 1 per cent. grade at 22 miles an hour and over a level at 58 miles an hour, while the light engine cannot take it up the grade at all. Finally the superheater locomotive can haul a 12-car train up a 1 per cent. grade at 17 miles an hour and over a level at 52 miles per hour.

These curves are based upon the assumption that the superheater engine can evaporate 9.5 lbs. of water per sq. ft. of heating surface per hour and that the Class Cc engines will evaporate 10.8 lbs., although it has been found that this latter figure can be exceeded by forcing the fire.

An endurance test was run with the superheater engine from Malmö to Katrineholm and return, a distance of 300 miles in each direction, changing crews midway on each trip, when it was found that the engine could make the run in ordinary express service with no appreciable loss of steaming qualities at the end. This is naturally regarded as of great importance from an economic standpoint as it will make it possible to greatly reduce the number of engines required for the service. The results of these tests were so satisfactory in every respect, including ease of motion, accessibility of working parts and as well as economy of operation that 10 more were ordered of the same design.

Consumption of Pulpwood in 1906.*

The chief features of the year 1906 in connection with the manufacture of wood pulp were

(1) A consumption of wood greater by 469,053 cords than that of any previous year.

(2) The highest average value per cord for all kinds of wood.

(3) An increase of 93,000 cords in the imports of pulpwood. Of the two woods imported—spruce and poplar—spruce alone showed an increase—poplar decreased by over 5,000 cords.

(4) Since 1899 the amount of wood consumed each year for pulp has increased, in round numbers, from two million cords to $3\frac{1}{2}$ million cords.

In 1906 the consumption of wood for pulp exceeded the high-water mark of 3,192,123 cords reached in 1905 by nearly one-half million cords, making the total consumption by 250 mills, 3,661,176 cords. The year showed a heavy increase in the consumption of hemlock wood. Except balsam, the consumption of which fell off by nearly 23,000 cords, or 40 per cent., all other kinds of timber show a normal increase in quantities consumed. The increase for poplar was less than for any of the others, and its consumption remained nearly stationary.

The following table shows the quantity of wood of different kinds used for the manufacture of pulp in 1899, 1905 and 1906

Kinds and Amounts of Wood Manufactured into Pulp.

Kind.	Quantity, cords. 1899.	1905.	1906.	Per cent. of inc. (+), or dec. (—) 1899 to 1905.	1905 to 1906.
Spruce	1,509,202	2,273,254	2,507,002	+ 50.6	+ 10.3
Poplar	256,953	322,058	328,470	+ 25.3	+ 2.0
Hemlock	*	375,422	528,381	......	+ 40.7
Pine	*	57,399	69,277	......	+ 20.7
Balsam	*	56,741	33,886	......	— 40.3
Cottonwood	*	10,507	......	......	
All other	220,155	96,739	194,160	—56.1	+ 100.7
Total	1,986,310	3,192,123	3,661,176	+ 60.7	+ 14.7

*Included in "All other."

In both the consumption of wood and manufacture of pulp New York has ranked first from the earliest time of which there is record. In 1906 New York alone consumed 1,295,904 cords, or more than twice as much as Maine, which ranks next, with 617,743 cords. Wisconsin ranks third, with 512,354 cords. New Hampshire follows, with 319,729, Pennsylvania with 282,973, and Michigan with 115,272 cords. No other state consumed as much as 100,000 cords. It is interesting that the consumption of New York shows a small decrease from the 1905 figures, while Maine, Wisconsin, Pennsylvania and New Hampshire have all increased their consumption. It should be borne in mind in connection with these figures that in practically no case is all the wood produced in the same state in which it is consumed. In New York, for example, the report of the state forest, fish and game commission shows a cut of 516,778 cords of pulpwood in 1906, or approximately 40 per cent. of the amount of wood used by the pulp mills of the state.

The following table summarizes by states the quantity and value of wood used for pulp and the amount of pulp produced during the years 1905 and 1906.

Wood Used for Pulp in 1905 and 1906.

State	1906 Amount cords.	1906 Value	Average price per cord at mill.	Estimated quantity pulp produced, tons	1905 Amount, cords.	1905 Value	Average price per cord (at shipping point.)	Estimated quantity pulp produced tons.
Maine	617,743	$4,575,100	$7.41	383,535	501,807	$2,950,625	$5.88	323,012
Massachusetts	33,302	262,030	7.87	18,086	34,362	171,810	5.00	16,095
Michigan	115,272	663,055	5.74	57,099	109,761	475,278	4.33	63,275
Minnesota	31,848	191,833	6.02	25,406	31,802	121,801	3.83	24,742
New Hampshire	319,729	2,361,270	7.39	174,513	233,700	1,257,306	5.38	128,898
New York	1,295,904	10,351,247	7.99	915,379	1,301,986	8,137,412	6.25	977,313
Ohio	34,723	189,011	5.44	16,868	54,000	274,320	5.08	29,050
Oregon	72,174	373,591	5.18	49,304	..			..
Pennsylvania	282,973	1,583,117	5.59	127,356	250,826	1,158,816	4.62	123,372
Vermont	34,968	290,384	8.30	38,403	22,271	122,490	5.50	20,207
Virginia	81,761	621,002	7.60	43,902	89,540	492,470	5.50	44,649
West Virginia	61,736	383,687	6.21	33,577	96,357	497,202	5.16	40,857
Wisconsin	512,354	3,708,540	6.84	338,997	382,471	1,686,697	4.41	240,657
Others	136,686	855,020	6.26	75,289	87,337	389,438	4.87	42,455
Total	3,661,176	$26,411,887	$7.21	2,327,841	3,192,223	$17,735,665	$5.56	2,084,482

New York led in both 1905 and 1906. In 1906 Maine ranked second, Wisconsin third, New Hampshire fourth and Pennsylvania fifth. In 1905, however, Pennsylvania ranked fourth and New Hampshire fifth, a reverse of the order of 1906. All of the wood imported into the United States for the manufacture of pulp comes from Canada and is free from duty. The amount has increased from 369,217 cords in 1899 and 622,515 cords in 1905 to 738,872 cords in 1906.

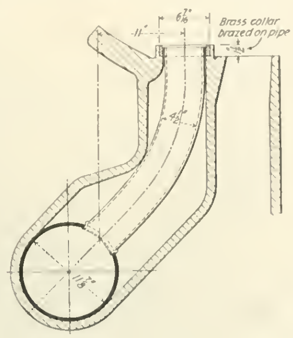
*Abstract of a report of the Forest Service, issued Nov. 26, 1907.

A Method of Repairing Cracked Piston Valve Cylinders.

BY B. P. FLORY,
Mechanical Engineer, Central of New Jersey.

Most roads that use locomotives with piston valves built several years ago have been troubled more or less with cracked cylinder castings. These cracks usually form in the walls of the piston valve chamber and it is very hard to patch them so that they do not leak.

The Central of New Jersey has a large number of piston valve engines and quite a few of these have cracked cylinders. On some classes of engines these cracks run vertically around the valve chamber, and on others they extend longitudinally. Just what causes these cracks has not been determined. One explanation is that the relief valve let cold air into the valve chamber while the engine was drifting. Another reason that may be advanced is that the cylinders may not have their metal distributed properly to take care of shrinkage strains.

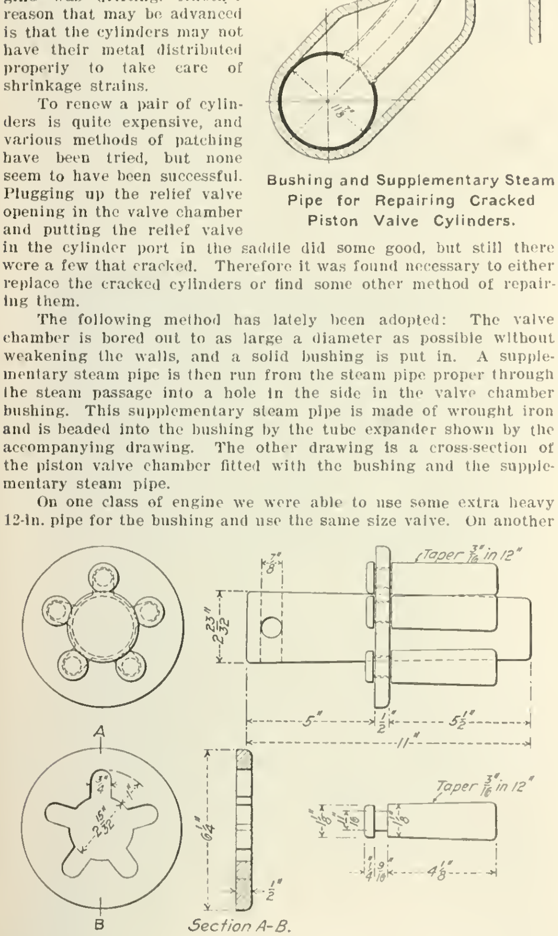


Bushing and Supplementary Steam Pipe for Repairing Cracked Piston Valve Cylinders.

To renew a pair of cylinders is quite expensive, and various methods of patching have been tried, but none seem to have been successful. Plugging up the relief valve opening in the valve chamber and putting the relief valve in the cylinder port in the saddle did some good, but still there were a few that cracked. Therefore it was found necessary to either replace the cracked cylinders or find some other method of repairing them.

The following method has lately been adopted: The valve chamber is bored out to as large a diameter as possible without weakening the walls, and a solid bushing is put in. A supplementary steam pipe is then run from the steam pipe proper through the steam passage into a hole in the side in the valve chamber bushing. This supplementary steam pipe is made of wrought iron and is beaded into the bushing by the tube expander shown by the accompanying drawing. The other drawing is a cross-section of the piston valve chamber fitted with the bushing and the supplementary steam pipe.

On one class of engine we were able to use some extra heavy 12-in. pipe for the bushing and use the same size valve. On another



Tube Expander for Beading Supplementary Steam Pipe Into Bushing.

type, however, a heavy freight engine, it was necessary to put in a new valve 10¼ in. in diameter, while the original valve was 12 in. diameter. It was also necessary to provide another place for the relief valve, so a pipe was tapped into the T head and the relief valve attached to the pipe outside of the smoke box. Because of the reduction of the area in the steam port, due to the use of the pipe, it was thought that, perhaps, the amount of steam passing through would not be sufficient, and so an indicator test was made to determine this.

The test was made on the engine that had the valve reduced to 10¼ in., in comparison with another engine of the same class fitted with the original valve and cylinders without the supplementary steam pipe. The train was made up of all-steel coal cars to insure uniformity of loading. No difference could be noticed in boiler pressure and admission pressure on the two engines with the throttle open. The cards showed that the engine with the smaller valve had a slightly higher back pressure and a slightly more rapid drop along the steam admission line. The coal and water tests showed that with the same weight of train there was almost no difference in their consumption. The heavy freight trains on the Central of New Jersey are not loaded to the maximum hauling capacity of the engine. The train load is that which experience has proven best for getting the greatest tonnage over a division in a given time. On a road where the train load is based on the maximum hauling capacity of the engine, the reduction in area of the steam pipe may necessitate a slight reduction in this train load.

The cost for fitting up a pair of cylinders as above described is about $90; the cost of a new pair of cylinders and the labor of installing them is $700. This method was devised by William McIntosh, Superintendent of Motive Power, assisted by G. L. Van Doren, Superintendent of Shops, and the writer.

Signaling of the East River Tunnels, New York.

Though the signaling arrangements for the recently completed tunnel under the East river between Bowling Green, Manhattan, and Borough Hall, Brooklyn, are on the same general principles as those followed in the New York subway, there are a number of interesting variations from the previous practice. In this as in the previous installation, the distinguishing feature is the use of an alternating track circuit for the operation of the relays by means of which the electro-pneumatic apparatus is controlled, while the rails act as returns for the current. It was shown by experiment before the installation in the New York subway was made that an alternating track circuit could be successfully used with a high-voltage direct-current return-power circuit provided that the return-power circuit was carried through only one rail and that the other rail was insulated at the ends of blocks. This principle controlled on the previous and on the present installation.

This extension of the subway system of Greater New York consists of a double tube under the East river connecting with the Manhattan lines at Bowling Green, beyond which the Manhattan lines terminate in a loop. It runs to Borough Hall in Brooklyn at the present time, though construction work has already been completed as far as Hoyt street, Brooklyn, and the continuance of the line to Atlantic avenue is in progress. The present account, however, deals only with the line between Bowling Green and Borough Hall, a distance of about 8,000 ft. This section is of especial interest, since for the greater part of the distance the tunnel lies under the waters of the East river and has grades much heavier than found in ordinary subways.

The new tunnel line, like the Manhattan subways, is operated by the Interborough Rapid Transit Company, though it is owned by the city.

Eighteen signals are included in this section, of which 14 are in the "tubes"—by which is meant the under-river portion in distinction from that part which is under land only on either side. The tubes are wholly separate and the signaling of each is to a great extent a separate proposition, except so far as current supply is concerned. Alternating current at 550 volts is carried in mains each consisting of two No. 2 wires in each tube, from the sub-station in Brooklyn. These are carried overhead in the tunnels in iron pipe to avoid disturbance by dampness. This voltage is transformed twice, reducing the voltage to 10 or 12 volts, the transformers being fixed on columns in the subway outside of the tubes and on the outer walls in the tubes. At Borough Hall station the cables are carried across overhead to avoid dampness and deterioration from oil. An extra set of alternating current mains is carried through the tubes for use in emergency. Air for the operation of switches and the automatic stops is taken from compressors situated at City Hall, New York, and in the Brooklyn sub-station. It is conveyed from the sub-station to the pipes by two 3-in. mains. These have expansion joints about 1,000 ft. apart. The compressors are of Ingersoll-Rand manufacture. There is also a small compressor under the Borough Hall station for use in case of emergency.

The principal compressors maintain a pressure in the pipes of 75 lbs. to 80 lbs. They are driven by Westinghouse type S-10 direct-connected motors. The compressors are of the straight tandem-compound single-acting type, having a capacity for compressing 240 ft. of atmospheric air at 120 r.p.m. Between the high-pressure and low-pressure cylinders is an intercooler. The cylinders have diameters of 12¼ and 19¼ in. respectively and a stroke of 12 in. Each is provided with an automatic starting and stopping device governed by the pressure, which operates to start at 80 lbs. and to stop at 90 lbs.

From the nature of the location lights only are used for signal indications. The signals differ from those in the New York subway. They are similar in respect to color indications, green being used for clear, yellow for caution and red for stop. In the New York subway the bull's-eye lenses are of clear glass, and in the front of them are placed two four candle-power incandescent lamps so connected that light is maintained in one if the other is out of order. The color indication is given by means of colored glasses mounted in slides which are raised by rods working in air cylinders in the base of the signal box, and lowered by counterweights. In the tunnel installation this arrangement is done away with. No movement takes place within the signal box. There are separate lenses and a separate set of lamps for each color. As the relay is picked up the lights behind the green lens are turned on, and when it is dropped the red or the yellow is displayed according to whether the signal is home or distant.

In the tubes (where there are no columns) the various parts of the signal apparatus are arranged along the right-hand wall in separate boxes, as shown in one of the accompanying illustrations. They are conveniently reached by maintainers from the shelf forming the top of the enclosure containing the conduits and a hand rail is provided at each signal as a measure of safety. The apparatus consists, in addition to the signal box, of a transformer to which current is brought from the alternating current main overhead, a resistance box for preventing the short-circuiting of the alternating current relay, a relay box with impedance coil and a box containing the valves for the operation of the automatic stop. Current for the operation of these is furnished from storage batteries, situated at Bowling Green and Borough Hall stations, which are charged by direct current motor generators furnishing current at 16 volts and taking power from the third rail.

An interesting detail in connection with the signal boxes fixed on the columns outside the tubes is the provision of a solid block of concrete in the form of a step, in place of the usual ladder. This affords an easy foothold and is free from any possible objection in the way of short-circuiting. Along similar lines and as indicating the care which has been taken in working out the details of the installation may be mentioned the use of asbestos wood guards along the third rail opposite the signal apparatus and the enclosing of all track instruments with a covering of the same material. (See Fig. 5.) The utmost care has everywhere been taken to guard against the possibility of fire. At Borough Hall station most of the switches now in use are temporary, being required for terminal purposes for which there will be no occasion when the line is extended further, but on all permanent switches the valves are insulated from pipes and from the third rail.

The automatic stop apparatus is the same as that in use on the Manhattan section of the subway. It consists of a rod extending across under the rails opposite each signal and having an arm or trip on the end next to the third rail. In a cast-iron box between the rails are contained an air cylinder, an electro-pneumatic controlling valve and a counterweight on the end of an arm attached to the rod. When the signal stands to indicate stop the air in the cylinder is cut off by a circuit-breaker connected with the signal.

Fig. 1—Signals and Overlaps, Eastbound Track.

Fig. 2—Signals and Overlaps, Westbound Track.

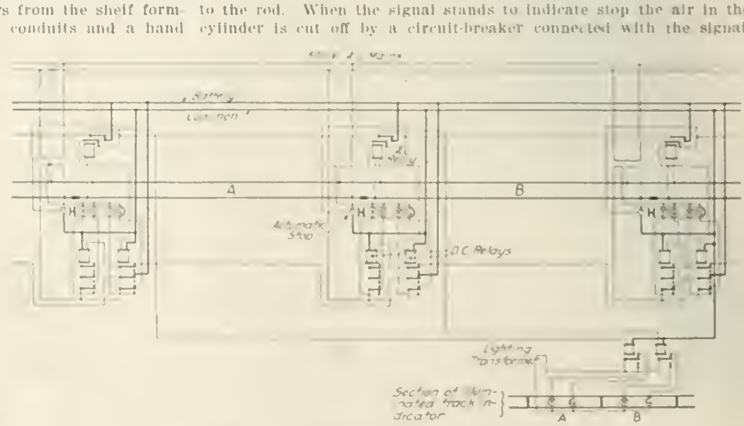


Fig. 3—Typical Block Signal Circuits.

The counter-weight drops and throws the trip arm to an upright position projecting it above the level of the rail. The trucks of all cars are provided with an arm which is connected with a valve in the air-brake train-pipe, and this arm, in case of a train running past a signal set at stop, engages with the trip. The valve in the train-pipe is opened and the brakes are set so as to stop the train before it enters the second block ahead. In order to provide against unnecessary delays to traffic, trainmen are furnished with a socket key by which the air valve may be turned in case of any derangement of the stop.

The location of the signals has been determined by a careful consideration of grades, time-interval and speed of trains. The

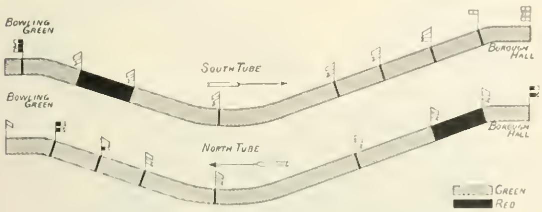


Fig. 4—Sketch of Illuminated Track Indicator.

grade each side from the lowest point is 3.1 per cent., the length of the incline on the Brooklyn side being nearly 50 per cent. greater than on the New York side. Full-block overlaps are provided giving two clear blocks in advance of each train, and they vary in length from 800 ft. to 2,400 ft., as shown upon the accompanying engravings. Circuits are so arranged as to make it possible to run trains in either direction on either track, thus providing for single-track operation in case of emergency or when track work is going on. They are so arranged as to make it impossible to admit trains from opposite directions at the same time. Assuming that the south tube is to be used alone, the operator at Borough Hall, having assured himself of a clear track, gives a signal to the operator at Bowling Green and one train may be admitted to the south tube from the Brooklyn end—a reversal of the traffic; and after it is once admitted the signals admitting to the tube are locked beyond control of the operator at Bowling Green. In case of an accident to the train from Borough Hall, and the fact is communicated to Bowling Green by telephone, the operator at the latter point can tie up the line at Borough Hall so that no other train can be admitted to the tube from the Brooklyn end.

Fig. 5—Fire-Proof Fixtures at Switches.

In the signal cabin at Bowling Green there is an illuminated track indicator, illustrated in the accompanying engravings. Primarily, the indicator consists of a case with a glass front on which are shown representations of the two tubes divided into blocks corresponding in proportionate length to the actual blocks. All of the glass except the representations of the longitudinal sections of the tubes is painted and made opaque. The tube sections normally appear green (clear of trains) and are illuminated by incandescent lamps within the case. A relay at each signal is connected up with the lamps in the indicator circuits in such a manner as to change the color of the space on the indicator representing a block from

Fig. 6—Track Indicator.

Fig. 7—Signal No. 312 and Accessories.

green to red upon the entrance of a train to that block. The position of every train in either or both tubes is thus clearly shown at all times to the operator at Bowling Green. As a further measure of safety a telephone connection is provided at every manhole in each tube by means of which trainmen may communicate with the operating tower. These connections are available about every 100 ft. throughout the length of the tubes.

The lower story of the Bowling Green cabin contains the junction boxes and the relays for operating the illuminated indicator, and in the maintainer's quarters nearby are kept the storage batteries and the motor generator set for operating electro-pneumatic valves, etc. The maintainer's quarters are fitted up with lockers, etc., in the neatest possible manner. The primary motor generators have compound wound motors and shunt wound generators, and are designed for a range of from 400 to 700 volts. The generator at the Borough Hall station is somewhat larger on account of the larger storage batteries. The latter are larger than required but were on hand and therefore were utilized.

The equipment of the sub-station at Brooklyn includes two oil-cooled transformers designed to operate either at 25 cycles for the third rail rotary transformers or at 60 cycles for the light circuit.

Electric detection is used on switches in place of detector bars.

All cables are of Okonite or of Standard make. As in the case of the Manhattan subway, the apparatus throughout was furnished by the Union Switch & Signal Company and is largely from designs of its engineers. The installation was in charge of J. M. Waldron, Signal Engineer of the Interborough Rapid Transit Company.

Boring Multiple Cylinders.

BY E. J. M'KERNAN,

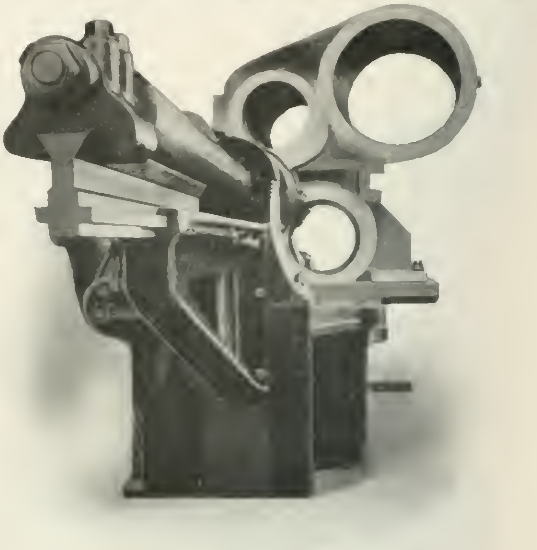
Tool Expert; Atchison, Topeka & Santa Fe.

The usual locomotive cylinder boring machine consists of a horizontal spindle and table permitting of no adjustment at all or of only lateral adjustment. With these machines of the old design much time is consumed in properly setting the cylinder so that the boring bar will strike the true center; and high speeds and rapid cutting are not obtained. These disadvantages are, of course, magnified when cylinder castings having two or more cylindrical chambers are to be bored and faced, because the work has to be set twice, and the cylinders and valve chambers (where piston valves are used) must be truly parallel with each other. If the cylinders should be out of parallel the working of the engine will throw great strain upon the guides, with consequent detrimental effect on the locomotive machinery, causing undue wear, strain and trouble.

The machine of the old single bar type, designed when simple slide valve cylinders of not more than 18 in. or 20 in. diameter were the prevailing type on locomotives, were adapted for use with the slow speed carbon steel which was the most efficient material for making cutting tools at that time. The mechanism of these old machines was simple, but the driving and feed gears were weak cast-iron affairs which drove the tool along at an unprofitably slow speed. Later as the art of cutting materials was on a more scientific basis, and tool steels of greater cutting capacity and speed were introduced in shop practice, attempts to work these new cutting tools to their proper limits in boring machines of this class would result in stripping the gears or other injury to the machine.

With the latter developments in high-speed cutting tools of great capacity, and in locomotive construction, with engines having piston valves and often compound cylinders on the Vauclain principle or on the four cylinder balanced compound principle, a machine capable of the most effective service under the latter conditions becomes a shop necessity. In order to meet this demand, one manufacturer produced a three-spindle machine which would require but one setting of the work and which would insure the parallel boring of all cylinders and chambers. While this type of machine possesses a number of advantages for certain classes of work, the single bar machine has been found superior for general railroad practice. A comparison of the two types of machines shows that the single bar has less gearing and is the simpler machine of the two and is consequently much easier maintained. On account of the lesser number of parts, the single bar machine is the more economical to drive, hence the power required can be obtained from a small motor. Where there are some advantages in boring three chambers at once it has been found in practice that chatter in one tool is transmitted to the other tools, causing a rough finish in all bores. It is apparent that this is entirely obviated in the single bar machine. From experience in the ordinary railroad shop it has been found that the single bar machine is best suited to locomotive work. It is economical in operation, in power consumed and in adjustments and owing to the fact that less machinery is involved the single bar machine is the most economical to buy.

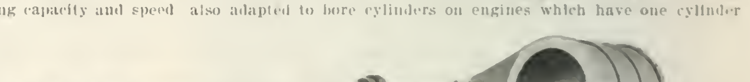
There have recently been built several heavy and solid single bar machines, with the boring bars capable of the heaviest strains, and of such a design as to insure working the cutting tools to the very highest capacity. The accurate setting of the work, especially in connection with multiple cylinders, is brought about by the application of a table having both lateral and vertical motion, and these



Boring Non-Parallel Cylinder Chambers.

machines produce very excellent work. But the examples thus far constructed are heavy, ponderous affairs, costing a great deal for the weight of metal in them alone, and they do not have the universally wide range for accommodating all classes of locomotive cylinder boring that should be a requisite in modern machines for this purpose. Their first cost is high, and the best results are not always obtained from them, not to speak of the relative large amount of shop room required.

At the Topeka shops of the Santa Fe there has been built a cylinder boring mill which will answer all requirements in boring cylinders for all classes of compound engines. This machine is also adapted to bore cylinders on engines which have one cylinder or chamber at an angle to the others. All cylinders or chambers may be bored at one clamping of the cylinder, by merely raising or lowering the table. This table has an elevating movement of 37 in. and a cross travel of 35 in. The table, which has the cross travel movement, has also a swiveling motion by which a range of 15 deg. incline may be had. (Fig. 1.)



Single Bar Cylinder Boring Machine.

This new boring mill is direct motor driven. The table is raised or lowered by power connection with the main motor through beveled gears and clutches, handled from the operator's side of the machine. All the mechanism is of the latest design and is strong and durable, all gears being made from good gray iron, all bushings of phosphor bronze; the boring bar is 7 in. in diameter and is made from open hearth steel, and is fed through the cylinder by means of a spur gear and rack which makes it very rigid in operation and gives a very smooth bore.

One of the facing heads on the machine is made so that it will move along on the bar and is driven by means of a 1-in. key and set screw, and will pull any kind of a cut that is put on the machine.

The facing heads are fed by means of a star feed attachment. The screws that elevate the table are made from soft steel and are 5½ in. in diameter and are three-quarters pitch, the screws set at right angles to the boring bar, making everything rigid. The total weight is about 15 tons, and the machine takes up floor space of 223 sq. ft., having an extreme length of 21 ft. and an overall range in width of 14 ft.

This machine is capable of boring a three chamber compound cylinder in 15 hours, or in a year of 3,000 working hours it can bore 200 three chamber compound cylinders. It can also bore a simple cylinder in three hours, or 1,000 in a year of 3,000 working hours.

On the old style boring mill it has taken from 26 to 28 hours to bore a three chamber compound cylinder. It will be noted that by the use of a modern boring mill of this kind 11 hours can be saved on each three chamber compound cylinder, where it used to take from eight to ten hours to bore a simple cylinder. One of these cylinders can now be bored in three hours on this machine, thus making a saving of five hours on each simple cylinder bored, or over $1,500 per year in operator's wages alone, in addition to increasing the machine capacity from only 375 cylinders per year to 1,000 simple cylinders, giving an output of 625 more cylinders per year. Where only 115 three chamber compound cylinders could be handled with the old style boring mill the new machine will bore 200 cylinders, thus increasing the output of compound cylinders about 77 per cent.

If a machine which bores only one chamber of a locomotive cylinder casting at one time is to compete successfully with one which can bore three chambers simultaneously it must not only bore rapidly, but it must be so made that only one setting will be required to bring the chambers into position to bore. This arrangement has been attained in the machine described, and after a cylinder has been lined up and clamped on the table any of the chambers may be brought exactly into position for boring, making it impossible to bore two chambers out of parallel unless desired.

A machine of this design has been in operation for some time at the Topeka shops, and is giving first class satisfaction, both in its convenience in handling, and in the lower production cost. It is understood that arrangements have been made for the Tool & Railway Specialty Manufacturing Company of Atchison, Kansas, to handle machines of this type on the market.

Eight Years of Development of the Illinois Central and the Chicago & Alton, as Compared by Stuyvesant Fish.

Stuyvesant Fish, ex-President of the Illinois Central, has given out a statistical comparison between the eight years' development ended June 30, 1906, of the Illinois Central under his management and the development during the same period of the Chicago & Alton under the more or less direct management of E. H. Harriman. Comparisons between different railroads, especially between two railroads so different as the Illinois Central and the Chicago & Alton, can seldom be made with exact accuracy. Without attempting to examine into the qualifying circumstances of each case, we present below some of the most striking comparisons, showing in percentages alone the increase or decrease of the figures for the year ended June 30, 1906, over those for the year ended June 30, 1898:

Increases in Per Cent. 1906 *over* 1898.

	Illinois Central.		Chic. & Alton.	
Gross earnings	89.03	per cent.	84.30	per cent.
Net earnings, taxes deducted	75.46	"	41.22	"
Fixed charges	16.64	"	154.02	"
Available for dividends	147.51	"	*37.08	"
Disbursed for permanent improvements, etc.	141.23	"	*96.83	"
Capital stock	81.03	"	79.31	"
Amount dividends paid on capital stock	153.44	"	*47.63	"
Funded debt, including leased line stock guar.	18.89	"	771.21	"
Funded debt, etc., per mile	1.45	"	658.01	"
Capital stock and funded debt:				
Total capitalization	36.74	"	260.63	"
Per mile	16.68	"	214.04	"
Fixed charges, incldg. interest, etc., per mile	*0.52	"	121.00	"
Ratio, fixed charges to net income, change	*31.12	"	84.41	"
Net income per mile.†	111.27	"	*45.23	"

*Decrease.

†Net earnings and other income less fixed charges, including interest, rents, and sinking funds.

Expenditures from income for permanent improvements, etc.:

Year.	Ill. Central.	Chicago & Alton.	Year.	Ill. Central.	Chicago & Alton.
1898	$1,726,452	$262,309	1904	$3,115,948	$205,809
1899	1,475,040	....	1905	3,439,282	41,914
1900	2,416,674	....	1906	4,161,739	8,318
1901	3,145,400	....			
1902	4,994,502	....	Total	$29,459,290	$518,350
1903	4,981,253	....			

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

VIII.

THE RAILROAD STEAMSHIP LINE.

On the Pacific Coast of the United States and in Europe.

The Pacific coast of the United States and Canada is the terminus of great transcontinental railroads, and also of long trans-Pacific ocean lines. Furthermore, the population of Pacific sea ports is comparatively small, the local traffic is light, and the consequent mutual dependence between the railroads and the steamships is strong. There results here a more complete and extensive alliance between railroads and steamship lines than in any other section of the globe. Every transcontinental line has its secure arrangements, and several of them own steamship lines plying to all important countries of East Asia.

The alliance began soon after the first transcontinental road reached San Francisco in 1869. At that time the Pacific Mail Steamship Company had a line to China and Japan, to Australia, to Vancouver, local lines on the United States Pacific coast, and reached New York via Panama, where it connected through its contract arrangements with the Panama Railroad & Steamship Company. This was a well organized and strong system. The company had long exercised the independence that arises from monopoly, and the Pacific Railroad Company soon became dissatisfied with the freight supply in which the steamship company did entirely as best suited its own arrangements and its eastern service. In 1874 the railroad objections took the form of a California Company formed by the Union & Central Pacific Railroad Companies. This company, called the Occidental & Oriental Steamship Company, chartered four White Star steamers, and established an Oriental service. In the rate war that followed, rates went down to almost nothing, but the railroad made the quicker connections with New York. This competition, making loss to both parties, resulted in a working agreement between the rivals, which came near to being a real consolidation of shipping interests. The ships of the two companies alternated in dates of sailing, they had the same rates, rules and conditions of service; they had joint agents to solicit freight, and the agents were not permitted to make any discrimination whatever between the two companies on pain of discharge. There were two companies to watch the workings of this plan and protect their own interests.

This friendly competition went on for nearly 20 years, when the Southern Pacific bought a controlling interest in the Pacific Mail Steamship Company, but it did not in any way alter its service or apparent relations to the partner steamship company. In 1897 a group of Japanese capitalists backed by $6,000,000 and government influence and subsidy concluded to go into the shipping business. They formed the company known as the Toyo Kisen Kaisha and toured the Pacific coast of the United States for a suitable terminus. The Southern Pacific interests, foreseeing a destructive rate war, admitted them to a place at once in the San Francisco service, and this third company joined the others on the terms identical with those established at the close of the rate war in the '70s, when the two companies first agreed on the conduct of this service.

Encouraged by this result, some Chinese merchants in Hong Kong formed the China Commercial Company shortly after this, chartered four steamers and started to carry passengers to Manzanillo, Mexico, and to compete at San Francisco with the combined lines. These new comers were not received on terms of equality, but were beaten off the Pacific after six months of furious rate cutting.

The Atchison, Topeka & Santa Fe Railroad for several years after 1898 maintained a line to the Orient from San Diego, but the local trade was not satisfactory, and the relations of this railroad company with the Southern Pacific were so intimate that the San Diego service was discontinued in 1901, and in its place the company used the San Francisco lines maintained by the Southern Pacific interests. Portland, Ore., has the Portland & Asiatic Steamship Company rendering a service, almost exclusively freight, in connection with the Oregon Short Line and the Harriman roads. The steamers are chartered from the Hamburg-American Company.

Puget Sound and the Hill roads are served by a variety of Pacific carriers. The Great Northern has the Great Northern Steamship Company, which ran the splendid new steamers, the "Minnesota" and "Dakota" until the "Dakota" was wrecked in 1907. They operated alternately after the San Francisco manner with the vessels of the Japanese Nippon Yusen Kaisha and extended their services to Manila. The Northern Pacific once had a Northern Pacific Steamship Company operating with chartered steamers, but it now has a traffic agreement with the Boston Steamship Company, which operates a line of steamers to the Orient. The Boston Company seems to have a preferred claim. Such resione of traffic as it cannot handle is provided for by outside contract.

The Hill interests are also engaged in the coasting trade of the Pacific. In 1901 the Pacific Coast Steamship Company, a company subsidiary to the Great Northern, took over the ships and good will of the Alaska Steamship Company, and it also operates a line from Seattle, Tacoma and Victoria to San Francisco, and to Guaymas and Mazatlan in Mexico, also minor lines on the California coast. The wide reach north, south and west of these distributaries and feeders gives the Hill roads a strong hold on Pacific commerce.

The population of regions adjacent to the Pacific is scanty and the new railroads at present under construction towards that coast will find the local traffic of ports aside from that produced by themselves to be so small that it has now apparently become the custom to prepare for the steamship line at the same time the railroad is decided upon. Some years hence the Grand Trunk Pacific Railway will reach the Pacific coast. Its first plan was to go to the now unused harbor of Port Simpson near the south point of Alaska. In 1904 the company announced that a contract had been made with the Allan Line (Steamship Company) for a trans-Pacific service from this port similar to their trans-Atlantic service now in operation in connection with that railroad. This will require a new fleet of steamers. New railroads to the Pacific ports of Mexico are also making contracts for steamer service for lines yet unbuilt.

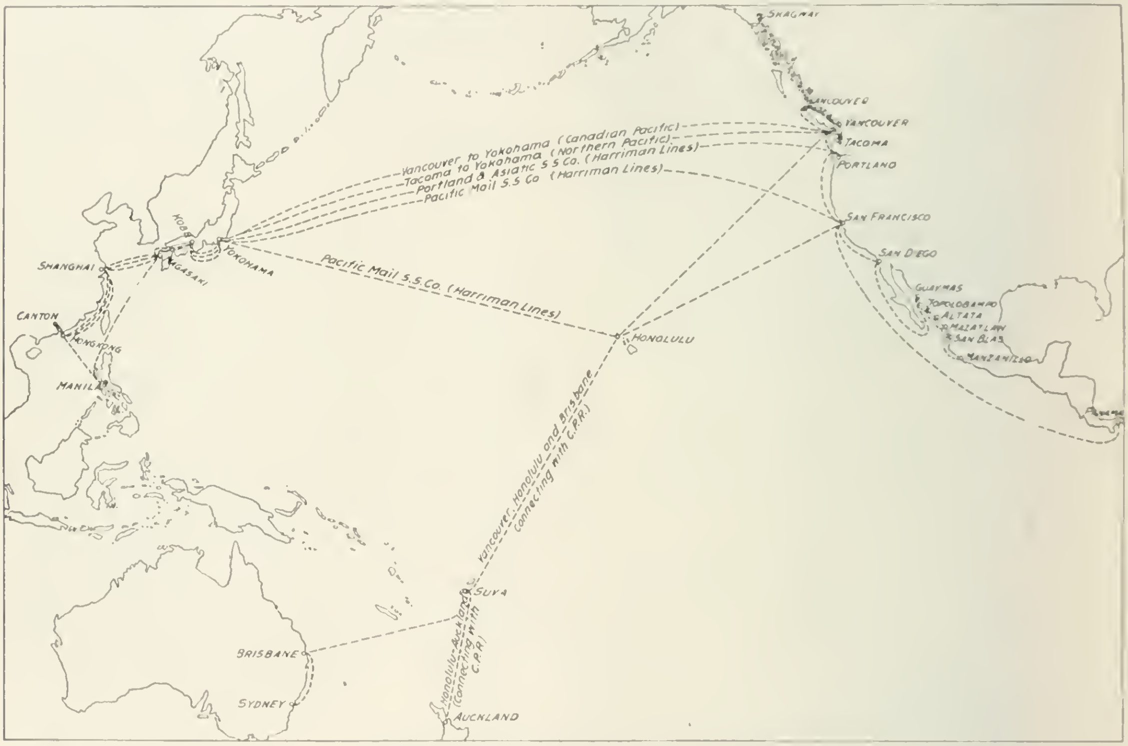
The Hamburg-American Steamship Company has entered into a contract with the Kansas City, Mexico & Orient road to run a line of steamers from Topolobampo across the Pacific as soon as the Orient road is completed. In 1906 the Orient Company already had a steamer in service from Topolobampo running north to Guaymas and south to San Blas. It has also a sailing vessel service from Topolobampo, which was being extended to San Diego in southern California.

The Canadian Pacific may be presented as the railroad with the most widely organized water transportation auxiliaries to be found upon the surface of the globe. In 1891 the establishment of its Hong Kong line set a new mark in transportation annals for then one company had a road clear across the American continent and steamers extending it to the limits of the China coast. In 1898 two steamers were also operated to Vladivostok.* In the company's report for the year ending June 30, 1907, the following fleet is reported:

Canadian Pacific Steamships.

Atlantic service	16
Pacific Coast service	11
British Columbia Lake and River service	17
Pacific service	6
Upper Lake service (Great Lakes)	3
Ferry service	2
Total all classes	55

That is to say, a transcontinental railroad operated two transoceanic services, connecting East Canada with Europe, and West Canada with Japan, China and Hong Kong. Lakes and rivers are used as feeders, and there were at one time rumors of proposed connections with the Trans-Siberian Railroad, and with the Yukon river through purchase of the White Pass & Yukon Railroad and a line of Alaska steamers. The steamship lines of this railroad company are not operated on working agreements, but are run by companies frankly owned by the railroad company. It also charters steamers which it operates on a line to New Zealand on alternate sailings with the Union Steamship Company of New Zealand.



Principal Railroad Steamship Lines on the Pacific.

THE THEORY OF THE RAILROAD STEAMSHIP LINE.

In this widespread combination of the railroad and the steamship line, the railroad is the dominant factor, the steamship is but a railroad attachment. When one stops to consider the capital involved, it appears natural that it should be so. Great Britain is properly hailed as the mistress of the seas, the world's great ocean carrier, and yet her merchant marine has a value not exceeding one-seventh part of the capital value of the British railroads* and a much smaller part of the value of the American railroads. The amount of money involved affects the order of development of transportation more than it reflects the value of the commerce. This is because the railroad is primarily a costly road, the ship but a vehicle using the highways of Providence.

That sea investments of railroad companies are but props to the railroads is clearly brought out in the annual report of the Canadian Pacific Railway for 1904. After giving a list of shipping amounting to nearly 150,000 tons,† the report states

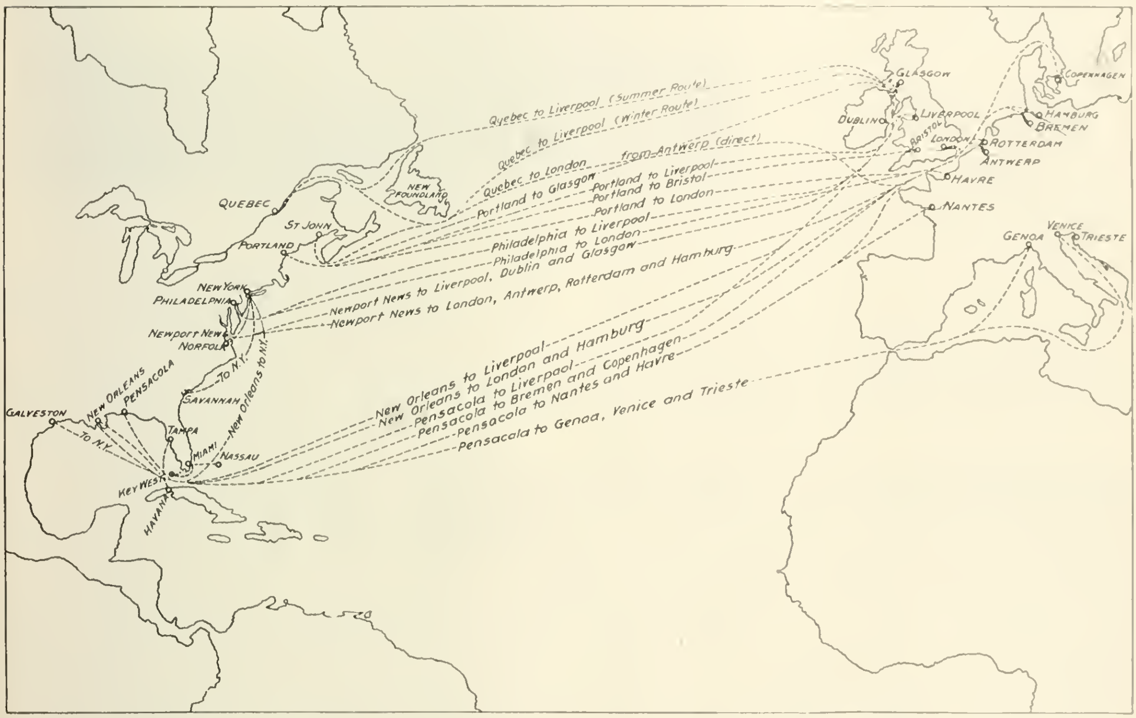
*Social Economist, 6: 283; Scribner's 10: 280; *Railroad Gazette*, Aug. 15, 1898, p. 615.

*The paid-up capital of British railroads at the end of 1906, was £1,283 million. The total British tonnage was 17,611,096. New freighters can be launched at from £10 per ton. Granting this rate of valuation (and it is too high) the value of the fleet is less than £180,000,000.

†An amount several times as great as that employed in the European commerce of the British Colonies two centuries ago, and it is also about six times as efficient per ton.

that the Atlantic steamer service shows no net revenue, due to demoralizing conditions, "nevertheless the steamship line has, as anticipated, proved a valuable auxiliary of the railroad." The report to the stockholders then proposed more new ships. The inevitable conclusion from the above seems to be that the railroad company can sometimes afford to lose money on a steamship line which serves as a freight collector or distributor for the railroad line.

British opinion also bears out this conclusion. The privilege for a railroad company to run steamers must be secured by special grant from Parliament, and such grants are bitterly opposed by shipping interests, because of the fear that the private vessel owner might be driven from the business, through the railroad steamers making rates that would be ruinous to a competing company that was an ocean carrier only. In the words of an editorial in *Fairplay*:* "It is well known that these steamers (belonging to the railroad companies) generally run at a loss, but the accounts of the steamers are merged in the general accounts of the companies and the steamers are supposed to make up as feeders for the lines what money is lost on their own making." Three years later an editorial in *Lloyd's Gazette*† stated that there seemed to be an attempt to make them more profitable. But this can scarcely be general.



Routes of Principal Steamship Lines Run Primarily in Railroad Service on the Atlantic.

A recent British government report (Dept. Paper 210 Foreign Merchant Shipping, London, 1905), discussing the fact that the Great Central Railway Co. runs steamers from Grimsby to Hamburg and carries emigrants pursuant to all the expensive regulations of the German law, says that this practice "is rendered profitable solely owing to the fact that this company is able to carry the emigrants through England on its own railroad lines to the port of embarkation for their trans-Atlantic destinations."

The building of terminal facilities is a necessary part of the connection between railroads and ships. It might apparently be undertaken by either of these carriers, it being the essential to one as to the other, but as a matter of fact the dock is usually built by the railroad because of the fixed location of the land carrier. The freedom of the seas gives the ship the opportunity to go to the best port that is already prepared, so it devolves upon the land end of the investment to provide the port and the harbor. Hence we find the state, the municipality and the railroad furnishing the necessary funds to provide the unloading facilities for the carriers by sea. The shipping company sticks to its element.

British harbors are usually enclosed stone docks—yet with so costly a type of construction several British railroad companies have built docks, thereby practically making harbors to which ships are glad to come. The railroads in question have in effect done for themselves the same thing that American roads have done when they contracted with foreign lines.

BRITISH RAILROAD STEAMSHIP LINES.

The distribution of British railroad steamship lines responds to the same laws as prevail in America. They are more common in the small ports than in the great ports. Harwich, Dover, Brighton, Southampton, Hull, Goole, etc., lack the traffic temptations to induce the establishment by ship owners of the complete and varied connections desired by railroads. They needed them and made them themselves. It was a very easy step for the British roads to operate steamers because the short sea journey to the continent bore about the same relation to railroad activity that our lake carriage does to our railroads. It has a local rather than an oceanic quality. The lively trade with the continent continues with a small type of vessel because of the frequent voyages required by the perishable nature of the traffic, and the large number of passengers carried. These continental connections almost resemble ferries in the frequency of the service. From Hull on the east coast to Southampton on the south coast and at many intervening ports steamers pass each day to and from the continent. This daily service includes Hamburg on the east and Havre on the west and where the sea is narrowest there are at times several railroad steamer connections daily, as at Dover and Brighton.

The small type of vessels required combines with British thoroughness to make ownership the prevailing practice rather than the traffic agreement, which is common in the trans-Atlantic steamship services of American railroads. The sea connection of British railroads with termini on the Humber estuary affords an interesting example of the British methods. The North Eastern Railway Company with a port at Hull, and the Lancashire & Yorkshire, having its port at Goole, have duplicate privileges from Parliament to own and run steamers to the following 17 ports: Copenhagen, Antwerp Ghent, Dunkirk, Hamburg, Rotterdam, Bruges, Amsterdam, Delfzyl, Flushing, Hulst, Harlingen, Stettin, Lubeck, Danzig, Stockholm and Warhus. This grant guarantees the railroads in such connections as they may care to establish, it is not necessarily for immediate use.

The North Eastern Railway actually runs no steamers in its own name. It controls majority stock in a company running a line to Amsterdam, Rotterdam and Harlingen, and has an agree-

*See September, 1901, p. 482.
†Weekly, Sept. 16, 1904.

ment with Thos. Wilson Sons & Company, Ltd., ship owners of Hull, to work in unison with them to the remaining ports.

The Lancashire & Yorkshire Railway runs steamers to the first nine of the 17 ports named in the Parliamentary grant.

The Great Central Railway, having terminus at Grimsby, also on the Humber, has a Parliamentary grant to own and run steamers to eight ports as follows: Antwerp, Hamburg, Rotterdam, Gothenburg, Malmo, Landscrona, Ellsingberg and Halmstadt. The company runs steamers to the first three and had an understanding with Thos. Wilson & Company not to run lines to the other five ports so long as Wilsons kept a regular service.

The traffic with Ireland partakes of all the economic characteristics of that with the continent, and is chiefly carried on by the railroad steamship lines. There were announced for 1906 twelve of these lines connecting Great Britain with Ireland. Nearly all of them (two only are for Liverpool) run from small and often unnoticed ports where the five railroads have been able to reach the sea. From Liverpool and Glasgow there are lines of independent steamers.

The maturity of British industries gives less prospect than in America for probable extension of this form of organization in transportation.

Thus far the British railroads have not ventured on trans-oceanic steamship connections, nor is it likely that they will find it necessary to do so. If it should be the case it will occur through the growth of some of the small ports, which are now lacking in connections, and probably in harbor facilities, but the large British ports are so well supplied with steamer connections, and cover the needs of a small country so adequately, that we may not expect much change in the near future.

Steamer Scotia, 21½ Knots; Holyhead-Dublin Service, London & North-Western.

EXPERIENCE IN OTHER FOREIGN COUNTRIES.

The managers of the newer railroads of Europe and Asia seem to be as generally convinced of the necessity of developing steamer connections as do those in America. The Anatolian Railroad Company loaned $600,000 to a steamship company to enable it to give better service in the Aegean sea. In 1901 the Chinese Eastern Railroad (Trans-Siberian) had 11 steamers at its disposal and was increasing them; in 1902 the railroad had six separate steamer lines running from Vladivostok, some of them running as far as the sea of Okhotsk, but Japanese competition made this service rather unsatisfactory—and it has since done worse things.

The Empress of Ireland; Atlantic Service, Canadian Pacific Railway.

The Roumanian State Railroads have been operating steamers from the Danube for a decade, and for a part of the time the line reached points as remote as Egypt and Antwerp.

The railroads of an undeveloped country like Russia are in a position akin to those of the United States. Gulf ports and steamship contracts are the rule. Since 1873 there has been a traffic association attending to this matter in the Baltic and usually making new arrangements each season upon the opening of navigation. This association ("Northern Oversea International Traffic") regulates arrangements and even goes so far as to deny to some lines permission to run steamers where they wish. In 1901 the contracts thus arranged by the Moscow Windau Rybinsky Railroad Company provided for service by four steamship companies from Windau to 10 ports distributed between Dundee, Dunkirk and Copenhagen. Arrangement was also made for service to the Rhine and for French and Spanish trans-shipments at Dunkirk.

In the management of state railroads in monarchial Europe we see the bureaucracy doing by rate control exactly the reverse of the common practice of American and English companies. The Anglo-Saxon Company runs a steamship line for the benefit of the railroad. The governments of Germany and Hungary, dominated by different and national motives and endowed with strong control arising from national power, use the railroads to favor and make profits for the pet national steamship line or lines, to which the railroad is made subservient. It is a part of the German export subsidy policy to give in some cases much lower railroad rates for export goods than for domestic traffic. This is a policy, however, which must be supported by taxation rather than industry. It is political rather than economic. In Hungary, the state has a railroad line to Fiume, and a subsidized line of steamers in the Adriatic. The Austrian government, using the port of Trieste, has the same. Four years ago competition arose and the Austrian steamers were cutting in on the trade of the Hungarian steamers at Fiume. The Hungarian government stopped this by arranging its railroad tariff, giving preferential rates on goods going out by the Hungarian steamers.

(To be continued.)

Foreign Railroad Notes.

A Berlin association of merchants which we may, perhaps, compare with the New York Chamber of Commerce, takes three standards for estimating the economic situation in Germany: Railroad earnings, number of workmen employed, and reports of the Imperial Bank. Now in 1907 (11 months) passenger earnings were 3 per cent. and freight earnings 6.4 per cent. larger than in 1906; against increases of 8 per cent. and 11.8 per cent. from 1905 to 1906. In the last half of 1907 fewer men were employed than one year before; and the average rate of discount of the Imperial Bank, which had been 4.99 per cent. in 1906, was 6.03 per cent. in 1907.

The Prussian State Railroad estimates for the fiscal year beginning with April next ask for 240,200 kilometric tons of rails, 105,800 of joint fastenings, spikes, etc., and 141,600 of ties and switches, the whole to cost about $18,000,000. The fuel requirements will be 8,815,900 tons of coal, 1,294,900 of coke, and 111,600 of lignite, to cost $31,700,000.

GENERAL NEWS SECTION

NOTES.

Figures have just been compiled by the Long Island Railroad showing that the company carried 23,950,547 passengers during 1907 on its trains. No passenger has been killed on the company's trains in 15 years.

The railroads of Mexico, particularly those connected with the government system, report heavy passenger and freight traffic. There is a considerable blockade at Vera Cruz of freight awaiting shipment to interior points.

The Iowa Railroad Commission has informed the express companies that they must comply with the long-and-short-haul provision of the Iowa railroad laws which have hitherto been applied only to freight and passenger rates.

An officer of the Erie is quoted as saying that the company will stand firm on its determination not to do away with piece work. The machinists of the road have bitterly opposed the piece work plan ever since its inception in the company's shops.

It is understood that the state of Sinaloa has voted a subsidy of $1,000 for every kilometer of road which the Kansas City, Mexico & Orient builds through that state on its way to Topolobampo. The company also has large bonuses from the state of Chihuahua.

Employees of railroads in the state of Mississippi are said to be preparing a large and impressive petition to the legislature opposing the proposal that a 2-cent law should be enacted. The employees see a connection between reduced fares and reduced wages.

The Ohio legislature has before it a bill to prevent the inspection of railroad men's watches by private individuals and to place the inspectors under the supervision and direction of the state. The bill requires watches to conform to certain standards but avoids reference to any specific makes.

The Midland Valley has this week been authorized by the State Corporation Commission of Oklahoma to charge 3 cents a mile for passengers. The state constitution makes a general rate throughout the state of 2 cents a mile, but allows the Corporation Commission some latitude. Other exceptions to the 2-cent rate were noted last week.

The County Attorney of Platte county, Neb., is about to bring criminal action against the Union Pacific under the new Nebraska anti-pass law. The company, through its attorney, has sent a letter to the railroad commission stating that it has given transportation to surgeons in accordance with continuing contracts made before the anti-pass law was enacted.

The Pennsylvania has collected data showing that 43 of its 85 principal officers are graduates of American colleges. The average age of these officers is 51 years and the average length of service with the Pennsylvania is 26 years. Sixty-seven of the 85 started their work for the company as beginners and, with a few exceptions, have been with the company ever since.

The Railroad Commission of Ohio decided on Feb. 17 that Ohio railroads are permitted, but not compelled, to issue excursion, commutation, mileage, and party-rate tickets; therefore, it is not in itself unreasonable and unjust discrimination for a railroad voluntarily to establish commutation rates between certain stations and to fail and refuse to establish like rates between all other stations on its lines.

Conferences have been held in New York during the past week on the proposal of the trunk lines to increase materially the terminal charge for split delivery of carload goods. A statement of the matter has been forwarded to the Interstate Commerce Commission by a special committee of the New York Produce Exchange, although it is not generally considered that the commission has jurisdiction in this case.

W. W. Finley, President of the Southern Railway, has openly challenged an examination of the circumstances which have led his company to contemplate a reduction of wages in the operating departments of his system. Mr. Finley, in effect, asks the Commissioner of Labor and the Chairman of the Interstate Commerce Commission to bring out all the facts, as a demonstration that his road is entitled to practise economy.

The Southern Pacific, through its counsel and special engineer, appeared before the United States Committee on Claims at Washington, February 24, advocating a favorable report upon the bill appropriating $1,600,000 to reimburse the company for its expenditures in reclaiming territory in southern California from the Colorado river floods of 1906. The committee has referred the bill to the Secretary of the Interior for a report from the government reclamation service.

The New York, New Haven & Hartford has given notice to the Interstate Commerce Commission that it will continue until May 1 the traffic arrangements with the Central Railroad of New Jersey, the Philadelphia & Reading, and the Baltimore & Ohio, for interchanging traffic via New York harbor. In December the New Haven gave notice that the arrangements with these roads would be canceled, but after a hearing by the Commission extended them to March 31. They are now to be extended further.

Governor Haskell, of Oklahoma, has ordered the Attorney-General of the state to institute proceedings to dissolve an alleged merger between the Chicago, Rock Island & Pacific and the St. Louis & San Francisco in Oklahoma. The Governor's order says that the interests of the two roads are pooled and are under the same management and that they are (meaning perhaps that they should be) in every sense competitive lines. The order demands a complete dissolution of the alleged combination and the perpetual maintenance of the two systems as distinct and separate roads.

In the controversy between the New York Central and John H. O'Brien, Commissioner of Water Supply, Gas and Electricity, with regard to the requests by the commissioner that the Public Service Commission require the railroad company to remove its overhead high tension transmission pole line and conductors along its right of way from a point north of Macomb's Dam bridge along the Harlem river, Harlem ship canal and the Hudson river to the city line, the railroad has filed a denial of the jurisdiction of Commissioner O'Brien and the Public Service Commission in the case at issue.

The Supreme Court, on February 24, gave the first decision in a series of cases attacking the validity of the Elkins anti-rebate law on the ground that this law was repealed by the Hepburn law. The case at issue was concerned with the appeal of the Great Northern from a $15,000 fine for granting a concession of 20 cents per 100 lbs. on 15 different shipments of oats from Minneapolis to Seattle in 1905, prior to the passage of the Hepburn law, so that the indictments, although returned after the passage of the law, were under the Elkins law. The court held that the anti-rebate provisions of the Elkins law were not repealed.

The annual report of the Insurance Department of the Pennsylvania Railroad shows that the company's employees extinguished 195 fires in 1907. These occurred in property valued at $7,500,000, yet the loss from them amounted to only $16,000. Fifty-one of the fires in Pennsylvania Railroad property during last year were caused by adjacent burning property. A loss of about $3,000 followed explosions of benzine, naphtha and lamps. Lighted cigars and cigarettes and matches cost the Pennsylvania over $49,000 in fires. Fires following wrecks caused a loss of about $43,000. Spontaneous combustion was responsible for a loss of $6,498.

The Rights of Capital.

The Canadian Board of Investigation, a body created to assist in adjusting difficulties between labor and capital, has given an opinion on the occasion of a demand by Grand Trunk telegraph operators for increased pay based on the increase which has been granted operators on the Canadian Pacific. The board held as follows:

"There are many considerations entering into this question. In our view there is the right of the man to receive a living wage and that right is paramount. The workman is entitled to get a fair day's wage for a fair day's work. What, however, often seems to be ignored is that capital and labor are both necessary in order to produce a profit.

"The object of the laborer should be to secure a fair share of this profit. But there is also to be considered the position of the man who advances the money to enable the undertaking to be carried on which gives employment. He, too, is required to receive a return for his money and his risk. A hundred millions of the capital stock of the Grand Trunk Road receives no dividends whatever. If such dividends on the preferred stock as are now being paid are still further reduced by the wage bill being increased, what must necessarily follow? The company cannot obtain further money for expansion, for it can be more remuneratively employed in other undertakings.

"This certainly would be a disadvantage to the vast number who find employment on the railroads. Then there are the constant demands of the public for the betterment of the service and equipment, for the increase of facilities and the bettering of the roadbed and general improvement in the accommodations. These can only be obtained where the parties asked to advance the money can see some possibility of return for the advance.

"Our experience has led us to the conclusion that there seems to be an oversight on the part of the public of two things. First, that there is a continual demand for an increase of expenditure on the part of the company for facilities, and second, a continual demand for the reduction of the tariffs which furnish the moneys necessary to provide these facilities and accommodations.

"The growth of earnings is not keeping pace proportionately with the growth of expenses. If operating expenses and wages must be increased from time to time and the public so demands, very serious consideration must be given to the proposals for the reductions of freight and passenger rates, inasmuch as every reduction directly affects the ability of the railroads to pay the wages asked by their employees.

"There is no doubt that the cost of living has greatly increased, and that the employees of a railroad company are entitled to be better compensated to meet such increased cost, but surely they are not entitled to be compensated at the sole expense of people who have invested their money and who would in return be deprived of their means of livelihood. The public should bear their share. The railroad employee spends his money for the benefit of every other member of the community, from farmer to manufacturer, and if the employee has to obtain more money to meet his increased cost of living, other classes of the community who receive the benefit of the money he spends should contribute their share toward enabling him to get the money he has to spend."

More Investigations.

"I see by Bradstreet's and Dun's reports that buyers in the dry goods trade are placing very small orders. You will look into this, and ascertain whether it is due to the state of trade or to past financial transactions of theirs.

"I am informed that large wholesale houses in Chicago and New York have cut prices on certain classes of goods as much as 20 per cent. You will inquire about this, and discover whether it is alleged that legislation, state or national, has been the cause. Of course lower prices would lead to great disorder at the bargain counters, which it would be my first duty to put down.

"I learn that the quotations of stocks have been low and business on the Exchange dull. You will investigate and report to me whether it is true that the sales of stocks have been so small that the revenues from stamp taxes have fallen off in a way to embarrass the treasury of New York, and that many worthy brokers have been brought to the verge of want. I desire that stocks be at once advanced in price."—*New York Evening Post.*

The World's Iron Production.

It is estimated that the production of pig iron in the world in 1907 was about 61,000,000 tons, as compared with 59,000,000 tons in the preceding year. Had it not been for the depression in the last quarter the increase would have been much greater. Of the total, the United States contributed about 42.3 per cent., Great Britain 17 per cent., and Germany 21.4 per cent.

The following table shows the world's production for a series of years.

Year	Tons	Year	Tons	Year	Tons	Year	Tons
1907	*61,000,000	1904	45,000,000	1902	43,400,000	1900	40,200,000
1906	59,000,000	1903	45,700,000	1901	40,200,000	1890	27,000,000
1905	53,700,000						

*Estimated.

The production of the three leading producing countries, the United States, Germany and Great Britain, in past years was as follows.

Year	United States, gross tons	Great Britain, metric tons	Germany, metric tons
1907	25,781,361	10,500,000*	13,045,760
1906	25,307,191	10,100,000	12,473,760
1905	22,992,380	9,592,737	10,987,623
1904	16,497,033	8,562,658	10,103,941
1903	18,009,252	8,811,204	10,085,634
1902	17,821,307	8,679,535	8,529,810
1901	15,878,354	7,928,647	7,860,893
1900	13,789,242	8,959,691	8,520,541
1890	9,202,703	7,904,214	4,658,450
1885	4,044,526	7,415,469	3,687,434

*Estimated.

In 1810 the United States produced less than 54,000 tons, and the 1,000,000 ton mark was not reached until 1864. In 1876 the country produced only 1,867,000 tons.—*Wall Street Journal.*

New Sound Steamboat Line.

A concern known as the New York & Providence Steamship Company has been incorporated in New York and proposes to compete with the Sound lines of the New York, New Haven & Hartford. Captain W. F. Bowman, who was master of the Enterprise Line steamship "St. Croix" when this company suspended business, is said to be the leader in the enterprise.

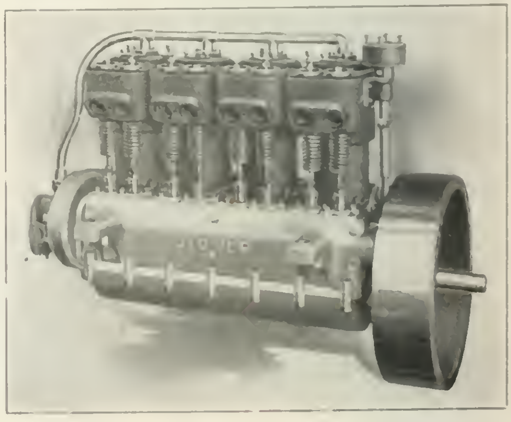
Stover Twelve-Passenger Motor Car.

The 12-passenger motor car illustrated herewith is the larger type of car made by the Stover Motor Car Co., Freeport, Ill. The company has been making six-passenger cars and is now making also this new type because of demand for cars of greater seating capacity. The six-passenger car answers the ordinary requirements of the division officer and a large number of them are in service on various roads. The three seats of the larger car flare beyond the body enough to give room on each for four good-sized men.

The car is driven by a vertical four-cylinder [illegible] h.p. gasolene engine. The accompanying photograph shows the engine with

Stover Twelve-Passenger Motor Car.

wiring and intake and exhaust pipes removed. The cylinders are 4½ in. x 5 in., water cooled. The crank case is of aluminum alloy and is in two castings, the upper half containing all of the bearings. The engine is attached to the frame by supporting arms cast on the upper half of the crank case, so that the lower half can be taken off in order to get at the bearings without disconnecting any other parts. The crankshaft is drop forged. Each cylinder is cast separately. The pistons have oil recesses and are fitted with four rings with square-cut joints. The piston rods are of large diameter and hardened. The connecting rods are drop forged, the bearings are phosphor-bronze and babbitt bronze, and the valves are drop forged in one piece and are interchangeable. The valve lifters are hardened steel and bronze. The timing gears are drop forged steel; they



Engine of Stover Gasolene Motor Car.

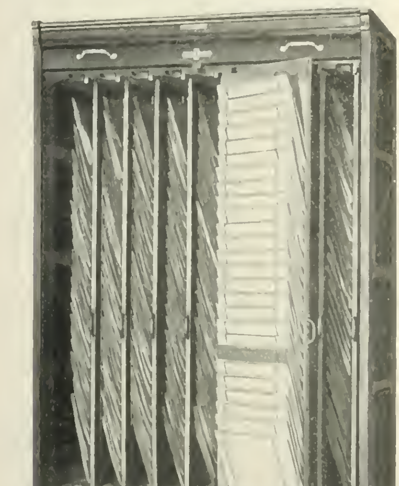
are completely enclosed in the crank case and run in oil. The cam shafts and cams are in one piece made of steel, case hardened, and also run in oil. The intake and exhaust pipes can be quickly removed by loosening four nuts. There are no gaskets in the joints between pipes and cylinders. The water pipes are brass, and the pump is the gear type, made of bronze except the bearing shaft, which is steel. The commutator has hardened steel contacts and the terminals are all protected by a glass cover. The cylinders and bearings are lubricated with a Hill Precision oiler. The ignition is jump spark, operated ordinarily on a storage battery circuit, but the makers will also wire the engine for a dry battery to be used in emergencies.

The transmission is through friction cones, instead of the usual trains of gears. This mechanism is under the front seat. Two small cones, mounted on the transmission shaft, bear against the face of a large wheel on the transverse jack shaft. By shifting the cones toward the center or towards the circumference of this wheel, the transmission ratio may be lowered or raised. As one cone bears on the wheel, the car is driven forward; when the other bears, the motion is reversed, so that the car can move at maximum speed in either direction. All these changes are governed by the vertical lever at the right of the driver. The power is transmitted from the jack shaft to the rear axle by a chain on cast steel sprockets. The spark and gas levers are on a vertical column in front of the driver. The car is designed for 30 m.p.h. with full load on level track. There are brakes on all four wheels, applied through a hand wheel mounted on the same column as the gas and spark levers.

The frame is of heavy pressed steel channels and the body is suspended on long semi-elliptic springs with cast steel hangers, making an easy-riding car. The axles are $2\frac{1}{2}$ in. in diameter and run in Hyatt roller bearings. The wheels are cast steel, 22 in. in diameter. The seats are upholstered in leather, and the floor and running board are covered with rubber matting. The standard body color is Brewster green. A chime whistle, operated by the exhaust, and a 9 in. acetylene headlight, generator and an oil tail light, are included in the equipment. The fuel consumption of the car is given as one gallon of gasolene for 12 to 15 car miles.

The Cook System of Filing Tariffs.

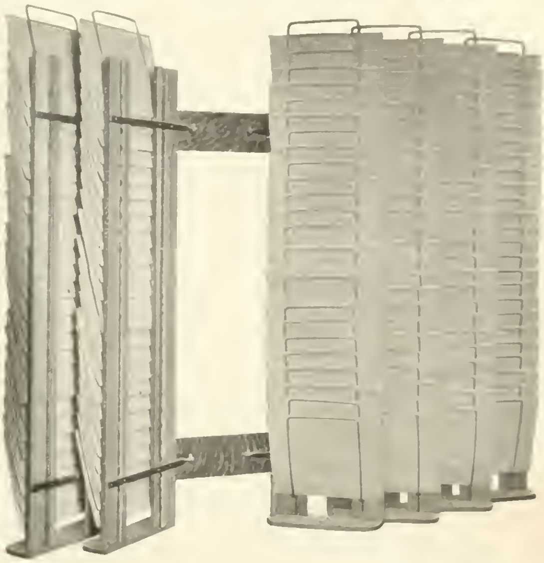
The file for railroad tariffs illustrated herewith is in use in the general offices and stations of a number of railroads by some of the largest commercial concerns in the country and by the War



Tariff Cabinet for General Freight Office.

Department. It was invented by C. W. Cook, Assistant General Freight Agent of the Atchison, Topeka & Santa Fe, and has been improved to its present form through several years of experience. It is convenient, simple and flexible as compared with the usual methods of filing tariffs, both in the general office and by station agents.

The basic feature of this file is a narrow rack or frame about 13 in. wide and 10 in. high, carrying wire holders rectangular in form, as shown in the illustrations. These holders are fastened to the rack with nuts and washers, and are adjustable vertically for pamphlets of any thickness. A rack has 26 wire holders. For general office use the racks or frames are mounted in a cabinet, usually holding eight racks. One of the illustrations shows this form and how a rack is drawn out and swung into position for use. Each tariff is separately filed so that it may be taken out and put back without disturbing any others. The tariffs are put in special folders to protect them. These folders carry the number and description of the tariff and the numerical filing order. Since



Station Frames for Filing Tariffs by the Cook System.

they are thus in place, much time is saved in consulting or filing them. It is said that tariffs seldom get disarranged.

A satisfactory system for a large number of tariffs in a general office is as follows: (1) Distance tables; (2) distance tariffs; (3) class tariffs, own issue first, followed by class tariffs joint with foreign road alphabetically arranged according to roads; (4) association tariffs; (5) special commodity tariffs alphabetically arranged according to commodity, local tariffs coming first and then joint tariffs alphabetically arranged according to roads.

For stations the plan is much simpler. The racks can be hung on the station wall, or any suitable support. One or more frames, as needed, can be put in, and others added as required. The agent thus has his tariffs conveniently and systematically arranged and instantly accessible. They also are convenient for public inspection and thus enable easy and satisfactory compliance with the law.

The use of this system of filing at local stations tends to do away with having agents wire the general freight office for rates and copies of tariffs which they may already have in the station, thus saving work at the general office, as well as use of the wires. The arrangement for quick and easy reference enables agents to quote rates promptly, and they quickly become trained to a better understanding of the tariffs. With a uniform plan for all stations, an agent changing from one station to another only needs to be instructed in the few details peculiar to that station. All details of the system are worked out in the general office and all an agent needs to do in familiarizing himself with the system is to follow the printed instructions furnished him.

The frames and cases used in the Cook filing system are made by the Rockwell-Wabash Co., Chicago.

Warren S. Stone on Wage Reduction.

Warren S. Stone, Grand Chief of the Brotherhood of Locomotive Engineers, is quoted as follows on the question of proposed wage reductions by the railroads:

"The threatened reduction of the wages of employees in train service is absolutely unjustified from any point of view. Their pay is based on a mileage basis, practically piece work, and they are only paid when there are services to be performed. Wages of employees in train service fall parallel with the shrinkage in business plus the increased living expenses away from home. When their earnings are \$150 per month their expense of living away from home is about 15 per cent, while at the present reduced rate of \$70, which has to be met by hundreds—under present conditions, that expense will increase to at least 20 per cent. of earnings because they are held away from the home terminal until there is a full ton nage train to be handled, making a total automatic reduction already in wages from 60 to 70 per cent.

"The roads are getting the same return in freight receipts for the service rendered as they did when the business was good, and there is no consistency in asking men to accept further reduction than result from the present business shrinkage, and the full power of the Brotherhood of Locomotive Engineers will be used, if necessary, in an effort to prevent any further reduction, because it would be absolutely unjust."

Lower Per Diem Adopted.

The resolution adopted by the American Railway Association at Chicago, February 7, in favor of reducing the per diem rate on interchanged freight cars from 50 cents a day to 25 cents, has been confirmed by the letter ballot which was ordered, and the new rate goes into effect March 1. The vote represented almost the entire number of cars in the association, being as follows:

Yes—243 memberships, representing 1,601,355 cars owned or controlled.

No—75 memberships, representing 589,635 cars owned or controlled.

Not voting—17 memberships, representing 30,142 cars owned or controlled.

The total membership of the Association is 335, and the cars owned or controlled by the members, 2,221,132.

The majority requisite for approval is 168 memberships and 1,480,755 cars.

The Traffic Club of Philadelphia.

A meeting has been called for March 3, 1908, to adopt a constitution and by-laws, elect officers and formally organize The Traffic Club of Philadelphia. The proposed constitution and by-laws are similar to those of the New York Traffic Club. The first steps toward organization were taken at a meeting on December 17, 1907, called by a circular letter signed by 75 industrial firms in Philadelphia. A nominating committee has made a ticket with Robert S. Perry, President of Harrison Brothers & Company, President, and Henry C. Trumbower, Treasurer of John Wyeth & Brother, Secretary. Apparently industrial concerns are to be more largely represented than in the New York Traffic Club, for out of the 18 proposed officers and directors only three (and these directors, not officers) are railroad men. Of the 19 officers and governors of the New York Traffic Club, 12 are officers of railroads, steamship lines or traffic associations.

Effects of Texas Legislation and Taxation.

The following remarks are taken from an address by B. F. Yoakum at Fort Worth, Tex., Feb. 15:

It is for the people of Texas to consider whether or not it is to their interest to treat the existing railroads fairly, and fix laws on a fair and equitable basis as will invite capital to make further railroad investments in the state. I am not going into details in this connection further than to illustrate one point which should appeal to every man as being unjust and prejudicial to existing railroads and a hindrance to further construction. The railroads of Texas are capitalized at about $100,000,000, or $33,000 a mile. The Railroad Commission of Texas in its last annual report valued the properties at $16,500 a mile, or one-half of the capitalization. The tax assessors of Texas have assessed the railroad properties on the 1907 tax rolls at $23,000 a mile. One of these valuations must be wrong—either that fixed by the Railroad Commission for rate-making purposes or that assessed by the tax assessors for taxable purposes. If, however, the tax assessors use the same percentage of true value of property in preparing their assessment roll for railroads as they do for other property—which is about 38 per cent.—then they have placed the true value of the railroads at more than they are capitalized, and the owners are entitled to consideration.

Now let us see for a moment what restrictive legislation has accomplished for the state. During the last sixteen years there have been only 3,900 miles of railroad built in Texas, and more than one-third of this entire mileage has been constructed in the last few years by interests with whom I have been associated and largely under my influence. Texas needs and should have as rapidly as money can be found for such investments 10,000 miles of new railroad, and if the 10,000 miles cannot be financed and constructed more rapidly than railroad construction has taken place in Texas during the last sixteen years, which has been on an average of 245 miles a year, it will require forty years to furnish the 10,000 new miles necessary for the best interest of our state—too long for most of us to hope to see its accomplishment.

Let us see what our new sister state, Oklahoma, has accomplished within the last sixteen years, where they have until recently had liberal laws. There have been constructed in Oklahoma 4,100 miles of railroad within the same period—sixteen years—with only 25 per cent. of the area of Texas. To put it in another way, within this period capital has come forward for over four times as much railroad in Oklahoma, considering the area, as in Texas. In Louisiana, to the east of you, during the last sixteen years the railroad mileage has increased 150 per cent., and now has twice as many miles of railroad as that of Texas to the square mile. The liberal laws of Louisiana were the inducement.

Economy in Train Crews.

In connection with the Pennsylvania Railroad's present plan of retrenchment, about 75 brakemen have been taken off through line passenger trains between Jersey City and Washington, Harrisburg, Altoona and Pittsburgh. The purpose is to reduce each crew to a conductor, a baggageman and one brakeman. The front brakeman is the one dispensed with. The new plan will make all inter-division trains comply with the standard in operation which has been in vogue for a long time on the New York division between Jersey City and Philadelphia. The new rule affects the Philadelphia, Baltimore and Washington and the Philadelphia Middle and Pittsburgh divisions, of the Pennsylvania, which with the New York division, make up the lines east of Pittsburgh. Eighteen men have been taken off trains running out of Jersey City on the inter-division schedules, and the others come off trains having their headquarters on the other three divisions. The taking off of these men from the head end compels the younger men to fall back into the freight train service.

A Committee on Automatic Stops and Cab Signals.

The Railway Signal Association in assigning work for 1908 has appointed the following committee on the above subject: W. H. Elliott, New York Central, Chairman, New York City; A. R. Raymer, Pittsburgh & L. E., Vice-Chairman; E. M. Weaver, Long Island; G. D. Fowle, Penna.; J. V. Young, Boston & Maine, G. N. MacDougald, Virginian, W. E. Bullard, New York, New Haven & Hartford; W. McC. Grafton, Penna. Lines West; H. J. Foale, Wabash; D. M. Case, Cincinnati, N. O. & T. P.; E. E. Mack, Chicago & E. Ill.; Wm. Hiles, C., C., C. & St. L.; A. C. Holden, Great Northern; J. R. Decker, Michigan Central, G. W. Hulsizer, Southern; G. H. Dryden, Balt. & Ohio; E. G. Graham, Boston & Albany; J. A. Beoddy, Norfolk & Western.

The committee has been instructed to report on:

1. Cab Signals and Automatic Stops which are worthy of recommendation.

2. On proper location of Automatic Stop Trips for varied conditions of traffic.

3. The advisability of the use of Cab Signals as a substitute for fixed signals or adjuncts thereto.

The committee invites inventors, manufacturers and others interested to communicate with the chairman giving full descriptions, patent specifications and drawings.

Fellowships at the University of California.

In July, 1906, Clarence W. Mackay and Mrs. John W. Mackay jointly, gave the University of California $100,000 to endow a professorship of electrical engineering. Part of the income was to be used for the salary of the incumbent of the chair, and the rest devoted to the furtherance of research work in electrical engineering in the university. Accordingly, two John W. Mackay Junior Fellowships in Electrical Engineering, of $600 a year each, have been established; they are open to all properly qualified university graduates.

The object of the fellowships is to enable students who have completed a college course to do research work with a view to aiding the advance of the application of electricity to scientific and industrial purposes. The holders of the fellowships are to live at the University of California. Experimental or other work, however, may be carried on outside the laboratories of the university. The appointment to each fellowship shall be for one year, which appointment may, however, be renewed, at the discretion of the Graduate Council of the university. Applications should be filed, as early as March 15, if possible, with the Recorder of the Faculties, Berkeley, Cal., to whom application should be made for announcement of courses and details of the work in electrical engineering and related subjects, and for application blanks, etc.

Eight Thousand Miles from Stump to Mill.

An Australian corporation has received a concession from the Russian Government to take out 30,000,000 ft. of timber a year from a forest in Siberia, which is 900 miles from Vladivostok. This is to be delivered in Melbourne, Australia, approximately 8,000 miles away, and nearly three times the distance from New York to San Francisco. In taking out the Siberian timber the Melbourne lumbermen will have to ship the entire year's cut in July, August, September and October, for during the rest of the year there is no open water at Vladivostok. Unmanufactured logs are admitted free in Australia, while there is a heavy duty on all manufactured wood, the duty on lumber, for instance, being nearly $5 a thousand board feet. At Melbourne a new mill is being built to manufacture these logs into dressed stock and lumber. These Siberian lumber operations illustrate the pinch in the timber supply in all parts of the world.

Trolley Route from Boston to Chicago.

A traveler who has covered the trolley route between Boston and Chicago reports that out of 1,497 miles he had to travel but 230 by steam train. two by stage and two on foot. He changed cars 68 times.

Surprise Tests on the Lehigh Valley.

The superintendents of the Lehigh Valley have just had made 197 surprise tests of enginemen, and report perfect records in all cases; no engineman was caught napping. It is a rule on the Lehigh Valley that at least three officials shall take part in every test, and they sign a report giving full details.

TRADE CATALOGUES.

San Pedro, Los Angeles & Salt Lake.—The passenger department has prepared a unique booklet entitled "A Souvenir of Delightful Journeys." It is made to resemble an orange both in size and cover color, and the inside has suggestions, in the form of halftone views, of what may be seen on short journeys out of Los Angeles. Another book is entitled "The A B C of the Salt Lake Route," having a page for each letter of the alphabet, with a suitable sentiment thereon.

Hammer Drills for Mining.—Bulletin 60-A of the Sullivan Machinery Co., Chicago, is a 12-page pamphlet on Sullivan hammer drills for mining work. This is a comparatively new type of rock drill, similar, in a general way, to the large pneumatic hammer. The bulletin gives full information about their construction and operation.

Lightning Arrester.—Bulletin S. 118 of the Railway Specialty & Supply Co., Chicago, consists of six pages describing lightning arresters for either a.c. or d.c. circuits. It is called the Arc Damp Arrester, and the circular describes its application to block signal layouts and interlocking plants.

Rubber Belt Conveyors.—The Jeffrey Manufacturing Co., Columbus, Ohio, has published a 48-page booklet of illustrations to show the application of rubber belt conveyors for handling material of various kinds. Price lists and details of parts of the machinery are also given.

Roofing.—The current issue of *The Exchange*, published by the Standard Paint Co., New York, has among other examples of the use of Ruberoid roofing, photographs of a large freight shed of the Northern Pacific, and of a large hotel at Monte Carlo.

Water Proofing.—The Hydrex Felt & Engineering Co., New York, is distributing a reprint of the paper on "Water Proofing Engineering" read before the Boston Society of Civil Engineers in October, 1907.

Lighting Current Transformers.—Bulletin 1,061 of the Allis-Chalmers Co., Milwaukee, Wis., is about lighting current transformers. It also gives information on insulating oil and insulation tests.

MANUFACTURING AND BUSINESS.

The office of the Vulcan Iron Works, Chicago, has been moved to the new plant at 28 N. Irving avenue, near Fulton street.

C. E. Walker has gone to the Locomotive Appliance Co., Chicago, in charge of sales of locomotive cylinders and valves, effective March 1.

The Conley Frog & Switch Co., New South Memphis, Tenn., has decided to double its capacity by erecting another building and buying additional machinery.

Philip J. Nash has taken charge of the sales department at 863 Monadnock building, Chicago, of the Ernst Wiener Co., New York. Mr. Nash has had long technical and practical experience in the industrial railroad business.

Kopp signal glass is used for most of the signal glass, lenses and roundels in the installation in the yards of the new Washington terminal. The Railway Specialty & Supply Co., Chicago, are agents of the Pittsburgh Lamp, Brass & Glass Co., makers of this glass.

F. T. Hyndman, until recently Mechanical Superintendent of the New York, New Haven & Hartford, is now representing the Eldo Co., 100 William street, New York City. "Eldo" is a protective coating for metal. The claims for this product are that it is made from a mineral gum and is perfectly elastic, is applied easily, dries rapidly, will resist high temperature, is a non-conductor of electricity and will not deteriorate. In color it is a glossy black.

The Federal Railway Signal Co., a New Jersey corporation, with office and works at Albany, N. Y., has been reorganized. A new company, the Federal Signal Co., formed with a New York charter, assumes all the assets and liabilities of the old company, and new capital has been provided for carrying on the business. The officers of the new company are: President, A. H. Renshaw, Vice-Presidents, Eugene Seitz and John T. Cade; Secretary, Frederic Pruyn, and Treasurer, Eugene Seitz.

Richard S. Mercer, who has for several years been representative at New York of the American Brake-Shoe & Foundry Co., Mahwah, N. J., died on February 23. Mr. Mercer was 16 years old. He was born at West River, Md., and, after being educated at Charlotte Hall Academy, began work in 1882 on the Pennsylvania. He was in the construction department for a number of years and then went to the maintenance of way department, serving for some years as supervisor of the Middle division until he resigned to go to New York.

The Robins New Conveyor Co., New York, which was recently incorporated, will be operated under the management of Thomas Robins, who founded the Robins Conveying Belt Co. in 1896 and was President of that concern until March, 1907, when its management passed into other hands. C. Kemble Baldwin is Chief Engineer of the new company. He has served in the older company in the same capacity for the last seven years. The offices of the company are at 38 Wall street, New York, and 1240 Old Colony building, Chicago.

The Allis-Chalmers Co., Milwaukee, Wis., will furnish the equipment for the central station in the electrification of the plant of the Clark Thread Co., Newark, N. J., plans for which have been completed. The plans call for a generating plant of 10,000 k.w. supplied by five steam turbine units. Only one unit will be installed at the outset; this will drive a three-phase, 60-cycle, 600-volt generator, rated at 2,500 k.w. on normal load. The turbine will run condensing. About 2,500 h.p. in induction motors will be installed at the start. The complete electrification of the plant will be carried out gradually.

H. U. Wallace, President of the Wallace-Coates Engineering Co., Chicago, has resigned to become General Manager of the Chicago, Lake Shore & South Bend, an electric line nearing completion between South Bend, Ind., and Kensington, Ill., where it connects with the Illinois Central. Mr. Wallace is a graduate of Purdue University, and was with the Illinois Central for a number of years, being Division Superintendent for three years and Chief Engineer for three years. He then became Third Vice-President of J. G. White & Co., New York, and for the past two years has been at the head of the Wallace-Coates company.

Robert F. Carr and several associates in the Dearborn Drug & Chemical Works, Chicago, makers of boiler compounds, have bought the holdings of the estate of the late William H. Edgar, who died two years ago. At a meeting of the stockholders, followed by a meeting of the Directors, the following officers have been elected: President and General Manager, Robert F. Carr; Vice-President, George R. Carr; Vice-President, Grant W. Spear, Vice-President and Eastern Manager, William B. McVicker, Assistant General Manager, J. D. Purcell; Assistant Secretary and Chemical Director, W. A. Converse; Assistant Treasurer, R. R. Browning; Superintendent, A. E. Carpenter. C. M. Eddy's holdings were also taken over; he desired to devote all his time to personal business interests.

Wynn Meredith, Member of the American Institute of Electrical Engineers, has become a partner in the firm of Sanderson & Porter, New York, engineers and contractors, and will have charge of the western office which they have opened in the Union Trust building, San Francisco, Cal. After technical training at the University of Illinois, Mr. Meredith, in 1888, worked on construction and operation of lighting and electric railway properties. He was connected with the electrical plant of the World's Fair at Chicago in 1893 and the California Fair in 1894. He was later associated with Hasson & Hunt, and then became a member of the firm of Hunt, Dillman, Meredith & Allen, San Francisco, Cal. During 15 years' residence in California Mr. Meredith has been engaged in general engineering work, and including much of the hydro-electric and power transmission work on the Pacific coast, in the United States and Canada.

Iron and Steel.

The New York, Ontario & Western is reported to have ordered 1,100 tons of rails from the Lackawanna Steel Co.

The Chicago & North Western has given the McClintock-Marshall Construction Co. a bridge contract requiring 1,400 tons of fabricated steel.

The Delaware, Lackawanna & Western has ordered 8,500 tons of open hearth 90-lb. rails from the Bethlehem Steel Co. The price will be somewhat higher than the standard figure for Bessemer steel.

The Great Northern has ordered 20,000 tons of rails from the Carnegie Steel Co. and 15,000 tons from the Lackawanna Steel Co. The Pennsylvania Steel Co. has orders from the Great Northern for 5,000 tons of open hearth and 5,000 tons of Bessemer rails, from the Atlantic Coast Line for 8,000 tons, and from other roads for 12,000 tons. The latter amount is in addition to the company's share in the recent Pennsylvania Railroad order.

OBITUARY NOTICES.

William F. Hallstead, formerly General Manager of the Delaware, Lackawanna & Western, died last week at his home in Scranton, Pa., at the age of 82. Mr. Hallstead was born at Benton, Pa. He entered the service of the Lackawanna as brakeman in 1852, and continued in the service of the company 47 years. He was promoted through the different grades of the operating department until in 1872 he was made Superintendent of the main line. In 1886 he was appointed General Manager, which office he held for 13 years.

James Dun, Consulting Engineer of the Atchison, Topeka & Santa Fe, died at St. Augustine, Fla., of heart trouble, on February 23. Mr. Dun had been on the Santa Fe for the past 17 years. He was born on September 8, 1844, at Chillicothe, Ohio. He began railroad work when he was 22 years old as a chainman in an engineer corps on the Indianapolis & Cincinnati, which is now part of the Cleveland, Cincinnati, Chicago & St. Louis. Next year he was appointed Assistant Engineer of the Atlantic & Pacific, now part of the Atchison, Topeka & Santa Fe. Four years later he went to the Missouri Pacific as Assistant Engineer, and in 1874 was made Engineer of Union Depot Co., at St. Louis, Mo. In 1877 he was appointed Superintendent of Bridges and Buildings of the St. Louis & San Francisco, and, after serving in this position for a year, went to the Atchison, Topeka & Santa Fe as Chief Engineer. In 1900 he was made Chief Engineer of the whole Santa Fe system, including the Coast Lines. He was appointed Consulting Engineer of the system in the fall of 1906.

James Dun.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Mechanical Engineers.

The March meeting of this society is to be held on Tuesday evening, March 10, in the Engineering Societies building, West Thirty-ninth street, New York. An address will be made by Dr. Charles P. Steinmetz, Professor of Electrical Engineering at Union University, on "The Steam Path of the Steam Turbine."

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Pacific.—F. W. Peters, Assistant Freight Traffic Manager of lines west, has been appointed Assistant to the Second Vice-President, with office at Winnipeg.

Philadelphia & Reading.—Harry E. Paisley has been appointed Treasurer of the railroad company and also of the Reading Company and the P. & R. Coal & Iron Co., in place of Richard Tull, deceased. John S. Sneyd has been appointed Assistant Treasurer in place of Mr. Paisley.

Seaboard Air Line.—L. G. Haas, heretofore Assistant General Manager of the Baltimore & Ohio, has been appointed Agent for the Receivers of the S. A. L. He will have charge of certain engineering features of extensions and of the industrial department, his duties not conflicting with those of Mr. Garrett, chief executive officer for the Receivers. George Hodges, heretofore Assistant to the General Manager of the Baltimore & Ohio, has been appointed Assistant Receivers' Agent of the S. A. L.

Operating Officers.

Baltimore & Ohio.—L. G. Haas, Assistant General Manager, has resigned. See Seaboard Air Line under Executive, Financial and Legal Officers.

Fourche River Valley & Indian Territory.—William Collins has been appointed General Manager in place of F. C. Fauth, resigned, office at Fourche, Ark.

Kansas City Southern.—Charles C. Riley has been appointed General Manager and Superintendent of Transportation, effective February 15. Mr. Riley was born in Indiana and was educated at Butler University. He prepared himself for the medical profession, but in 1888 entered the railroad service on the Cleveland, Cincinnati, Chicago & St. Louis. He held various positions in the transportation department until April 10, 1897, when he went to the Baltimore & Ohio Southwestern as Superintendent of Car Service and Superintendent of Transportation, which place he held until December 1, 1900. In 1901 he was instructor at the College of Physicians and Surgeons at Indianapolis. From October, 1901, to July, 1903, he was Car Service Agent of the Chicago Great Western, and then for a year was Superintendent of Car Service of the Erie. From that place he was promoted to be Superintendent of Transportation, resigning from this position this month.

National of Mexico.—J. C. Sielski has been appointed Superintendent at San Luis Potosi, in place of A. Larkin, deceased.

New York, New Haven & Hartford.—E. T. Horn has been appointed Assistant Superintendent and D. F. Stevens Trainmaster of the Shore Line division. P. W. J. Smith has been appointed Passenger Trainmaster of the New York division, with office at the Grand Central Station, New York City. C. H. Motzett has been appointed Freight Trainmaster of the New York division, with office at Harlem River, N. Y. E. H. Morse has been appointed Passenger Trainmaster of the Boston division, with office at Boston, F. S. Hobbs Freight Trainmaster of the Boston division, with office at South Boston.

New York, Chicago & St. Louis.—The lines of this company have been divided into three operating divisions, as follows: Buffalo division, Buffalo to Conneaut; Cleveland division, Conneaut to Bellevue; Fort Wayne division, Bellevue to Chicago.

The Superintendent of the Buffalo division is W. F. Watterson, office at Buffalo, N. Y.; Trainmaster, G. C. Todd, office at Conneaut, Ohio.

The Superintendent of the Cleveland division is R. W. Mitchener, office at Cleveland, Ohio; Trainmaster, C. E. Maxfield, office at Cleveland.

The Superintendent of the Fort Wayne division is S. K. Blair, office at Fort Wayne, Ind.; Trainmaster, E. S. Kirby, office at Fort Wayne.

W. I. Bliss has been appointed Superintendent of Telegraph, in place of R. W. Mitchener, promoted.

Traffic Officers.

Canadian Pacific.—W. B. Lanigan has been appointed Assistant Freight Traffic Manager, at Winnipeg, Man., in place of F. W. Peters, promoted.

Chicago, Milwaukee & St. Paul.—R. M. Calkins, hitherto Assistant General Freight Agent at Chicago, has been appointed General Freight and Passenger Agent of the lines west of the Missouri River, with office at Butte, Mont. E. C. Nettels, also Assistant General Freight Agent at Chicago, will succeed to the place vacated by Mr. Calkins.

Mobile & Ohio.—E. A. Bynum, appointed Assistant General Freight Agent, with office at New Orleans, in place of N. M. Leach, has taken up the duties of his office.

Pennsylvania Lines West of Pittsburgh.—W. M. Wallace has been appointed Division Freight Agent of the Erie & Ashtabula division, in place of H. M. Bradley, office at Erie, Pa.; effective April 1.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—E. E. Chrysler, Master Mechanic at Chickasha, Okla., has resigned.

International & Great Northern.—F. S. Anthony has been appointed Master Mechanic of the Gulf division at Palestine, Tex. J. B. Dolsen, Foreman of the Car Department at Palestine, has resigned.

Mexican Central.—F. L. Carson has been appointed Master Mechanic of the Torreon division in place of O. R. Hale, transferred.

CAR BUILDING.

The Atlanta, Birmingham & Atlantic has ordered 112 coal cars of 80,000 lbs. capacity and 30 cabooses from the South Atlantic Car & Manufacturing Co.

The Mexico, Santa Fe & Perry Traction Co., under construction in Missouri, intends to ask bids on rolling stock soon. S. L. Robson, Mexico, Mo., is President and General Manager.

The J. D. MacArthur Co., Ltd., Winnipeg, Man., as reported in the *Railroad Gazette* of February 14, has ordered from the Hicks Locomotive & Car Works, for delivery on April 1, 50 flat cars of 60,000 lbs. capacity and one caboose. Bodies and underframes will be of wood.

RAILROAD STRUCTURES.

ALEXANDRIA, LA.—A contract has been given to Edward Crebo, of Kansas City, to build the union passenger station to be used by the Texas & Pacific and the St. Louis, Iron Mountain & Southern.

CAINSVILLE, ONT.—The Toronto, Hamilton & Buffalo is planning to put up a new steel bridge on heavy concrete abutments here.

GRAND FORKS, B. C.—It is said that the Canadian Pacific will make improvements here, including roundhouses, at a cost of $150,000.

MINNEAPOLIS, MINN.—The Chicago, Milwaukee & St. Paul, it is said, has bought 40 acres of land adjoining the city limits as a site for shops and terminals. This is preparatory to changes which will follow the extension of the company's lines to the Pacific coast.

MONTREAL, QUE.—Bids are being asked for by the Canadian Pacific for the construction of the new stock yards in this city.

OTTAWA, ONT.—The Canadian Railway Commissioners have authorized the Canadian Pacific to build bridges as follows: Over Belly river at Lethbridge, Alta.; at mile 35.2 over Carpenter creek, B. C.; at mile 0.72 over Fraser river, Mission branch, B. C.; at highway crossing at Bala, Ont.; at mile 7.32, Mud Branch, Thames river, Ont.; at mile 8.2 over Thames river, Ont.; at mile 9.44, Huron street crossing, Embro, Ont.; at mile 18.9, Brockville branch, Ont.; at mile 34.6 over Badger creek, Man.; at William street subway, also approved plan of abutment and piers of proposed bridge over Pine street, at Woodbridge, Ont.

QUEBEC, QUE.—The Quebec Bridge Co. has decided to rebuild the steel cantilever bridge over the St. Lawrence which collapsed last spring.

ST. STEPHEN, N. B.—The New Brunswick Southern is asking Parliament for authority to build a bridge over the St. Croix river.

TRINITY, TEX.—The Beaumont & Great Northern is planning to make improvements here, to include shops and a roundhouse.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICAN RAILROAD OF PORTO RICO.—This company expects soon to finish the cut-off from Hormigueros south to Lajas, 12 miles. (April 12, p. 531.)

A branch line is to be built this year from San German, east to Sabana Grande, nine miles. This work includes one large bridge and several smaller structures. All the work is being done by the company's forces.

ATLANTIC, QUEBEC & WESTERN.—The Canadian Railway Commissioners have approved the location of this company's line in the townships of Perce, Mal Baie and Douglas, county of Gaspe, Quebec, mile 60 to 90; also in section 3, mile 20 to 30.8, and section 10, mile 90 to 102.4 through the townships of Douglas and York, county of Gaspe.

BATON ROUGE, HAMMOND & EASTERN.—See Illinois Central.

CANADIAN NORTHERN.—This company, it is said, has had a large force working all winter on the Hudson Bay line from Etoimami, Sask., north. The line is finished to Pass Mission, at the junction of the Saskatchewan and Carrot rivers, about 100 miles. The surveys to Ft. Churchill call for a line 125 miles long.

Several improvements, it is said, are to be made this year on the line between Port Arthur and Winnipeg. The company intends to replace 30 miles of the present rails between Atikokan, Ont., and Rainy River with 80-lb. rails, and make extensive improvements on this division, mainly at Fort Frances.

CHERRYVALE, OKLAHOMA & TEXAS.—Surveys reported made by this company for its proposed line from Cherryvale, Kan., via Pawhuska, Okla., and Guthrie, to Geary. General Manager J. H. Brewster is quoted as saying that capital has been secured to complete this section of the line. S. M. Porter, President, Caney, Kan. (July 19, p. 83.)

DENVER, LARAMIE & NORTH WESTERN.—This company, which has projected a line from Denver, Colo., to the northern boundary of Wyoming, about 500 miles, is said to have bought recently 160 acres of land in Denver as a site for terminals. Rights of way are reported secured for the line. S. Johnson, President; J. O. Curry, Treasurer; J. T. West, Secretary, and former Senator Harris and Judge J. T. Millkan, of Kansas, are said to be interested. (Sept. 27, p. 370.)

EVANSVILLE, MT. CARMEL & OLNEY INTERURBAN.—Incorporated in Indiana, with a capital of $10,000, to build an electric line from Evansville, Ind., northwest to Olney, Ill., about 60 miles. A. Knoop, President, Olney; G. W. Couerter, Secretary, Mt. Carmel. The directors include G. J. Siebert, J. Laubscher, E. O. Lockyear, of Evansville; T. Newall, E. B. Bixby, of Cynthiana; J. F. Siebert, J. O. Smith, of Lancaster; A. Knoop, F. W. Boyer, J. F. Hyatt, of Olney.

FORT WAYNE & SPRINGFIELD TRACTION.—Plans under way to build a line from Decatur, Ind., south to Richmond, Ind., 70 miles. Officials of this company are reported to be interested.

GRAND TRUNK PACIFIC.—Foley, Stewart & Welch, contractors for 120 miles of the line from Edmonton, Alb., west, have sublet 30 mile sections to J. McAllister, M. McKenzie and B. Baker. The remaining 30 miles is to be sublet in one and two-mile sections.

ILLINOIS CENTRAL.—Construction work on the connecting links on the Birmingham extension to a connection with the Central of Georgia have been finished, and the line is to be ready for operation April 1. The line from Jackson, Tenn., to Birmingham, Ala., 219 miles, is over the Illinois Central tracks to Perry, 5.80 miles, thence over the Mobile & Ohio to Ruslor, Miss., 51.48 miles. The Mississippi & Alabama in Mississippi and the Alabama Western in Alabama extend from Ruslor to Haleyville, Ala., 80.07 miles. From Haleyville the company has trackage rights over the Northern Alabama to Jasper, 40.69 miles, and from Jasper over the Kansas City, Memphis & Birmingham to Birmingham, 40.96 miles. This will give the Illinois Central a through line to Birmingham. The line from Corinth, Miss., to Haleyville, Ala., 80.1 miles, was opened for traffic Feb. 10. The company has finished terminals in Birmingham at a cost of $2,000,000. It is announced that through trains from Chicago to Birmingham, Ala., will probably be established about April 1.

Work on the Memphis & State, which is to be a double-track line from Anlon, Tenn., to the Nonconnah yard, about seven miles, has grading finished and about one-half the track laid. It is expected to have the line open for traffic about March 15.

The work under way on the Yazoo & Mississippi Valley relaying the present track from Natchez, Miss., northeast to Harrison, 27.8 miles, with 75-lb. rails, will probably be finished about March 15th.

The new double-track belt line being built around Memphis, Tenn., is expected to be put in operation March 15th.

Train service was begun on the Baton Rouge, Hammond & Eastern on February 27. This line joins the Illinois Central at Hammond, La., and connects at Baton Rouge with an extension of the Southern Pacific, which is being built from Lafayette, La., to Baton Rouge. A saving of about 50 miles is accomplished by this short route between the Illinois Central and the Southern Pacific, which also saves going through the congested terminals at New Orleans.

MATAMOROS & SANTA CRUZ STREET RAILWAY.—A St. Louis syndicate organized by W. H. Bixby, T. West, S. Fordyce, H. Harstick, E. Scott and R. Brookings, has recently bought this Mexican line. It is the purpose of the new owners to rebuild and electrify the line, also to extend it to a connection with the National Railroad. The proposed improvements include a line to Brownsville and the absorption of the Rio Grande Railroad, operating 22 miles from Brownsville, Tex., north to Point Isabelle. This is a steam road, which it is proposed to convert into an electric line. The work will include a bridge over the Rio Grande at Brownsville, for which permission to build will have to be obtained from both the United States government and the Mexican government.

MEMPHIS & STATE.—See Illinois Central.

MEMPHIS, PARIS & GULF.—This company is now in operation from Nashville, Ark., southwest to Ashdown, 26.9 miles. The company proposes to extend the road this summer. The projected route is from Memphis, Tenn., via Little Rock, Ark., to Paris, Texas, 400 miles.

MEXICAN CENTRAL.—This company is improving its track between Chihuahua and El Paso and adding heavier rails. Five thousand tons of 75-lb. rails are being distributed to replace the 56-lb. rails now in use.

MONTANA RAILROAD.—This company has finished grading work on a revision of line from Lombard, Mont., to mile 36.2, near Minden. Ditmer, Bradbury & Wheelbrew, contractors. Tracklaying is expected to be finished in March. The work included eight tunnels and one viaduct.

PITTSBURGH, BINGHAMTON & EASTERN.—The New York Public Service Commission (Second district) has granted permission to this company to change that portion of its proposed route within the state of New York. The line is projected from Binghamton, N. Y., to Clearfield, Pa., 225 miles. Twenty-one miles built in 1907. The Holbrook, Cabot & Rollins Corporation, contractor. (Jan. 17, p. 105.)

RIO GRANDE RAILROAD.—See Matamoros & Santa Cruz.

TEXAS ROADS.—A company is being organized by Dr. C. F. Simmons, of St. Louis, and associates to build a line from San Antonio, Texas, south to Rio Grande, on the Mexican border, about 200 miles, with a branch east to Corpus Christi, 50 miles. Rails are said to have been bought to be laid on the first 40 miles.

UNION TRACTION COMPANY.—Incorporated in Texas, with office at Clarksville, in Red River county. The company proposes to build an electric line from Texarkana via Sherman and Ft. Worth to Mineral Wells. C. P. Moore, President, and J. T. Upchurch, Secretary and Treasurer.

WEST TEXAS & NORTHERN.—The West Texas Construction Company has been organized to build this proposed line from Stanton on the Texas & Pacific to Lubbock, the county seat of Lubbock county, 110 miles. Fourteen miles graded north from Stanton. (Nov. 15, p. 666.)

YAZOO & MISSISSIPPI VALLEY.—See Illinois Valley.

RAILROAD CORPORATION NEWS.

ATLANTIC COAST LINE.—The Atlantic Coast Line Company of Connecticut, which is the holding company for the Atlantic Coast Line Railroad, has declared a quarterly dividend of 2 per cent., reducing the annual rate from 10 to 8 per cent.

BALTIMORE & OHIO.—This company has sold $6,000,000 one-year 5 per cent. collateral notes dated March 2, 1908, to Speyer & Co. and Kuhn, Loeb & Co., of New York. These notes are in denominations of $10,000 and $25,000 and are secured by $8,000,000 refunding 4 per cent. bonds of the Pittsburgh, Lake Erie & West Virginia "System," which includes 1,687 miles of Baltimore & Ohio lines, including the Pittsburgh & Western and the Cleveland, Lorain & Wheeling.

Gross earnings for January decreased $1,188,000, or 19 per cent. Expenses were $201,000 less, leaving net earnings of $1,013,000 against $2,000,000 in 1907, a decrease of $1,988,000, or 17 per cent. For the seven months ending January 31, 1908, the net earnings were $14,000,000 against $16,009,000 in 1907, a decrease of 17 per cent.

CAMDEN & TRENTON (ELECTRIC).—Wilbur F. Sadler, Jr., of Trenton, was, on February 18, appointed receiver of this company by Vice-Chancellor Walker, of New Jersey, on a bill of complaint by former President Henry V. Massey, alleging insolvency and mismanagement. The road is controlled by the New York-Philadelphia Company.

CANADIAN NORTHERN.—The Canadian Northern is applying to the Parliament of Canada for permission to issue $19,250,000 new stock, increasing its authorized stock to $50,000,000.

CANADIAN PACIFIC.—This company has sold $10,000,000 4 per cent. debenture stock in London at a price slightly above par. There was previously $106,045,111 of this stock outstanding.

DELAWARE & HUDSON.—A temporary injunction restraining the company from paying the four quarterly dividends of 2¼ per cent. each (9 per cent. for the year) payable at four different dates during 1908, was given by Judge Platzek in the Court of General Sessions of New York City this week to ex-Judge Rufus B. Cowan, who, at the annual meeting in May, 1907, made an attack on the present management criticising especially the purchases of coal lands, of traction properties about Albany and of railroad properties in Canada.

ERIE.—No action was taken on February 19 or on February 26 by the directors on the first preferred dividend. The former is the date on which the semi-annual dividend is usually declared. The question as to whether the company had the right to issue dividends in scrip without the approval of the New York Public Service Commission is still pending.

ILLINOIS CENTRAL.—Judge Ball, of the Superior Court of Illinois, on February 20 dissolved the injunction granted on October 11 to Stuyvesant Fish restraining the Railroad Securities Company and the Union Pacific Railroad from voting $28,123,100 Illinois Central stock (29.56 per cent. of the total) held by them at the adjourned annual meeting on March 2. Stuyvesant Fish has sent a letter to the stockholders saying that any stockholders who wish to withdraw proxies given to him may do so on request.

INTERNATIONAL & GREAT NORTHERN.—T. J. Freeman, Solicitor of the Texas & Pacific, was on February 26 appointed receiver of this company by Judge McCormick in the United States Circuit Court at Fort Worth, Tex. President George J. Gould issued a statement that the receivership came as a result of orders of the Texas Railroad Commission for extensive improvements at a time when earnings were rapidly decreasing. The International & Great Northern operates 1,160 miles of line, all in Texas.

INTERBOROUGH-METROPOLITAN.—President Shonts, of this company which controls the surface, elevated and subway lines of the borough of Manhattan, New York City, has sent a circular to stockholders summarizing the financial condition of the company for the year ended December 31, 1907. The general balance sheet on that date was as follows:

Assets.		
Interboro R. T. stock, at cost in securities of this company		$104,763,012.00
Metropolitan St. Ry. stock at cost in securities of this company		68,684,155.00
Metropolitan Securities Co. stock at cost in securities of this company		28,720,695.00
Metropolitan Securities Co. loans secured by notes and stocks and bonds of subsidiary companies as collateral		8,844,700.48
Real estate, at cost		594,464.89
Office furniture and fixtures		5,461.06
Engineering in suspense (additional subways)		50,114.78
Metropolitan Securities stock full paid		30,773.16
Cash and accounts receivable		1,835,802.84
Total		$212,944,509.51
Liabilities.		
Capital stock, common	$100,000,000.00	
Reserved against outstanding stocks not acquired	6,737,808.00	
		$93,262,192.00
Capital stock, preferred	$55,000,000.00	
Reserved against outstanding stocks not acquired	9,260,000.00	
		45,740,000.00
Collateral trust 4½ per cent. bonds	$70,000,000.00	
Reserved against outstanding stocks not acquired	2,175,000.00	
		67,825,000.00
Notes payable		1,545,000.00
Accounts payable		42,309.76
Accrued interest 3 mos. to Jan. 1, 1908, on Inter-Met. 4½ per cent. bonds (covered by dividend of Interborough R. T. Co., paid Dec. 31, 1907)		763,091.25
Profit and loss surplus		766,916.50
Total		$212,944,509.51

The income of the year, largely made up of dividends on Interborough Rapid Transit and Metropolitan Street Railway stock, was $4,753,561, and the expenses, largely made up of interest on its own bonds and dividends on its preferred stock, were $4,511,569. The surplus for the year therefore was $241,992. This, added to the profit and loss credit balance on December 31, 1906, of $524,924, makes up the profit and loss surplus of $766,916, shown on the balance sheet.

KANSAS CITY SOUTHERN.—Gross earnings for January, 1908, were $646,000 against $773,000 in 1907, a decrease of $127,000, or 16 per cent. Net earnings were $203,000 against $320,000 in 1907, a decrease of $117,000, or 37 per cent. For the seven months ended January 31, the net earnings were $1,929,000 against $2,028,000 in 1907, a decrease of $99,000.

LONG ISLAND.—In the year ended December 31, 1907, gross earnings increased $535,000 and operating expenses $1,045,000. Net earnings decreased $510,000. In the month of December, 1907, the excess of expenses over gross earnings was $53,000 larger than in the corresponding month of 1906.

NEW YORK, CHICAGO & ST. LOUIS.—Gross earnings for the year ended December 31, 1907, were $10,385,288 against $9,901,947 in 1906. Net earnings were $3,151,549 in 1907 and $2,322,511 in 1906. These are high record figures.

PERE MARQUETTE.—Arrangements have been made for refunding the $2,600,000 5 per cent. equipment bonds maturing March 2 with the same amount of 6 per cent. equipment notes, which are to be redeemed in four annual instalments of $650,000 each, due March 1, 1909-1912 inclusive. These $2,600,000 bonds are the outstanding balance of $3,500,000 five-year equipment bonds issued in 1903 to pay for $5,503,000 worth of equipment, for which $2,103,000 was paid in cash.

PITTSBURGH, CINCINNATI, CHICAGO & ST. LOUIS.—Gross earnings for January decreased $506,000, operating expenses and taxes, $375,000, and net earnings, $132,000.

TEXAS & PACIFIC.—Estimated gross earnings for the week ended February 21, 1908, were 16 per cent. less than in the corresponding week of 1907.

UNION PACIFIC.—See Illinois Central.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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CONTENTS

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The directors of the Erie Railroad on August 28, 1907, declared the regular semi-annual dividend on the first preferred stock and the regular annual dividend on the second preferred stock, in 4 per cent. interest-bearing scrip, payable in cash in 1917. Under the Public Service Commissions law of the state of New York, the company applied for authority to issue these interest-bearing dividend warrants. Decision of this application was delayed until March 1, 1908, when the Albany Public Service Commission, in an opinion written by Chairman Stevens, denied the application. The Commission holds that in order to authorize, under the Public Service Commissions law, the issue of stocks, bonds or other evidence of indebtedness (1) capital must be secured by the issue, (2) the use of such capital must be necessary for acquisition of property, construction or extension of facilities, improvement or maintenance of service, or for refunding, and (3) that the amount authorized be reasonably required for such purpose or purposes. Furthermore, that dividends can be declared only from surplus profits, which belong to the corporation and not to the stockholders until a dividend is declared. The Commission then points out that by the declaration of a dividend payable in the future no capital is secured, and that the issue of warrants evidencing such dividends is not necessary for any of the four specified purposes to which new capital may, under the law, be applied. By the declaration of a scrip dividend a company secures nothing which it did not possess before, and therefore under the law the issue of dividend warrants cannot be approved. In other words, the Commission will not authorize a company to put itself in debt for the purpose of paying dividends. As was remarked in the *Railroad Gazette* shortly after the declaration of these dividends, they represented what was really an enforced loan from the stockholders at 4 per cent., while the Erie was able to get money in the open market only at rates more than twice as costly as this. The decision of the Commission is in the direction of straightforward methods of railroad finance. It means that in New York state a railroad company will either decide to pay dividends or not to pay them, and that there will be no attempt to compromise by issuing obligations on the future. One of the interesting sidelights of this case is the fact that there is small reason to doubt that with the industrial depression which has come about since last August, the directors of the Erie are likely to be the people most pleased by this decision.

The extent to which it is possible to control locomotive fuel expense by careful and systematic purchase and distribution of the coal, based on exact knowledge of its quality and other conditions affecting its economic use, was described in the paper presented at the November meeting of the Western Railway Club (*Railroad Gazette*, January 10, 1908). The scheme outlined is more or less theoretical, although it is backed up by about a year of experience on the Burlington, where the ideas and methods described are being gradually introduced. Naturally, it requires a long time—years—to get such a scheme fully in operation. While the plan has been worked out primarily on the basis of the conditions peculiar to the Burlington, the purpose of the paper is to present it in such form as to be generally adaptable. There is so much to commend in the plan that it is well worth the careful study of every manager interested in lowering the cost of this, the largest single item in his operating expense. The competitive points for the different kinds of coal determined by the equation used in the paper will, in nearly all cases, fall between division termini. While it is not so stated in the paper, it is not the intention that there actually should be a change of coals at such a point. The best results are got, of course, when the quality of coal is uniform over a division, since a change of adjustment in the locomotive is necessary to burn each different grade of coal with the best economy. A locomotive drafted for poor coal, if given a good coal would burn it wastefully, throwing an unnecessary quantity out of the stack. Practically the change of coal would doubtless be made at the division point nearest the competitive point. Other factors of primary practical importance are grade conditions and the volume and direction of traffic. The former, the author points out, can be taken care of by the cost of haulage, which it is important to determine accurately. Concerning the latter, the plan would, of course, be subordinate to traffic requirements at all times. Traffic fluctuations and the exi gencies of operation incident thereto might disarrange the plan seriously at times, but the general good effect would not be lost. The chief advantages of the scheme as outlined have been summed up as follows: (1) Material reduction in the cost of fuel is shown to be possible. (2) Improved locomotive service, due to the use of uniform grades of coal. (3) Increased mileage and consequent increased earning capacity of coal cars.

A VAGARY OF THE RAILROAD SITUATION.

If one looks back on the panic periods of this country in their bearing on railroad affairs he finds that the period of 1837 had no such bearing at all simply because at that early date our railroads were practically non-existent. Coming down twenty years to the panic of 1857 conditions were essentially the same because the railroads had not risen to be a great fiscal interest. The two sharp panics of those periods were at bottom financial, with, of course, their shadows on general industry. Very different, as related to the railroads, were the panic of 1873 and the long drag of five years that followed it. By that time the railroads had grown to be a vast interest, and the panic of 1873 was, in fact, rooted in undue railroad expansion which in the two or three years preceding had become a kind of craze. Similarly in the later panic periods, including the present one, the impact on the railroads has been quick and severe. Having grown to a larger size and become closely identified with the industrial energy of the nation, railroads have also been the first to receive the shock. And this is also true probably of any panics to come in future years. We refer, of course, to the steam roads regarded as a great and pretty homogeneous transportation system and as distinguished from the street railways which, in the main, are still localized institutions and outworking their destiny, whatever it may be, under different and more limited conditions as contrasted with the steam lines.

Looking more closely into the panic periods in which our railroads have figured actively one notes, however, between those of the past and the present a sharp distinction. In the earlier panics of 1873 and later down to the present period the railroads, like other great vested interests, have been allowed to recuperate under natural law. It was a hard and inexorable law, but its workings were simple and logical. Credit was contracted, business receded, earnings fell off and the weaker roads went to the wall. There were receiverships, reorganizations and heavy individual loss, sometimes inflicted even upon the conservative investor, though, in his case, apt to be temporary. Combinations of capital and transitory devices like the clearing house certificates, modified and assuaged panic, but they did not affect much the railroad situation which had to work itself out through adversity and pain. But painful as was the ordeal of the railroads it was not intensified by artificial and extraneous agencies, and prosperity re-established itself under a law just as natural as was that which had brought adversity. The railroad corporations had one load, and a heavy load, to carry, but they did not have two loads, and, in a general way, and under the teachings of experience, they could foresee results, brace themselves to bear the burden and adopt the means to alleviate it.

For the first time in our national history one finds now those normal conditions shifted and the railroads in effect singled out from other great vested interests to be the victims not only of economic, but of artificial and man-made law. The man-made law even goes further and repeals or arrests the recuperative statute of political economy. There is no foe of the railroad, however demagogical he may be, who questions the place of the railroad not only as an industrial asset, but also as an element in public convenience and necessity. He would not have to be hard pushed to admit that the railroad is a more important ingredient of prosperity than the great factory. Yet not only does public policy not single out the great factory for attack, but even protects it under the tariff. Here and there in the form of conspicuous combination it becomes a target, but in the main public policy is protective. Not so with the railroad. It must be picked out from the mass of vested interests for assault from every quarter. Legislatures must raid it. State commissions must hamper it. Federal authority, with its far-reaching influence on public policy and temper, must menace it. It may raise wages liberally in good times, but it must be denied the right to lower them in hard times. Fundamental rights of property conceded to the meanest citizens—and to private corporations—must be refused the railroad carrier. The dollar placed in private enterprise is guarded by law, the dollar placed in the public serving railroad must be penalized. Recession of pay and prices is the normal process by which hard times emerge into better times. Yet authority is doing its best to suspend, in the case of the railroads, that remedial process and, unless all precedent misleads us, is thus postponing the recovery.

The times indeed are extraordinary and unprecedented. For the first time in American history, and it may even be said, in the history of nations, great forces are seeking to check or, at least retard the normal remedies of panic and after-panic and administer to the patient medicines not only novel but in their character directly opposed to normal therapeutics. Big trade combinations are declaring that prices must be maintained however low the volume of business falls. The unions, in a somewhat similar combination and mood, are declaring that wages must be sustained even though men be discharged and the profits of the employer still fall; and a great branch of the nation's industry, the railroads, is not merely marked for continuous attack, but refused the primary right of the employer and property owner to help himself. These may be policies that will cure hard times and be panaceas for industrial ailment, but they are of a nature to amaze Adam Smith or John Stuart Mill.

PENALTY LAWS IN THE SOUTH.

We print this week, on another page, an abstract of the principal railroad penalty laws in a group of southern states. The list is very instructive. Most of the penalty laws were enacted during the extraordinary pursuit of state legislation which followed the activity of the national government in 1906, and the schedule perhaps illustrates as well as any other single document the effect which the federal government's methods of invective has had on the minds of state politicians who have seen and remembered the success which has attended this sort of thing in the highest quarters. The plain assumption that the railroads are acting unfairly and that their occasional failures of service are wilful, runs through all this mass of penalty legislation. The tone and moderation of these laws suggests the tone and moderation of the popular tribunal which meets Saturday evenings in the village store. There is no thought of fair play or of giving the railroads a chance to explain or justify their own position. Thus, in Alabama the free time under the car service rules is 72 hours on a large range of commodities, and carriers are not permitted to release cars by unloading carload freight for storage into their own warehouses or into public or private warehouses until $5 demurrage charges have accrued; that is to say, until the carrier has suffered about ten days' delay. If a company enters suit through the federal court, its license to do business in the state is canceled, and the carrier must, to all intents and purposes, insure freight more broadly than any chartered insurance company in the world, since it is illegal for it to enter into any contract limiting its liability for loss or damage to property in transportation, whether or not this loss or damage is caused by act of God or the public enemy. In Georgia, there is a penalty of a dollar per car per day for failure to furnish cars for loading within four days, Sundays and legal holidays excepted; there is a penalty of full damage to be paid by the initial line, regardless of place of damage, for failure to trace freight and advise applicant within 30 days of the cause and place of delay or damage; and there is a penalty of $50 for failure to pay loss or damage claims on intrastate business within 60 days. In North Carolina, the penalty for not furnishing cars within four days of application is $5 per car per day, entirely regardless of the car supply situation, although the North Carolina legislature doubtless knew or was in position to find out that there have been times within the last two years when the Angel Gabriel could not have gotten freight cars for $10 a day.

The discouraging thing about an exhibit of enactments like this is that the state legislatures do not care in the least whether they are unjust to the railroads or not. It is a comparatively simple matter to right law-made wrongs which have been occasioned by ignorance and misapprehension, but it is not so easy to remedy grievances that are the result of direct intention. We feel sure, however, that it will not be long before the most harmful and injurious of these laws are repealed. Wisconsin gave an example of this in the seventies, as everybody knows, and it must always be remembered that lawmakers, however dim their economic vision, may be counted upon to have a perfectly clear sense of the things that make for popularity. Railroad development in some of the states that have been hardest hit by this legislation has received a setback the extent of which cannot yet be realized, but will be seen plainly when capital is again actively seeking investment and turns away from the states where it is treated with conspicuous injustice.

We have already expressed the opinion in these columns that repeal of the most iniquitous statutes will occur before they have time to get to the Supreme Court, and we should be very much surprised if the pendulum of legislative enactment did not swing a long way back from its present position, which is certainly high above the point of equilibrium, on the radical side. Meantime, there is one feature of the situation which must not be overlooked. If the existing lines in some of the most troubled states can contrive to live under the state laws at all, they ought to be able to live without competition, and it may well be that there are areas where the 1907 crop of legislation is preferable to the competition which would surely have come within a year or so if the attitude of the state had been friendly to corporations. This principle has for some time found an example in New Jersey, where the tax requirements are so onerous that new capital keeps away from steam and electric enterprises alike. Thus, after all, it may turn out that the existing lines in some of these southern states will not eventually be hurt as much as they anticipate.

THE LAW OF LATENT DEFECTS.

A recent decision in the courts of the state of New York in which an interpretation is given of the law governing responsibility for mechanical defects of such a nature or so located as to make their discovery an impossibility under any ordinary system of inspection is of peculiar interest to those who have to deal with such matters in railroad rolling stock equipment. An investigation covering the whole range of decisions discloses the somewhat remarkable fact that reliance is placed in nearly every case subsequently decided upon a decision rendered in 1852 in Hegeman vs. Western Railroad Corporation, 16 Barbour, 353, and affirmed on appeal, 13 N. Y. 9, two justices, however, dissenting. The facts may be stated as briefly as possible: Plaintiff on September 9, 1850, was on his way from Greenbush to Boston. Near Hinsdale, Mass., the car in which he was seated was derailed and broken up by the breakage of an axle. Examination subsequently disclosed a firecrack 11 in. inside the wheel and about 16 in. from the middle of the axle, where the breakage occurred. The accident resulted in the death of three passengers and the plaintiff was permanently crippled.

An interesting side issue brought out during the trial was the existence of something known as a safety beam, which it appeared had been in use upon New York and New Jersey roads for some 10 or 12 years. The use of this beam it was said would prevent a broken axle from falling on the track or thrusting up against the car and a car could run a long time with a broken axle. Among the witnesses upon this point were Mr. Bradley, of the Bradley Car Works, and Mr. Bouton, master mechanic of the Watervliet arsenal.

In his charge the judge stated to the jury that defendant was responsible for all defects in the axle whether the car had been built by the railroad company or by an outside manufacturer, and it was for the jury to say whether the defect could have been discovered by investigation and remedied; that if the safety beam were capable of preventing serious results from such an accident it did not necessarily follow that defendant was liable because the device had not been adopted. It was for the jury to say whether defendant had been negligent in this regard. The jury gave a verdict for plaintiff for $9,900.

On appeal, the prevailing opinion held that defendant was responsible for damages if the defect could have been discovered in the process of manufacture by the application of any test known to men skilled in the business. The significant feature, however, of this decision was in sustaining this position in the charge of the trial judge: That although the defect was latent and could not have been discovered by vigilant external examination, yet if it could be discovered by a known test applied either by the manufacturer or by the defendant, the latter was responsible. The dissenting opinions were offered on the ground that the position of making a railroad company responsible for all defects whether discoverable or not was not tenable and it would be dangerous to establish such a rule. Another point of dissent was to the position that defendant was as responsible as if the car had been built in the company's shops. The manufacture of cars is a distinct business and the workmen employed are in no sense servants of the railroad company.

It is of interest to note in passing a citation from an earlier case that "a coach proprietor is liable for all defects in his vehicle which can be seen at time of construction as well as for such as may exist afterwards and be discovered on investigation; if not, he might buy ill-constructed vehicles and his passengers be without remedy." It was affirmed also that the degree of caution required in stage-coaching was not as great as in steam railroading where trains run at a high rate of speed, which, in this case, was shown to have been 25 to 30 miles per hour, or "the ordinary speed of passenger trains." The car was a new one and had been laid up during the two winters of its life because the company "did not want to deface it by putting stoves into it."

In the appellant's brief it was contended that carriers are not insurers and to hold them responsible for latent defects was tantamount to making them insurers. It is an impossibility for a railroad to do all its own work; it must depend upon others and the law will protect it against things which elude human sagacity. If greater care is required than in the case of the stage-coach, the passenger takes the risk for the benefit of the higher speed. The whole charge was characterized as "singularly inaccurate" and as requiring defendant to possess greater knowledge that was available at the time. Nevertheless, the judgment of the Supreme Court was affirmed.

In several other cases, notably in Palmer vs. D. & H. C. Co., 46 Hun, the rule laid down in the Hegeman case was sustained in every particular. In the case cited, the court said: "These cases sufficiently indicate and illustrate the views of the Court of Appeals of this state and of the Supreme Court of the United States with reference to the duty of railroad companies towards the passengers they carry on their trains."

But far more stringent is the doctrine laid down in Alden vs. New York Central, 26 N. Y. 102. In this case the accident was caused by breakage of an axle from a crack so concealed by the hub of the wheel as to be undiscoverable without removing the wheel. The Court of Appeals affirmed the judgment sustaining a verdict for the plaintiff. It adopted the rule of vigilance and care laid down in the Hegeman case, but suggested that the ground of that rule lay not in the negligence of the carrier but rather in that the carrier seems to be an absolute insurer of the passenger's safety.

The Alden case was, however, disapproved in McPadden vs. N. Y. Central, 44 N. Y., and the rule in the Hegeman case reasserted and followed with the limitation that the rule did not apply so as to render a railroad company liable for injury caused by the breaking of a sound rail by reason of extreme cold which could not have been anticipated or avoided by any human foresight.

In Brignoli vs. Chicago Great Western, 4 Daly 182, the defendant was held liable for a broken rail owing to a defective cross-tie. The car in which the plaintiff was a passenger overturned and his shoulder blade was broken without negligence on his part.

While none of these cases is especially remarkable of itself, a mention of them appears to be of value as indicating the closeness with which subsequent decisions have followed the Hegeman case. Notwithstanding the development in all lines of railroading since 1852 when there were less than 10,000 miles of railroad in the country, and when the precedent established by that case was itself supported upon precedents of stage-coaching days, the law so far as it relates to hidden defects in mechanical appliances in railroad equipment appears to have then been established beyond probability of disapproval.

Pennsylvania Railroad.

The Pennsylvania system now includes 11,176 miles of line, of which 6,078 are East and 5,097 West of Pittsburgh and Erie. The gross earnings of all lines East in the year ended December 31, 1907 were $216,000,000, and of all lines West for the same period, $110,000,000. Thus the total earnings of "all transportation companies owned, operated or controlled by or affiliated in interest with" the Pennsylvania were just under $327,000,000, an increase of $31,000,000, or 10 per cent., over the year 1906. Net earnings of all companies were $83,600,000, against $84,400,000 in 1906, a decrease of $700,000, or less than 1 per cent. During the year these lines carried 3,800,000,000 passengers one mile and 37,700,000,000 tons of freight one mile.

The Pennsylvania Railroad proper includes the cream of this immense system. The operations covered by the sixty-first annual report, just issued, are those of the 3,903 miles including trackage rights, directly operated by the Pennsylvania Railroad, of the total 6,078 miles of line east of Pittsburgh and Erie. These returns do not include the Philadelphia, Baltimore & Washington; the Northern Central; the West Jersey & Seashore; the Cumberland Valley; the New York, Philadelphia & Norfolk; the Baltimore, Chesapeake

& Atlantic, the Maryland, Delaware & Virginia, or the Long Island Railroad, all of which are east of Pittsburgh.

The lines directly operated are in five grand divisions. The Eastern Pennsylvania division includes 1,248 miles of line, made up of the main line and branches between Philadelphia and Altoona. The Western Pennsylvania division has 632 miles of line and includes the main line and branches between Altoona and Pittsburgh. The New Jersey division includes 475 miles of railroads, the ferries from Jersey City to Manhattan and to Brooklyn, two miles, and the Delaware & Raritan canal, 66 miles. The Erie division, the old Philadelphia & Erie, has 695 miles and runs from Wilkesbarre and Sunbury to Erie, on Lake Erie. The Buffalo & Allegheny Valley division has 830 miles and reaches Buffalo and Rochester on the north and Pittsburgh on the south. The lines directly operated, and these only, except for the New York & Long Branch Railroad, which is operated under special contract jointly with the Central Railroad of New Jersey and is included, are shown on the accompanying map.

The gross earnings of these 3,903 miles directly operated were $164,800,000 last year, against $148,200,000 in 1906, an increase of 11 per cent. But the Pennsylvania had the same experience as other railroads and operating expenses rose from $101,800,000 in 1906 to $119,600,000 last year, an increase of 17 per cent., which was larger in amount than the gain in gross earnings. Net earnings, in consequence, were $1,200,000 smaller than in 1906. To the 1907 net earnings was added the "other income," mostly income from investments and interest, amounting to $13,800,000, making a total fund of $59,000,000 available. After deducting from this, rentals paid to roads operated on the basis of net earnings, $4,900,000; taxes, $4,000,000, and other fixed charges, $16,600,000, there was a net income of $33,600,000, against $35,700,000 in 1906, a decrease of $2,100,000.

Dividends paid amounted to $21,900,000, against $19,900,000 in 1906. Payments of principal of car trusts amounting to $3,200,000 were made, as against $4,200,000 in 1906. There was a sharp reduction in the extraordinary expenditures, from $8,700,000 in 1906 to $3,300,000 last year, but in addition $2,500,000 was transferred to the extraordinary expenditure fund in each year. The year's surplus was $2,400,000, which was transferred to profit and loss, while in 1906 no part of net income was so applied.

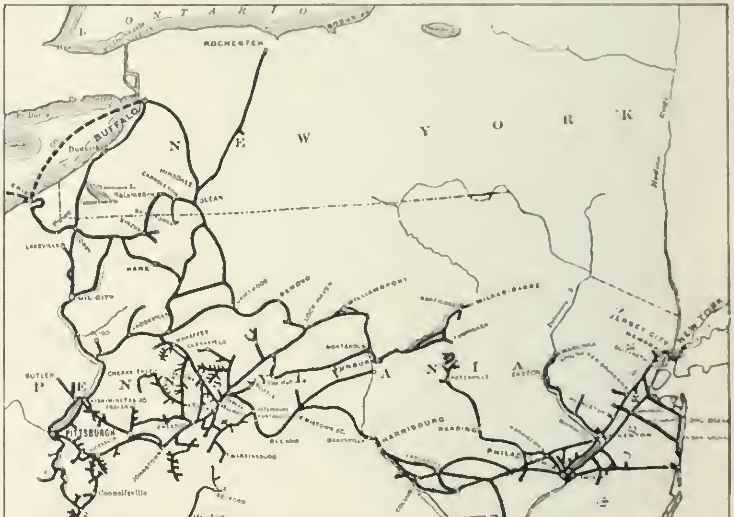
Profit and loss account was also credited with $1,600,000 received as profit from the stock dividend of the Northern Central, adjustment of value of securities owned in roads absorbed, and settlements of sundry accounts. In 1906 profit and loss was increased $15,200,000 mainly through the sale of Baltimore & Ohio and Chesapeake & Ohio stock. It is through this account that the New York tunnel line is being financed. There was $7,000,000 taken from this credit balance for this purpose in 1907 and $13,000,000 in 1906. In 1906 there was also $2,200,000 transferred from profit and loss to the extraordinary expenditure fund. As a result of these various adjustments, the profit and loss credit balance on December 31, 1906, and December 31, 1907, was the same—$24,700,000.

The cost of the New York tunnel extension to December 31, 1907, appears to have been $69,500,000, of which $39,500,000 is capitalized on the balance sheet and $30,000,000 has been charged against income and profit and loss. The present status of the work, as shown more in detail in our Railroad Construction column, is that the tunnels under the Hudson river are finished, the foundations for the station between Seventh and Ninth avenues at Thirty-second street are finished and work on the steel structure of the building has begun, the tunnel under Manhattan Island is nearly finished and two of the four tunnels under the East river have been joined, with every prospect that the other two headings will meet by the end of next month. There have been and will be substantial credits to the cost of the work from the sale of real estate not permanently required. From this source $1,600,000 was received last year, the main item in this amount being the payment by the United States Government for the post office site on Eighth avenue between Thirty-first and Thirty-second streets.

President McCrea sums up the operating results of the year as follows:

"There was a heavy increase in the volume of freight traffic until December, the tonnage and ton mileage for the year showing a large gain and the revenue, an increase of more than 12½ per cent. over the previous year; but there was a material reduction in the gross and net earnings per ton mile. While the increase in the passenger traffic was much below the percentage shown in 1906 over 1905, being but 9.13 per cent. as against 14.41 per cent., the gross revenue therefrom increased barely 4½ per cent., as compared with a gain in 1906 of 14 per cent. over 1905. The expenses, also, were largely increased, the cost per passenger mile showing an increased percentage of nearly 13 per cent. and the cost per train mile an increase of nearly 17 per cent. As a result there was a reduction of nearly one-third in the net earnings per passenger train mile; and while this was due in part to a more accurate distribution of expenses as between freight and passenger traffic, it was clearly shown that the lower fares which prevailed during part of the year had not stimulated traffic to the extent necessary to offset the loss of revenue and the higher cost of operation due to the increase in wages and cost of supplies. It may be noted that the average rate received on the entire system during the year was less than two cents per mile."

The detailed operating expense accounts are made up in a peculiar way, as a result of the changes in classification made by the Interstate Commerce Commission on July 1, 1907. Each sub-heading which is the same under the old and the new classification, is shown for the full year. On the other hand, sub-accounts which were changed by the new classification are shown under the old heading for the first half of the year and under the new heading for the second half. For instance, under maintenance of way, engineering and superintendence covers one-half of the year and superintendence the other half. Under maintenance of equipment, depreciation accounts are shown for the second half of the year. Depreciation on steam locomotives amounted to $275,000, on passenger train cars $267,000 and on freight train cars $2,000,000. Conducting transportation has disappeared, and in its place are the two accounts, traffic expenses and transportation expenses abbreviated in the general summary to "traffic" and "transportation."



Pennsylvania Railroad.

Lines East of Pittsburgh and Erie directly operated.

Maintenance of way per mile operated cost $5,192 per mile, against $4,378 in 1906; repairs, renewals and depreciation of equipment (no renewals of steam locomotives) cost $3,315 per locomotive, against $2,652 in 1906; $1,381 per passenger car, against $1,144 in 1906, and $118 per freight car, against $103 in 1906. There were 7,728 cars bought during the year, which with 2,540 other cars bought for the Lines West were provided for by $11,900,000 of new car trust securities. At the close of the year the Pennsylvania Railroad owned 3,210 locomotives, 2,070 passenger train cars and 128,024 freight cars. No new locomotives or passenger cars were acquired during the year, but the number of freight cars available for service rose from 119,036 on December 31, 1906.

One of the most remarkable results shown is an increase of over 40 per cent. in the tonnage of the combined Eastern and Western Pennsylvania divisions, which carried 142,000,000 tons, against 101,000,000 tons in 1906. The increase in tonnage carried by the five grand divisions was 12 per cent., and the increase in ton mileage 16 per cent., which was handled with an increase of only 7 per cent. in freight train mileage.

Mr. McCrea sums up the company's policy for the immediate future and the present business situation as follows:

"In pursuance of the policy announced in the last report, the expenditures for the year were confined almost exclusively to completion of work actually under way; and it is gratifying to note that with the exception of a part of the relief freight lines for which no present necessity exists, substantially all the improvements outlined in the report for 1902 as essential to put the road in condition to meet the legitimate demands of its traffic have been completed. As a result, the average daily mileage of freight cars moved over its lines increased about 20 per cent. between 1903 and 1907. The expenditures for the present year will be practically confined to finishing the work now in progress on the main line and to the tunnel extension to and through New York and the terminal station in that city.

"The prosperity which had existed for a number of years in all branches of industry and which had so exceptionally increased the traffic on the railroads met with a severe check in November last, which is now largely affecting the revenues of the system. While a number of causes seriously disturbed public confidence and thus brought on the financial panic which has so sharply affected the business interests of the country, an important one undoubtedly was the fear that, as the result of recent federal and state legislation, the regulation of the railroads had approached so nearly to an effort to control their management and revenues, that the investments therein were not assured of that protection to which they are justly entitled. Eventually, it may be assumed, the questions that arise will be fairly adjusted, but in the meantime the railroads have to face the loss of revenue consequent upon the enforced idleness of a large portion of their equipment, while to a proportionate number of their employees this has necessarily brought about either an entire loss of employment or a material reduction in the hours of labor."

A summary of Mr. McCrea's remarks about the various construction projects of the company and its affiliated lines will be found in the Railroad Construction column.

The following table shows the operating and income results of the Pennsylvania Railroad, including only the lines directly operated:

	1907	1906.
Mileage worked	3,903	3,897
Freight earnings	$123,826,165	$109,960,888
Passenger earnings	32,623,889	31,231,338
Gross earnings	164,812,826	148,239,882
Maint. way and structures	20,265,845	17,060,498
Maint. of equipment	31,721,614	26,201,245
Traffic expenses	2,034,705	1,772,012
Transportation expenses	61,835,024	53,504,168
Operating expenses	119,607,348	101,805,641
Net earnings	45,205,477	46,434,238
Other income	13,794,106	12,784,262
Net earnings and other income	58,999,583	59,218,500
Net income	33,575,056	35,674,301
Dividends	21,908,436	19,869,661
Principal of car trusts	3,150,694	4,246,039
Extraordinary expenditures	3,260,651	8,701,475
Transferred to extraordinary expenditure fund	2,500,000	2,500,000
Year's surplus	2,351,424	....
Applied from profit and loss to New York tunnel line	7,000,000	13,000,000
Applied from profit and loss to extra. expenditure fund.	....	2,200,849

NEW PUBLICATIONS.

Air-Brake Catechism. Twenty-first edition; revised and enlarged. By Robt. H. Blackall. New York: Norman W. Henley Publishing Co. 375 pages; 5 x 7 in.; 131 illustrations. Cloth. Price, $2.00.

Perhaps the most salient feature of this book is the fact that the text and illustrations are confined exclusively to apparatus made by the Westinghouse Air-Brake Company. The discussion is confined to practice on this side of the Atlantic, where the author has gained his experience. As its name indicates, the work is in the form of a catechism, and the questions and answers are couched in simple language, readily understood even by those who are not in the habit of acquiring information from books. In its arrangement the catechism follows the chronological order of the development of the brake itself, starting in with the very simple construction of the straight-air design, as first introduced, and proceeding through the plain automatic, the quick-action, the high speed and the new "K" triple valve that is now superseding the earlier form of quick action triple valve. In this way the reader is led on from the simple to the complex, in construction and action, just as the railroads have been led on in the use of the air-brake itself. Thus the book represents the evolution of the brake, and it would be exceedingly difficult for a novice in any other way to grasp the complexities of the operation of the latest developments, though it becomes comparatively easy to do so when led up to it, step by step, provided, of course, that close attention is given.

The book deals not only with the air-brake mechanism and operation in themselves, but takes up the auxiliary apparatus, such as the brake slack adjusters, the hanging of brake-shoes, the water brake, the Sweeney compressor, the air signal and the calculation of leverages.

The general description of the apparatus is either followed or accompanied by instructions regarding the operation and maintenance, including inspecting and testing, together with an outline and indication of the principal causes of trouble with the system. Here much detail must necessarily be omitted, otherwise the one volume would be expanded to a dozen or more, as would be indicated by a reference to the reports of the Air-Brake Association. Still there is enough to serve as a reliable guide for practical, everyday work, whether on the engine, in the cars or on the track as inspector. As a whole, the book serves as a striking object lesson of the magnitude and importance of this branch of the railroad service; a branch which, in the eyes of the general public, is only seen in a vague and indefinite way and then usually in connection with a disaster.

The weak point in the book is one common to many of its class, and it lies in the index. This is incomplete, in that some things in the book are not mentioned at all, while others would be made much more available by a better cross-indexing. If a book is to be used for quick and ready reference the short-comings of the index will quickly make themselves known. With this exception, however, the design and arrangement of the book is to be heartily commended.

Table of Quantities for Preliminary Estimates. By E. F. Hauch and P. D. Rice. New York: John Wiley & Sons. 92 pages; 4 in. by 6½ in.; cloth. Price, $1.25.

This book contains a series of tables of quantities contained in 100-ft. sections with roadbed widths of from 12 ft. to 32 ft. varying by 2 ft. and for a width of 35 ft. These are worked out for side slopes of ¼ to 1; ½ to 1; ¾ to 1; 1 to 1; 1¼ to 1, and 1½ to 1. These are followed by tables of toe slopes for the same widths of roadbeds and for slopes of 1¼ and 1½ to 1. In all cases the quantities are estimated for heights running from 0 to 50 ft. at 1 ft. intervals and for transverse slopes ranging from level to 35 deg. on 5 deg. differences. At the back of the book there is a table of cubic yards based on calculations made from the sum of end areas for lengths of 100 ft.; a table of decimals of a mile expressed in feet; one of acreage for a right-of-way 100 ft. wide; one of chains reduced to feet; another of feet reduced to decimals of a chain, and a table of fractions of an inch in equivalent decimals.

The tables have been prepared to meet the requirements of the locating engineer, and the calculations were made for each successive value of the height by means of differences that checked with the calculation of the final height, so as to avoid all possibility of mistakes. In making these calculations, five (and in some cases seven) place logarithms have been used, and it is believed that the tables are correct to the nearest cubic yard.

Statistical Tables. Information Relative to American Railroad and Industrial Companies, and Details of Securities Dealt in on the New York Stock Exchange. 84 pages; 3¼ x 5¼ in. Published by Spencer Trask & Co., Bankers, New York. 1908 edition.

The bankers who prepare this handbook for distribution, free of charge, to their customers and prospective customers, have done a thorough job in small space. The tables show at a glance the principal points on which an investor wants information, and cover a wide range of investments.

The Men Who Sell Things. By Walter D. Moody. Chicago: A. J. McClurg & Co., 1907. 295 pages; 5 x 7 in.

This breezy little book is described as containing the observations and experiences accumulated by the author in over 20 years as traveling salesman, European buyer, sales manager and employer. It is exceedingly easy to read, and in a rather slangy, narrative style, brings out a good many ideas which ought to be helpful to young salesmen.

CONTRIBUTIONS

Late Trains.

New York, March 2, 1908.

To the Editor of the Railroad Gazette:

There is an unconfirmed rumor that the New York Public Service Commission of the Second district is going to try to cure that crying evil, the late train. Whether with this end in view or not, the railroads have recently been ordered to make an itemized report each month of the number of delayed trains, the length of the delay and the causes. Primarily this is a report of engine failures, and there is a list of 53 items classified under the general headings of heating or hot bearings, steam failures, leakages, breakages and miscellaneous causes. The inference to be drawn from the arrangement of the report is that engine failures in one form or another, are responsible for the majority of train delays. But in order that the showing may be complete, there are three causes of delay that, under a rigid interpretation, may be made to cover all others outside of the engine failures. These are heavy trains, terminal, and other causes. These reports will necessarily throw light on train delays and the reasons for them and certainly there is need for some such independent gathering of the facts. This evil is surely capable of being remedied. The rolling stock in use is as a whole not in such a dilapidated condition that it cannot be run over a division without a breakdown. If, then, it can do this, the trouble must be looked for in a schedule faster than the engine can make, in such defective terminal facilities that trains cannot be run through the yards, or in inadequate train and station crews for expeditiously handling passengers, baggage and express. The natural remedy would be either to cut the schedule speed down till it comes within the limits of the facilities or to increase the facilities. As matters stand, except on a few roads, notable exceptions, it is the general expectation of the public that trains will be late. People merely wonder how late. If the Public Service Commission can reform this state of affairs it will have done a very great thing toward establishing itself in public favor. It will have brought about a lasting and substantial service to the railroads as well, by removing one great cause of irritation that has contributed much toward the unpopularity of railroad corporations.

TRAVELER.

The Subway Car.

[There was published in the *Railroad Gazette* of February 28, 1908, part of a report to the Public Service Commission for New York City by Bion J. Arnold, Consulting Engineer, on subway cars. This part of the report covered the general discussion of the problem of handling the traffic in the present subway operated by the Interborough Rapid Transit Company, a description of the recommended type to which the present subway cars should be converted to get maximum efficiency, and Mr. Arnold's general recommendations. The rest of the report, which follows, is a discussion of the various types of cars which can be used in rapid transit work and the various kinds and arrangements of seats in them. In order to start the argument intelligently, the brief summary of the desired requirements for a successful car and of the classification of the various cars is repeated.—EDITOR.]

TYPES OF SUBWAY CARS.

A successful car for the present subway should possess as many as possible of the following requirements:

1. Separate entrances and exits.
2. A space which can be cleared so as to be ready to quickly receive the passengers boarding a car.
3. Convenient means of circulation inside a car.
4. Standing-room space contiguous to the exits.
5. As many cross-seats as practicable.
6. Exit and entrance doors sufficiently removed from each other to allow for the car's stopping convenient to guiding rails on the platforms.
7. Doors located so as to minimize the danger from open spaces at curve platforms.

The various cars may be classified in accordance with the number of doors in the sides of the cars as follows:

Cars with central side doors and end doors.
Cars with two quarter side doors.
Cars with three doors near center.
Cars with multi side doors.
Cars with double doors near ends.

Each one of these types may have seats of either the longitudinal, the cross "back-to-back," or of the "walk-over" style, or a combination of two or more styles, as will be shown more in detail as the cars are described.

CARS WITH CENTRAL SIDE DOOR AND END DOORS.

It has often been suggested that cars provided with an additional door in the center of each side would at once do away with the conflict of passengers which now takes place at the present end doors of the cars, and at the same time, by providing additional door space, materially reduce the station waits.

The present cars could be altered to provide central side doors. I have made a number of studies of details of construction and general arrangement of seats applicable to a car of this type. I find that at present the all-metal cars can be rebuilt at an expense of $2,000 per car, and the composite cars altered at a cost of $1,500 per car. A drawing of the present car before and after being altered to a car with central side doors is shown in Fig. 1. These figures contemplate the reinforcing of the sides of the car and the trussing of the under frames in such a way as to leave the changed cars practically as strong as the present car. The weight in both cases will be slightly increased by the introduction of the central side doors in the present car.

Cars of this type have been in use on the Brooklyn Bridge shuttle trains for many years. They have recently been introduced for subway and elevated service in Boston and Philadelphia, and have been adopted by the Hudson & Manhattan Railroad for use in the new tunnels between Manhattan and Hoboken. The Hudson & Manhattan cars are fireproof cars with central side doors and at the same time weigh less than the present subway end-door cars, demonstrating that, if desired, future cars can be built with central side doors without excessive weight and at the same time possess the fireproof qualities desirable for subway cars.

In the Brooklyn Bridge shuttle-train service, the cars were unloaded to one platform and then loaded from a separate platform, thus avoiding the conflict of passengers, which is such a noticeable feature of the subway. The advantage of the center door in this case was simply that of additional door space, and for the Brooklyn Bridge conditions the location of this extra door space in the center of the car side was most advantageous. At the time the shuttle trains were abandoned on account of running the Brooklyn Elevated trains directly into the Manhattan terminal, the lack of this extra door space in the present elevated cars was decidedly noticeable, emphasizing the fact that the cars of the single-end door type are not adapted for handling the New York City rush-hour crowds. No difficulty in connection with maintaining a circulation of passengers was experienced with the central door cars because of the separate loading and unloading platforms,

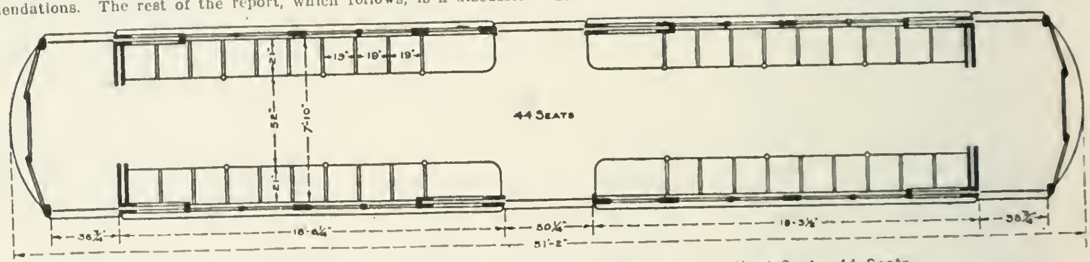


Fig. 2—Car With Central Side Door and End Doors. Longitudinal Seats, 44 Seats.

so that little can be learned from the operation of these cars on the Bridge that can be applied to the study of the car problem of the present subway.

In Boston conditions are more nearly similar to the subway service, although the excessive transfer of passengers at the stations is lacking. In many stations, however, passengers now enter and leave the cars, using the same station platform, and, in order to avoid the conflict between these two streams of passengers, an effort was made, when the central-door cars were first put in commission in Boston, to set up a circulation by making it the rule for passengers to enter this car at the end doors and leave by the center door. Signs were posted in the cars, and at the same time the car guards and station attendants were instructed to carry out this regulation, but the effort has proved futile. It has been found that the Boston passengers could not be controlled sufficiently to maintain this much-desired circulation. Some passengers would persist in getting off through the end doors, while others would insist on getting on the cars through the central doors, thus causing considerable annoyance to passengers who were endeavoring to obey the rule, and ending generally in confusion. The operation of the cars in actual practice, therefore, has finally resulted in partially reverting to the old plan of allowing passengers to leave and enter the same door. Under these circumstances the extra door in the side of the car has reduced the conflict of passengers by providing additional door area, resulting in somewhat decreasing the station waits, although the time of these station waits has not been reduced much below that found in the present New York subway.

With the Boston experience in mind, it is hard to see how the car of the central side-door type would greatly relieve the New York subway conditions, on account of the usual excessively congested condition in the cars during rush hours. When a passenger boards one of these crowded cars with the intention of getting off at the next station, he should not be compelled to push himself through the standing passengers in the car in the short time which it takes to run between stations, and even if this circulation in the car could be maintained, the movement of the passengers from the end door to the central door would become an objectionable feature, causing nearly as much discomfort to the passengers and delay to the trains as the present method of operation with the single end doors. It would, therefore, seem that to attempt to compel all passengers to maintain circulation by entering the end doors and leaving by the central door would not be effective under the congested condition of the present subway.

The Hudson & Manhattan cars will operate under conditions very similar to the Brooklyn Bridge terminal service; that is, a large majority of the passengers will get on the cars at the stations at one end of the line and get off at the stations at the other end. In such service it is not essential to maintain a circulation of passengers in the car, as the transfer privilege is not a factor to be contended with. Under these circumstances, the central side door, cutting down as it does the average length of time required by a passenger to reach a seat, and at the same time furnishing a wider door space, will add materially to the comfort and speed with which the passengers can be handled. The successful use of the central side-door car in terminal work, however, does not furnish a precedent which demonstrates that this type of car

ever, are not available for use with the present subway car, and the introduction of an additional door in the center of the present car would therefore mean the use of a sliding platform at a number of the stations where the cars stop at curved platforms of which the edges next to the car are concave.

The present platforms have been built of sufficient length to serve only one door of each end car of each train, and the end cars therefore lap over the end of each platform. To get the full benefit of the introduction of central doors in the sides of the cars, it would be necessary to extend each platform at least 50 ft. There are no difficulties, however, in accomplishing this extension, except the matter of expense, which would be considerable, on account of the inconvenience of carrying on the work and at the same time keeping the subway trains in operation, but this expense and inconvenience could not, in my judgment, be justified by the advantages gained.

With the central side-door car it would be expected that the train guard, who now opens and closes the doors from his position between two cars, would experience difficulty in operating the addi-

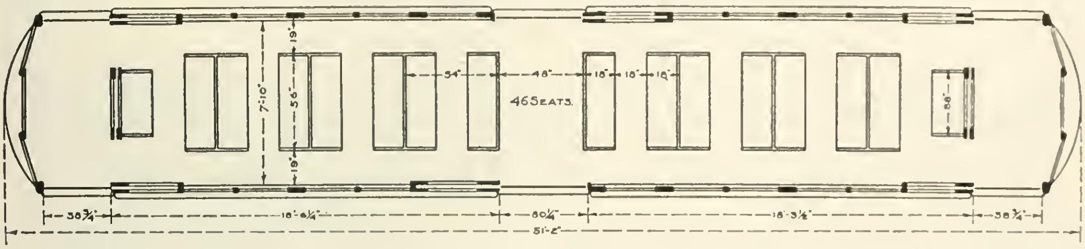


Fig. 3—Car With Central Side Door and End Doors, Using Present Subway Car Body. Cross Seats Back to Back With Two Aisles, 46 Seats.

would be satisfactory under subway conditions, whereas the failure of the center-door car on the Boston subway to reduce the length of stop to much less than the time required in the New York subway even with the present end-door cars, does not furnish any encouragement toward rebuilding the present subway cars so as to provide them with central doors.

The difficulty of operating the central side-door car in the present subway with curved platforms at many stations has been often pointed out by the subway officials. There is no doubt that the use of these curved platforms, even with the present type of car, is a source of danger and the cause of considerable delay, both of which could have been avoided if the platforms had been built with straight edges.

The stations at which the curved platforms would give trouble with a central door in the side of the car are shown by the follow-

tional center doors, particularly during rush hours, but as station attendants are now provided at express stations for handling passengers at times of heavy traffic, this difficulty should not be serious.

Several possible arrangements of seats with a central side-door car are shown in the accompanying drawings. The number of seats above the established minimum of 40 indicates at once the increase over the present seating capacity secured by each car.

CAR WITH CENTRAL SIDE DOOR AND END DOORS.
Figure 2.
Longitudinal Seats.
(44 Seats.)

The seating arrangement in this car is similar to that used in the Hudson tunnels, the Boston and the Philadelphia subways, and the Brooklyn Bridge cars. Side doors can be introduced in the

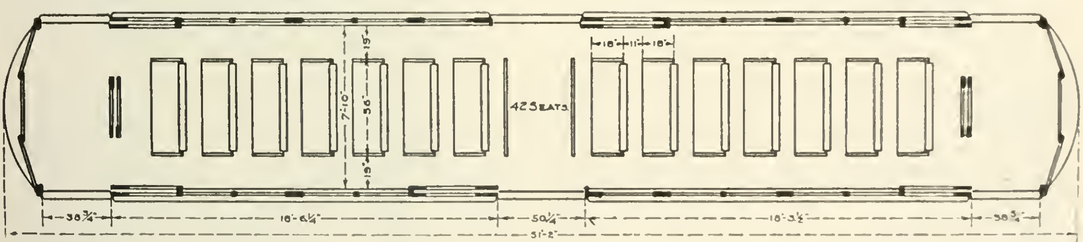


Fig. 4—Car With Central Side Door and End Doors, Using Present Subway Car Body. Cross Seats of "Walk-Over" Type With Two Aisles, 42 Seats.

ing table, which also gives the minimum radius of the platform curves and the width of the open spaces at the center of the car between the platform and side of the car:

Station.	Minimum radius of platform curvature.	Width of spaces bet. car and platform at center of car.
City Hall	147 ft.	26 in.
South Ferry	191 "	24 "
Fulton St.	250 "	16 "
Brooklyn Bridge	410 "	12 "
Worth St.	480 "	10 "
14th St.	485 "	10 "
Times Square	452 "	11 "
177th St.	470 "	10¼"

At many of these stations, if a central door car were used, it would be necessary to provide a sliding platform similar in operation to the ones used in the Boston subway, and also at the South Ferry station of the Manhattan Elevated. In future subways it is possible to obviate the necessity for these sliding platforms either by avoiding the use of a curved platform or by designing the under framing of the car in such a way that the station platforms could project under the car body. These solutions, how-

present subway cars, as indicated by Fig. 1, which shows the plan of the present car altered to a car with a central side door.

This design contemplates the removal of all cross seats in the present car. A number of partitions can be placed between the seats, as is done in the Hudson tunnel cars, which will compensate in a degree for the removal of the cross seats. The vertical hand rods can be introduced, which will be more convenient for the support of standing passengers than the usual straps. With the circulation idea maintained, the distance which each passenger must move in getting to and from a seat is the same in every case, so that with this car all passengers are treated exactly the same, and there is no advantage of position or comfort to be secured by crowding.

This car allows the most effective arrangement of seats and standing room that can be devised. All seats are equally good, thus removing the objection of having three kinds of seats, as found in the present subway car. The rates of acceleration and retardation in the subway, although rapid, are accomplished smoothly, and very little fault can be found with longitudinal seats, although it must be admitted that seats of this kind are not as popular as cro[illegible] seats.

CAR WITH CENTRAL SIDE DOOR AND END DOORS
Figure 3.
(Using Present Subway Car Body.)
Cross Seats Back to Back with Two Aisles
(16 Seats.)

This car combines a car of the central side door type with the style of seating used in the Illinois Central suburban car Two seats more per car than is provided by the longitudinal seat plan are secured by this arrangement, but at a considerable sacrifice in the efficiency of the standing room. The location of the standing room in the center of the car next to the exit will have a tendency to make passengers "move up in the car." The backs of the seats at this point will give something solid to lean against, thus making this standing space somewhat more comfortable than in the longitudinal seat car.

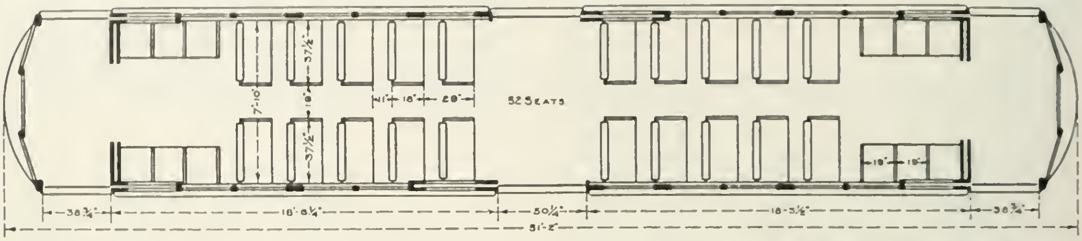


Fig. 5—Car With Central Side Door and End Doors, Using Present Subway Car Body. Cross Seats of "Walk-Over" Type With One Aisle, 52 Seats.

Half of the seats in this car "ride backward," and this may be considered objectionable by some passengers. In the subway, however, riding backward is not as uncomfortable as in a car running in the open. In the subway the eyes are occupied with objects inside the car, while in a surface or an elevated car a disagreeable sensation may be caused to a passenger riding backward by looking at objects which are receding from him. Owing to the use of seats of the "back-to-back type" on the present subway cars, on many of the elevated cars, and on Pullman coaches, the public is becoming educated to ride backward, and the fact that seats of this type do not involve turning over at stub-end terminals gives this arrangement quite an advantage from an operating standpoint.

Owing to the narrowness of the aisles this car is not well adapted for the easy circulation of passengers during rush hours.

CAR WITH CENTRAL SIDE DOOR AND END DOORS.
Figure 4.
(Using Present Subway Car Body.)
Cross Seats of "Walk-Over" Type with Two Aisles.
(42 Seats.)

In this car all seats are arranged so that passengers can "ride forward," which will make it necessary for the train guards to turn the backs of the seats at all stub-end terminals. It will be necessary to limit the space between seats to 29 in in order to provide a central standing room space as well as a cross-over aisle at each end of the car If a greater space between seats is allowed, either this standing room must be reduced and the aisle removed, or some of the seats sacrificed. In any event the car cannot be made to compare favorably with the "back to back" cross seat type.

To make the center seat of a bank of three seats acceptable, it must be made easy of access and egress, as the passengers naturally take the outside seats first, which makes it inconvenient to get in and out of the center seat To use the "walk-over" type of seats therefore, with two aisles, would practically mean a reduction of seating capacity of this type of car to 36 seats, instead of the 42 seats, shown in Fig. 3. The inefficient use of room, therefore, with the "walk-over" cross seats and the extra care required for the operation of seats of this type are objections which would prevent the adoption of such a car.

CAR WITH CENTRAL SIDE DOOR AND END DOORS.
Figure 5.
(Using Present Subway Car Body.)
Cross Seats of "Walk-Over" Type with One Aisle.
(52 Seats.)

If a single aisle is used a very satisfactory seating capacity with the present subway car fitted with central side doors can be obtained by using cross seats of the "walk-over" type, spaced in the car without reference to the present windows. The seat spacing can be rearranged much better with the seat of the "walk-over" type than with a seat of the "back-to-back" type, as the former is not required to fit the framing of the car

The average passenger appears to prefer a "front-facing" seat, and this car provides the maximum number of seats of this kind If a sufficient number of cars could be passed through the subway to keep the standing passengers down to 50 passengers per car, there is no doubt that a car of this type would give excellent satisfaction, but as soon as this car is called upon to carry 100 passengers standing in addition to 52 seated passengers, the congestion in the long, narrow aisle will slow down the movement of passen-

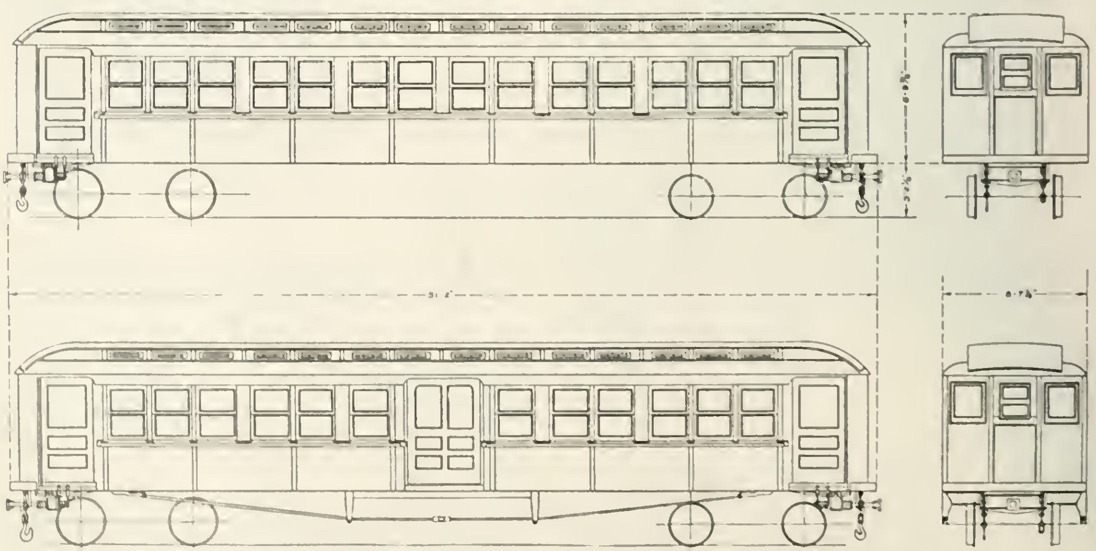


Fig. 1—Present Car Before and After Being Altered to a Car With Central Side Doors.

gers inside the car, and the car would then unload slowly and neutralize the advantages gained by the introduction of the central door.

CAR WITH TWO QUARTER SIDE DOORS.

On roads where the traffic is not as heavy as in the subway, a type of car with two doors, each located about one-fourth the length of the car from the end, is sometimes advocated. This type of car would have as many doors as the present end-door car, but the doors dividing the car into quarters would give the quarter-door car the advantage of providing the shortest average distance from the door to the seat. This car would therefore cause the passengers to occupy the center of the car and thus use the entire length of the car more effectively than it is now used in the present end-door type.

With cars of this type, each door should be of double width, if it is to accommodate subway traffic, so that two streams of passengers could pass through the doors at the same time; that is, at each quarter of the car there would be practically two doors. The circulation may be provided for by using one set of doors as entrances and the other set as exits. There would be no objection to a division post in the center of the double door with this type of car, as the door openings are large enough to require two separate doors, each of which could close toward the dividing post, and thus do away with the danger of a sliding door opening past the middle post. Owing to the distance of the doors from the end of the car the same difficulties at curved platforms would be met that are encountered with the center door car.

The location of the train guards would be a problem with this type of car, as these guards could not work to advantage from between the cars as at present. If the guards are moved into the car their most effective location would be at the center of the side of the car, from which position they could not only control the movement of the doors but also encourage the circulation of the passengers from the rear toward the front exit door.

CAR WITH TWO QUARTER SIDE DOORS.
Figure 6.
Longitudinal Seats.
(44 Seats.)

It would be difficult to alter the present car frame so as to introduce the wide doors shown in Fig. 6 without making the car considerably heavier than at present or sacrificing its structural strength, and this latter expedient would not be advisable.

Except for the fact that all the passengers entering one car must gather at one place on the platform, and that, therefore, the inevitable crush would take place in loading, this type of car has many advantages. This car, however, would work much better during non-rush hours than during rush hours. It would be difficult to maintain a circulation of passengers in one door and out the other as soon as the space in the car between the doors became filled with standing passengers. As soon as passenger on the platforms desiring to enter the car became blocked at a time when the exit doors were empty and open, there would be a rush to board the car through the exit doors, as has been proven by the experience with the Boston public. The only way to control the circulation with this car would be by means of platform railings. At stations where it is desirable to divide the Broadway passengers from the West Farms passengers, as is now done at Grand Central, this type of car would not lend itself to a satisfactory division of the platform space, as the doors would bring the passengers leaving one train in conflict with passengers on the platform waiting for the next one.

CAR WITH QUARTER SIDE DOORS.
Figure 7.
Cross and Longitudinal Seats.
(48 Seats.)

A certain number of cross seats could be introduced in the quarter-door car, and these cross seats could be placed to advantage in the ends of the car. Such an arrangement would leave the central part of the car free, so as to provide the two open standing spaces contiguous to the entrance and to the exit doors. The location of the cross seats with the one central isle at both ends of the car leaving the two standing spaces near the doors connected by a broad aisle between the longitudinal seats in the center of the car, is an arrangement which should materially assist the circulation in the car from entrance to exit. Passengers who are slow in leaving the cross seats in the rear of the car would no doubt have some trouble in reaching an exit, as they would encounter the stream of entering passengers.

Either type of cross seat could be used with this car, though there is some preference for the "back-to-back type," as the back of such seats would present a substantial support convenient to the door openings. The vertical post idea could be advantageously used to make the standing room in this car comfortable.

If future subways could be built sufficiently in advance of the demand for them, this type of car could be used to good advantage, and cross seats could be substituted for longitudinal seats. Under present conditions, however, there would be a temptation to move in the other direction and fold up the longitudinal seats during rush hours, thus providing increased standing capacity.

CARS WITH THREE DOORS NEAR CENTER.

The objections to a car with a central side door, on account of the difficulty which might be experienced by the train guard in controlling the center door from his position between the cars, could be removed by locating the end doors nearer a central door, thus providing practically a large door in the center of the car with two smaller doors, one between the center and each end of the car. This arrangement would also be an improvement over the quarter-door car, as with three doors the moving passengers would be divided into three groups instead of two.

This car should be provided with a separate guard for each car, and this guard should be located so that he could see along the side of the car in one direction, and thus be in a position to quickly close all doors at once.

A circulation with this car can be set up in either direction. In maintaining a circulation, however, this car would not have the advantage of a space such as a platform which could be cleared of passengers while moving between stations, so as to provide an

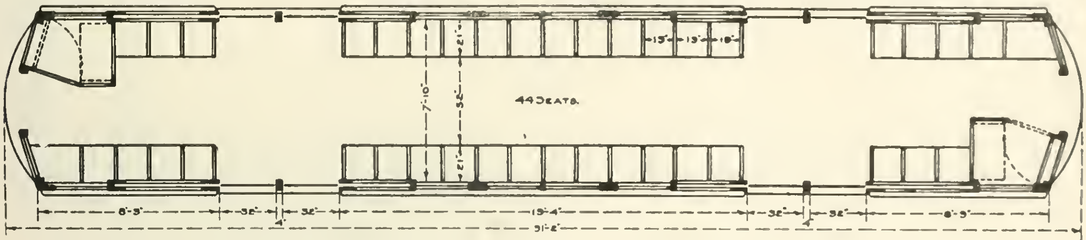


Fig. 6—Car With Two Quarter Side Doors. Longitudinal Seats, 44 Seats.

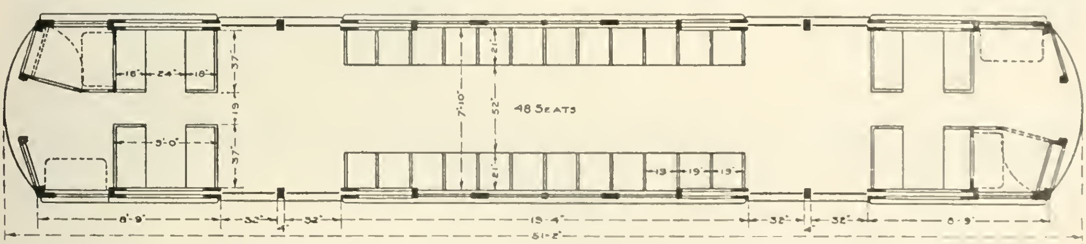


Fig. 7—Car With Quarter Side Doors. Cross and Longitudinal Seats, 48 Seats.

opening space for the entering passengers, as with cars of the end-door type.

The door openings being on the center and near the quarter lines of the car, would lend themselves conveniently to an effective system of platform guard rails, but the center door would be a disadvantage at curved platforms.

CAR WITH THREE DOORS NEAR CENTER
Figure 8.
Longitudinal Seats.
(44 Seats.)

This car is similar to the present end-door car fitted with an additional center side door, with the exception that the end doors are located much nearer the central door. The nearer these end entrance doors are brought to the central exit door, the easier will it be to maintain a circulation in and out of the car through the separate doors.

The location of the end doors at the quarter division points of the car, or even nearer to the central door, is practically the only way that the central door can be used with success in the subway, as a comparatively easy means of reaching the exit must be provided. Otherwise a passenger boarding a car when it is crowded will either find it impossible or will refuse to crowd his way through the standing passengers in the car in order to reach the regular exit, and will insist on leaving the car by the door he entered. As soon as one exemption is allowed to the rule of "in one door and out the other," confusion will at once take place, and the advantage of having the passengers move together in a predetermined way without hesitation will be lost.

This car lends itself to the longitudinal seat plan throughout its length, as there is not enough space in the ends of the car for cross seats, and it would be a mistake to limit the connecting space between the doors by the introduction of an aisle or aisles serving cross seats.

CAR WITH THREE DOORS NEAR CENTER.
Figure 9.
Combination of Cross and Longitudinal Seats.
(44 Seats.)

In order to make room for cross seats in the ends of a car of this type, and at the same time provide the shortest distance possible between the entrance and the exit doors, a large double door may be placed in the center of the car, to be used for an entrance, and two smaller doors at each side to be used for exits.

The circulation in this car would be in the opposite direction to that shown with any of the other cars. The passengers would gather at one place on the station platform ready to enter this car, and would quickly pass through the large double doors. The passengers leaving the cars from the cross seats would not encounter a stream of entering passengers.

The seating capacity of this car is liberal, and the location of the standing room is convenient and efficient. All the doors can be controlled by a guard centrally located where he can see the moving passengers, and to a large extent control their movements.

The troubles with the curved platforms, and the structural difficulties of adapting the present car frame to this design, are serious disadvantages to the use of a car of this type with the present subway.

CARS WITH MULTI SIDE DOORS.

Cars of this type are in successful use in the suburban service of the Illinois Central in Chicago. These cars are 72 ft. long over all, and 10 ft. 6 in. wide over the sheathing. There are 12 sliding doors on each side, opening on a level with the platform, and two doors on each side, opening to steps which are used at stations where there are no high platforms. There are end doors, so that passengers may pass from car to car in the train, and the cars are not provided with extension platforms.

The doors are operated by the train guard from the inside of the car, the operating mechanism being designed so that when the car stops at the station platform the train guard on each car unlocks the doors by means of a single wheel, leaving the doors to be opened by the passengers. Before starting from the station the movement of the operating wheel by the guard in the reverse direction closes the doors which have been opened, and at the same time locks all the doors. When the edge of the door is within 3 or 4 in. of the jamb it stops, and then moves slowly forward to the closed position, the purpose of this being to allow any passenger who may be caught in the door to move aside. An electric signal apparatus is connected with the doors so that a signal is automatically transmitted to the engineer when the last door in the train is closed.

Seats are provided for 100 passengers, 50 facing in each direction, and there is an aisle on each side of the car between the seats and the doors so that passengers entering any door may pass down the aisle to any seat. The seats were originally all of wood, but were found to be uncomfortable, and were changed to rattan. In general, this car has given satisfaction, the principal objections apparently being in regard to the size and the shape of the seats and their arrangement in the car. Some objection is also made to the lack of ventilation in the summer. The problem of heating the cars in winter has not proven to be a serious one, as ample steam coils taking steam from the locomotive are provided under each seat. Under subway conditions it would be better to have the door mechanism designed so as to open all the doors simultaneously, as some delay is now occasioned by passengers hesitating to open the doors.

THE MULTI SIDE-DOOR CAR AND THE PRESENT SUBWAY.

The present length of the subway cars would allow for a maximum of 8 side doors, or for four times as many doors as at present. The present end doors, each about 38 in. wide, or a total door area of 76 in. for each side. With 8 side doors, each 25 in wide, there would be a door opening of 200 in. per car, or nearly three times the door space provided in the present car. The best that could be expected of the multi side-door car, as far as reducing the time required at present for unloading and loading the passengers is concerned, would be to have this time cut down to one-third the present amount.

In order to determine the efficiency of this type of car I have had a large number of observations made of the Illinois Central car in actual operation. The density of traffic on the Illinois

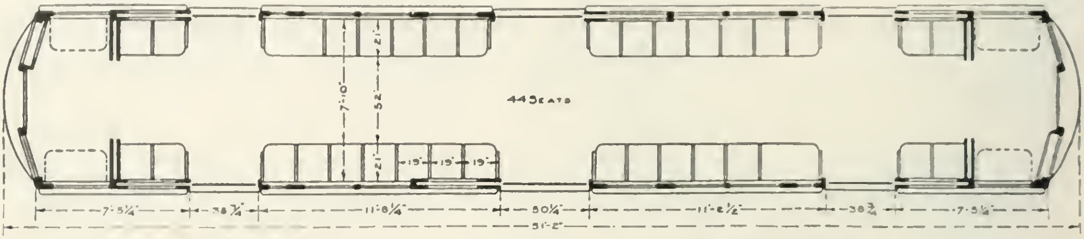


Fig. 8—Car With Three Doors near Center. Longitudinal Seats, 44 Seats.

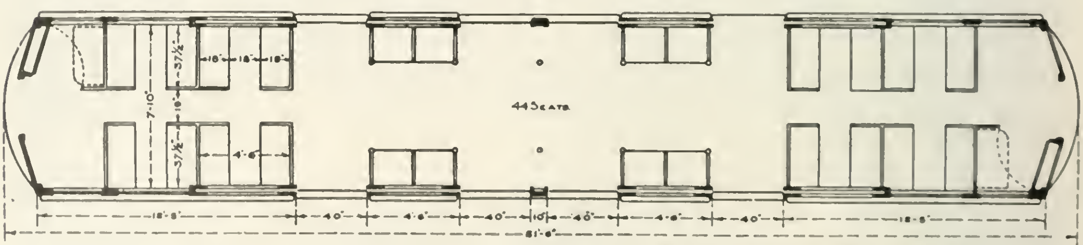


Fig. 9—Car With Three Doors near Center, Combination of Cross and Longitudinal Seats, 44 Seats.

Central suburban line at Chicago does not compare with the density of traffic in the subway, and therefore a conclusion from a comparison of the movement of passengers must be drawn with caution. During rush hours in Chicago the maximum number of passengers passing through the 12 doors of the car was found to be 4.8 per second, and, in making this observation, care was taken to include only the time between the opening and the closing of the doors, so as to eliminate the variable time required for giving the starting signal and in starting the train. It should be borne in mind that the Illinois Central cars are over 72 ft. long, and this result was obtained with 12 doors, and not with 8 doors, which is the greatest number possible for the 50-ft. subway car.

It is fair to assume, therefore, that with the 8-door car in the subway, passengers would be unloaded and loaded at the rate of not more than 4 persons per second per car. As a result of a great many observations of the present rate of passenger movement in and out of the present cars during rush hours in the subway, I find that this rate does not vary far from 1 person per second per door, or at the rate of 2 passengers per second per car, except under extremely congested conditions, when the rate becomes slightly less. During slack periods passengers readily pass in and out of the car doors at this rate, while during rush hours the station platform attendants facilitate the movement, which would ordinarily be considerably reduced by the congestion, and the prompt closing of the doors by the uniformed attendants at the busy stations goes far toward making it possible to load the cars at the rate of 2 persons per car per second, except during the very busiest periods.

At the Borough Hall station of the Brooklyn extension, recently opened, this rate is often increased to an average of 2½ passengers per car per second for the first 30 seconds of loading, but at this station at the present time there exists only terminal conditions without the conflict of transferring traffic.

It would be impracticable to provide a platform attendant for each door of the multi side-door car. It is therefore necessary, in considering the effect of a car of this type on the length of station waits during rush hours, to compare the operation of the multi side-door car without the advantage of a station platform attendant at each door to assist in the loading of the passengers, to the operation of an end-door car with a platform guard to not only expedite the movement of passengers, but also to assist in closing the doors. With this comparison in mind it is difficult to see how the use of the multi side-door car in the subway would reduce the present time of loading and unloading by more than one-half; that is, the present rate of passenger movement of 2 persons per car per second maintained with the present end-door car might possibly be increased to 4 passengers per car per second with the multi side-door car.

This result could only be obtained upon the assumption that all of the multi side doors could be promptly closed by the train guards. In Chicago there is apparently no difficulty in doing this, but it should be remembered that during rush hours the subway traffic is fully 10 times as large as the Illinois Central traffic during the corresponding period, and experience in the subway has demonstrated that in order to close the car doors during the rush period a corps of uniformed, trained platform guards, in addition to the train guard, is absolutely necessary.

It has further been learned that the only way to move trains through the subway on schedule time is to close the car doors promptly, and thus limit the platform delays. It is difficult to see how this could be accomplished with the multi side-door car unless the stream of passengers was stopped before it reached the loading platform. This would transfer the "crush" from the platform in the vicinity of the car doors, as at present, to a platform entrance or a number of entrances, which could be made sufficiently large to considerably reduce the crowding, but the inevitable cutting off of the stream of passengers must be quickly accomplished in some manner, in order to allow the prompt movement of the trains. If the multi side-door cars were to be adopted for the subway, the stations should be arranged so as to control the passenger flow before it reaches the train, as it would be found exceedingly difficult to cut off the passengers at 64 separate places, which would result from the use of 8 doors in each car of an 8-car train.

The introduction of the transfer system, which furnishes a possible saving of a minute or two as a reward for considerable pushing and crowding, has driven a number of the regular subway passengers "minute mad." To deprive these patrons of an opportunity to catch a train by closing a station gate in their faces at the time the train pulls into the station would meet with considerable objection if attempted in the present subway, where the stations are not built to provide for the comfortable carrying out of this arrangement, but the suggestion should be borne in mind in connection with the design of future subways. The only logical place to cut off the flow of passengers is at the entrance to the station platforms, and not at the doors of the cars, a fact which is demonstrated by the design of steam railroad passenger stations and ferry-boat waiting rooms.

To allow the successful use of the multi side-door car would make other changes necessary, particularly with the station platforms. The present platforms serve only one of the end doors of each of the end cars of the train. To get the full advantage of all of the doors along the entire length of the train it would be necessary to extend both the express platforms, which are 350 ft. long, and the local platforms, which are 200 ft. long. This requirement would mean a 50-ft. extension on 38 separate platforms south of 96th street, as well as the extension of a number of platforms north of 96th street, and in some cases this alteration under running conditions would be an expensive and exceedingly difficult piece of work.

The final serious objection to the multi side-door car in the present subway is the fact that practically the entire car bodies now in use would necessarily either be scrapped or used elsewhere, as it would be practically impossible to rebuild them so as to provide 8 side doors on each side of each car. Under these circumstances, the cost of the change would mean an expense of at least $5,000,000 for multi side-door cars, and of about $2,000,000 for plat-

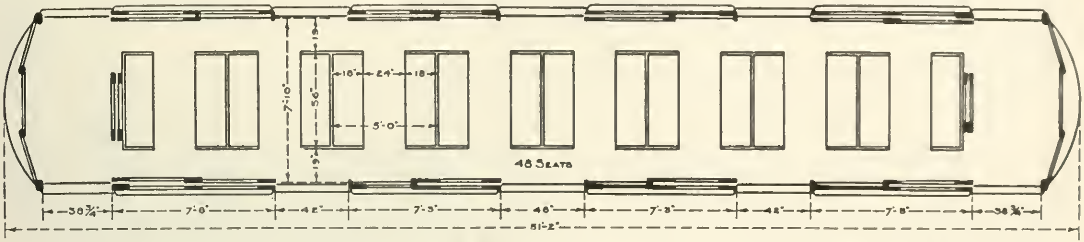


Fig. 10—Car With Multi Side Doors. Cross Seats Back to Back With Two Aisles, 48 Seats.

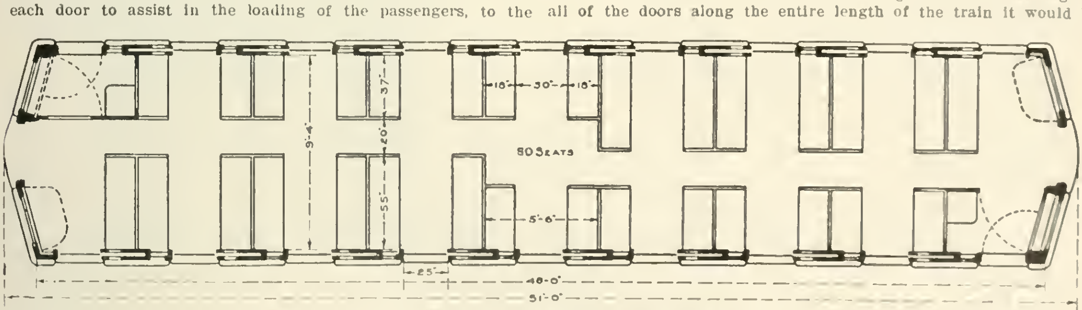


Fig. 11—Car for Future Subways With Multi Side Doors and Cross Seats Back to Back With One Aisle, 80 Seats.

forms, and, in my opinion, the improvement to be expected from these changes with the present subway would not justify the investment.

MULTI SIDE-DOOR CARS AND FUTURE SUBWAYS.

If the multi side-door car is to be considered for future subways, the station platforms should be arranged so that the unloading can be done on one station platform and the loading can be accomplished from another and separate platform. Such an arrangement would necessarily contemplate some inconvenience to the passengers transferring from one service to the other, and the adoption of the separate platform idea would make impossible the use of the island platforms which, under present arrangements, often serve both the express and the local trains, an arrangement which contributes greatly to the convenience of those using the transfer privilege. To make the changes necessary to provide separate platforms for the present subway and at the same time keep the trains in operation on a schedule which calls at frequent intervals for a train on each of the four tracks every two minutes, would be so difficult as to make its cost unjustifiable, and the suggestion, therefore, can only be used in considering an entirely new subway. These remarks apply as well to the straightening of the platforms. The curves of the present platforms would seriously interfere with the operation of the multi side-door car. Sliding platforms, or extension platforms on the cars, to correct this defect are at best complicated and unsatisfactory expedients, and as long as with future subways a different station arrangement and separate platforms would be necessary to make a success of the multi side-door car, it would add little to the station requirements to specify that if multi side-door cars are to be used, the station platforms should be free from curves.

CAR WITH MULTI SIDE DOORS.

Figure 10.

Cross Seats Back to Back, with Two Aisles.

(48 Seats.)

This plan indicates the introduction of three wide doors in the sides of the present subway cars and the rearrangement of the seats in accordance with Illinois Central plan. With this car no attempt would be made to set up and maintain a circulation, and every door would be used as a combined exit and entrance. While this car would lessen the conflict of passengers at the car doors it would not provide a means of entirely removing this cause for discomfort.

At least two platform attendants for each car would be necessary during the busy hours, to assist the train guard in cutting off the stream of passengers entering the car and to aid in closing the car doors. The car platform space would be available for passengers preferring to ride on the platform, as with this car it would not be necessary to enforce the rule that passengers must not ride on the car platforms.

CAR WITH MULTI SIDE DOORS (FOR FUTURE SUBWAYS).

Figure 11.

Cross Seats Back to Back, with One Aisle.

(80 Seats.)

This design has the advantage of one aisle instead of two, and is 18 in. wider than the present car, thus at once increasing the possible seating capacity, and this general arrangement of seats will, therefore, be found the most efficient way to carry out the policy of attempting to provide a seat for every long-haul passenger. The free space between the seats has been increased to 30 in. in an attempt to provide room for the passengers entering and leaving the car to pass by the seated passengers with the minimum amount of annoyance.

This car ought to work well with a load not exceeding 100 passengers, 80 of whom would be seated, but would prove exceedingly uncomfortable if the standing passengers began to encroach upon the space between seats. As the space between seats is sufficient to allow passengers to pass between the knees of those seated, and is the only avenue of entrance and exit, this space would naturally be occupied by standing passengers, particularly during rush hours, much to the inconvenience of the seated passengers, and this is the penalty that must be paid for maximum seating capacity.

There are 8 doors in each side of this car, but the absence of free space near each exit and entrance will cause this car to be loaded and unloaded slowly, and the advantage of the extra number of doors will disappear just at the time that this feature would be of the greatest use.

CAR WITH MULTI SIDE DOORS (FOR FUTURE SUBWAYS).

Figure 12.

The Illinois Central Type of Seat.

(68 Seats.)

This design shows a car 18 in. wider than, and of the same length as present car, with seats in banks of four on 5-ft. centers, which spacing will allow the same number of passengers per foot length of car as is found with the Illinois Central cars. There is a door opening between each set of seats, making eight doors along the side of the car. The two aisles are made a little wider than in the Illinois Central car, and the seats are more comfortable, although the free space between opposite seats has been reduced from 27 in. to 21 in., in order to make each seat deeper.

The car is contemplated only for future and larger subways, as it would be impracticable to rebuild the present cars to allow for the extra width necessary for the four cross seats shown and operate them in the present subway.

The advantages of this type of multi side-door car, although many, are not as great as would at first appear, owing to the delay which would be caused by passengers searching for seats before they selected an entrance and entered, and the conflict of entering passengers with those who would have already entered the car and

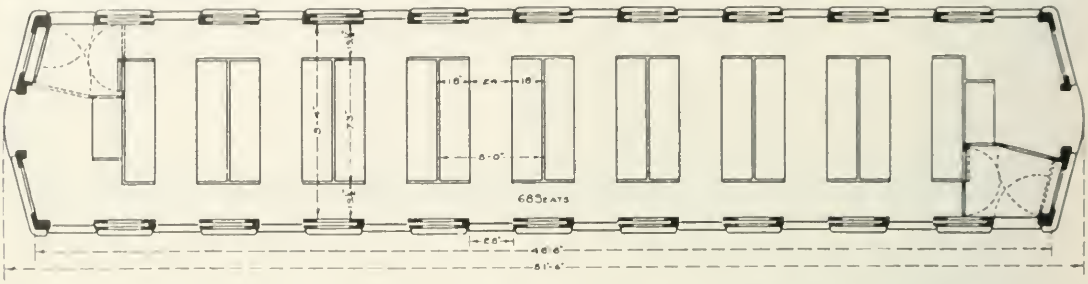


Fig. 12—Car for Future Subways With Multi Side Doors and the Illinois Central Type of Seat, 68 Seats.

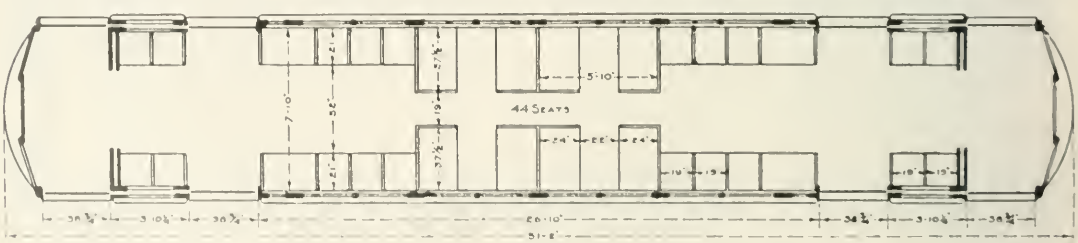


Fig. 13—Car With Double Doors near Ends, Combining Cross and Longitudinal Seats, Using Present Car Body and Seat Spacing, 44 Seats.

would be using the aisles for the purpose of finding seats. For subway use all doors should be operated at once by the car guard, in order to reduce the delay which is sometimes experienced in Chicago, due to the hesitation of inexperienced passengers in opening the doors.

CARS WITH DOUBLE DOORS NEAR ENDS.

Several different seating arrangements possible with cars having double doors near the ends are shown and discussed below:

CAR WITH DOUBLE DOORS NEAR ENDS.
Figure 13.
Combining Cross and Longitudinal Seats.
(44 Seats.)
Using Present Car Body and Seat Spacing.

This design contemplates taking out eight of the longitudinal seats in the present car and introducing four extra exit doors. The design, which is the same as shown in the drawing previously published of the recommended type of the present subway car altered to a car with double doors near ends, shows the most effective change that, in my judgment, can be made with the present subway car, as it introduces the extra doors at places where the framing of the present car and the arrangement of the present seats will be the least disturbed.

When the first consignment of subway cars was built the end doors were only 29 in. wide, but the operation of the cars soon proved this narrow door width to be a mistake, and the doors were widened to 38 in. While this width is not sufficient to allow passengers to pass through the doors two abreast, it is found that they naturally stagger themselves and pass through the door much faster than if they were forced to move in single file. As soon as the doors are made much wider, as in the Brooklyn Bridge shuttle cars, the crowding passengers make an effort to pass through the door three abreast, much to the discomfort of the middle passenger. To avoid this difficulty a dividing post in the center of a wider door might be introduced, but with a sliding door for cutting off the flow of passengers this center post would serve to multiply the danger and increase the accidents. The new doors have, therefore, been shown of the same width as the redesigned doors of the present car.

CAR WITH DOUBLE DOORS NEAR ENDS.
Shown last week.
Combination Cross and Longitudinal Seats.
(48 Seats.)
More Compact Seats for Future Cars in Present Subway.

This is the recommended future car for the present subway, a drawing of which was shown in the previous article. In the present subway cars the space devoted to the cross seats is used in an uneconomical manner. There are 70 in. between the center of the backs of these seats, which is taken up by two 6-in. back cushions, two 18-in. seats and a clear space between seats of 22 in. Where space is as much at a premium as it is in the subway cars, the arrangement of these seats should be made more compact, and this can be done without sacrificing the comfort now secured with the more liberal spacing. For double side seats, served from a center aisle, a clear distance of 20 in. between seats is sufficient, and the allowance of 18 in. for each seat, together with its back, has been found satisfactory, thus making a total over-all distance of 56 in. for one bank of seats. The width of 18 in. for each passenger for the cross seats and of 19 in. for the longitudinal seats in the present car is good practice. With the more economical arrangement of cross seats, more space can be devoted to such seats and at the same time the seating capacity of the car can be increased. This improvement should be kept in mind in ordering future cars for the present subway.

CAR WITH DOUBLE END DOORS (FOR FUTURE SUBWAYS).
Figure 14.
Back-to-Back Seats on 60-in. Spacing.
(62 Seats.)

As it is probable that future subways will be larger than the present one, the cars can be made wider, and thus increase the carrying capacity per lineal foot of car, an increase not practically obtainable in any other way.

The widening of the car could be carried to any reasonable degree, but in Fig. 14 it is designed to allow for five seats abreast. The 60-in. spacing of the seats will provide convenient access to the inside seats. There is but one aisle, the width of which is ample and the standing room is convenient to the exit. During rush hours this standing space can be increased by folding up the longitudinal seats, each of which can have a ledge arranged to provide a comfortable support for part of the standing passengers. Vertical posts can be conveniently located so as to guide and support the passengers standing in the open spaces at the end of the car.

SUMMARY OF TYPES OF CARS.

The various types of cars which approximate fulfilling the requirements for present and future subway service are as follows:

1. Car with central side door and end doors (Fig. 5).
   (a) Longitudinal seats (Fig. 1).
   (b) "Back-to-back" cross-seats, with two aisles (Fig. 2).
   (c) "Walk-over" seats, with two aisles (Fig. 3).
   (d) "Walk-over" cross-seats, with one aisle (Fig. 4).
2. Car with two quarter side doors.
   (a) Longitudinal seats (Fig. 6).
   (b) Cross-seats (Fig. 7).
3. Car with three doors near center.
   (a) Longitudinal seats (Fig. 8).
   (b) Cross-seats (Fig. 9).
4. Car with multi side doors.
   (a) "Back-to-back" cross-seats, with two aisles (Fig. 10). Using present car frame.
   (b) "Back-to-back" cross-seats, with one aisle (Fig. 11). For future subways.
   (c) Illinois Central type of seat (Fig. 12). For future subways.
5. Car with double doors near end.
   (a) Combination of cross and longitudinal seats (Fig. 13). Using present car frame and body.
   (b) Combination of cross and longitudinal seats (drawing shown in previous article). Using more compact spacing of seats; for future cars for present subway.
   (c) Combination of cross and longitudinal seats (Fig. 14). Wide car for future subways.

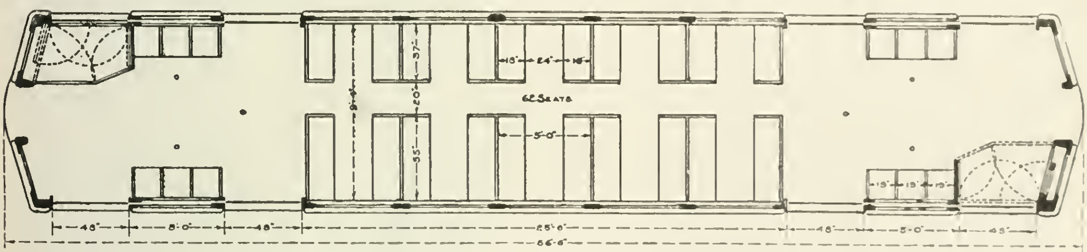


Fig. 14—Car for Future Subways With Double End Doors. Back to Back Seats on 60-in. Spacing, 62 Seats.

Wider cars containing 60 seats and run in 10-car trains at the rate of 40 trains per hour will provide 24,000 seats per hour on one track. The capacity of the express tracks in the present subway is 52 seats per hour in 8-car trains which pass limiting stations at the rate of 30 trains per hour, or 12,480 seats upon one track. In other words, future subways may have twice the seating capacity of the present subway, as now operated.

Depths of the Principal Harbors of the World.

New York.—The approach to the harbor when completed will have a depth at low water of 40 ft.

Boston.—The depths of the approaches are being increased from 36 ft. to 44 ft. at high water. The variation of the tide is 10 to 11 ft.

Baltimore.—Present depth 29 ft. 6 in. at h. w., to be increased to 36 ft.

Newport News.—To have a depth of 36 ft.

New Orleans.—The channel is to be dredged to a depth of 36 ft. h. w.

San Francisco.—Thirty-one ft. l. w., 36 ft. 6 in. h. w.

London. The Thames has a depth of scant 28 ft. l. w. The docks are separated from the river by locks. The dock entrance at Gravesend have a depth of 25 ft. 8 in. l. w. and 44 ft. h. w. It is intended to increase the depths to 29 ft. 6 in. l. w. and 48 ft. h. w.

Southampton.—Twenty-nine ft. to 31 ft. l. w. spring tide, with 14 ft. 9 in. rise of tide.

Liverpool.—The channel in the Mersey has a width of 1,475 ft. with 27 ft. depth at l. w. Rise of tide 19 ft. 6 in. to 26 ft.

Plymouth.—Has a natural depth of 30 ft. l. w., 42 ft. h. w.

Havre.—Depth of dredged channel to deep water 35 ft. 6 in. The lock to the principal basin, Basin Bellot, is 99 ft. wide, with 35 ft. over the sill at h. w.

Antwerp.—The depth of the Scheldt and of the harbors is planned for 24 ft. 6 in. l. w. and 38 ft. h. w.

Rotterdam.—The minimum depth of the channel to the sea, when completed, 24 ft. 6 in. l. w., 29 ft. 6 in. h. w.

Amsterdam.—After completion of the improvements to the North Sea canal, its minimum depth will be 32 ft., which can be increased to 33 ft. 6 in.; the minimum width of bottom 164 ft., with a lock 738 ft. x 82 ft. x 32 ft. 5 in. The depth of the outer harbor, Ymuiden, is 37 ft. h. w.

Bremen and Bremerhaven.—Bremerhaven is the port of Bremen, and extensive dredging operations have secured a channel in the Weser to the sea 26 ft. 3 in. deep at l. w. and 37 ft. at h. w. The principal harbor basin, the Kaiserhafen, has an entrance lock 732 ft. long, 92 ft. wide, with 34 ft. 8 in. depth at the sill at h. w. Since 1888 the fairway of the Weser to Bremen has been deepened to 14 ft. l. w. and 18 ft. h. w.

Hamburg.—Previous to 1902 the fairway in the Elbe was 27 ft. at h. w., compelling the largest vessels to lighter at Cuxhaven or at Brunshausen. Dredging has increased the depth to 32 ft. 9 in. at h. w. As this is barely sufficient for present requirements, extensive improvements on the lower Elbe are contemplated.

Genoa.—Depth in the harbor 52 ft.; alongside quays 29 ft. 6 in.

Naples.—Depth in the harbor 111 ft.; alongside quays 32 ft. 6 in.

Calcutta.—Twenty-seven ft. at h. w.

Bombay.—Twenty-nine ft. 6 in. at h. w. Rise of tide 8 ft. 6 in.

Colombo.—Thirty-six ft. at h. w. Rise of tide 2 ft.

Hong Kong.—Thirty-nine ft. at h. w.

Yokohama.—Thirty ft. 6 in. at l. w., 35 ft. at h. w.

Nagasaki.—Twenty-one ft. to 121 ft. l. w.

Sydney.—Thirty-four ft. h. w. Rise of tide 5 ft.

Melbourne.—Thirty ft. h. w. Rise of tide 3 ft.

Rio Janeiro.—Fifty ft.

Capetown (Table bay).—Thirty-four ft l. w., 39 ft. h. w.

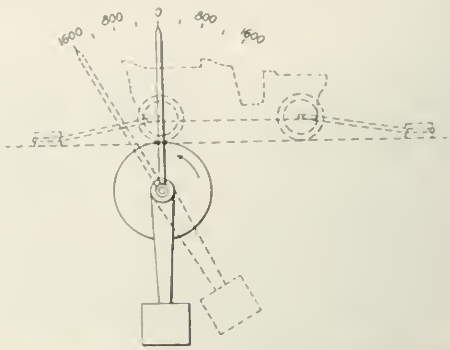
In this connection the following is also of interest:

Suez Canal.—On completion of the work in progress, depth will be 33 ft. 9 in. width at bottom 1,083 ft., so that in this year vessels with a draft of 27 ft. 9 in. can be admitted.

Panama Canal.—The projected depth is 40 ft.; minimum width of bottom 150 ft.

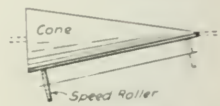
An Automobile Dynamometer.

The Automobile Club of America has learned a lesson from the locomotive testing plants and has had a dynamometer designed for testing automobiles in the same manner that similar work has been done with locomotives at Purdue and by the Pennsylvania Railroad Owing to the fact that but one pair of wheels has to be provided for, the mechanism is, of course, much simpler than that of the locomotive machine. It is the first and only one of its kind, and is arranged to show at once the speed in miles per hour and feet per

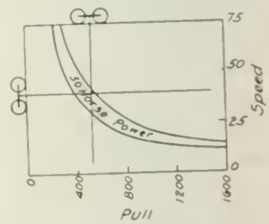


Pendulum Dynamometer; Automobile Testing Plant.

Automobile in Position for Records.



Speed Roller and Cone.



Speed and Power Diagram.

second, the tractive effort, horse-power of motors, grade climbing ability and braking power.

It is also provided with an electric fan for catching the exhaust from the automobile in order that the air in the room may be kept clear of smoke and other products of combustion.

It was designed for the club by Dr. S. S. Wheeler, and is an assemblage of power absorbing and measuring instruments and a large power chart with automatically operated pointers.

The car is held in place by cables, and the driving wheels are carried by drums as in the case of the locomotive testing plant. Instead of the hydraulic brakes the motion of the drums is resisted by a pendulum hanging below the floor and attached to the drum shaft, not rigidly but by means of a frictional resistance that can be varied. This pendulum then swings out from its vertical position according to the pull exerted by the car upon the drums. This is indicated by a pointer attached to the pendulum and reaching above the floor. The indications thus obtained are transferred to a ruler traveling across the face of a large chart.

The speed of the car is obtained by moving another ruler vertically across the chart by means of a special piece of apparatus.

A cone is revolved by an electric motor at constant speed. To verify this speed, a bell, attached to the cone, shaft, rings at each 100 revolutions, or at intervals of 30 seconds. A wheel or roller, driven by the automobile and therefore revolving slowly or fast to correspond, rolls upon the surface of the cone and is pulled, by an independent motor, back and forth between the small and large ends of the cone until it finds the point where it does not slip because that portion of the cone presents the same speed as the roller. This longitudinal adjustment of the roller is transmitted by a wire cable to the speed ruler on the chart, and the power required for moving the ruler is thus made independent of the automobile. The roller, driven by the car if running at 60 miles per hour, must be drawn to a position near the large end of the cone in order to run with the cone. Whereas, if the car drives the roller at only five miles per hour, it must be drawn to a position near the small end of the cone. A system of electric contacts is arranged with a motor to shift the roller automatically until it finds the point where it will roll on the cone without slipping.

The speed and power rulers are thus moved across the chart automatically to correspond with the speed and the tractive effort or pull that the dynamometer shows the car is making.

On the board are painted the horse-power corresponding to each different speed and pull so that the result at each moment can be read at a glance and without calculations.

The chart is on a heroic scale and can be read easily by the driver of the car. The speed of the car may be read from the chart in either of the popular ways of stating it: Miles per hour; minutes per mile, kilometers, etc., by means of the several different scales provided.

All of the measuring apparatus is made reversible so that when running backward the performance of the car may be measured.

As a secondary apparatus, a grade meter is provided, operated by the pendulum indicator of the dynamometer. To use the grade meter the clamp is set upon the sliding scale at the point representing the weight of the car. The moving lever then assumes at each moment the angle of inclination of the grade the car would climb (if there were no wind resistance, slipping, etc.) with the effort that the car is then making.

To observe an automobile coasting down hill, either forward or backward, it is necessary merely to start the electric motor on the shaft carrying the two large drums upon which the driving wheels of the automobile rest. The brakes may then be tested and the wheels or gears or engine may be run free (not run by the power of the automobile) and the relative friction loss in the principle of the automobile may be ascertained.

The consumption of petroleum for fuel in Russia has been suddenly checked, due largely, and perhaps chiefly, to higher prices. During the first nine months of 1907 the six railroads which have been the chief users of petroleum consumed but 142,500,000 gallons in 1907, against 261,500,000 in the corresponding nine months of 1906, a decrease of no less than 45 per cent. Meanwhile the production of the Donez coal mines increased 2,115,000 tons, which is more than 20 per cent. In fuel value this increase in coal is about equivalent to four times the decrease in petroleum consumption on these six railroads.

Penalty Laws in the South.

The following abstracts cover the principal penalty laws in a group of southern states:

ALABAMA.

Free time under car service rules, 72 hours on fertilizers, hay, coal, coke, brick, lumber in box cars, bulk meat, potatoes, grain and grain products, cotton seed, cotton seed meal and cotton seed hulls, and 48 hours on other freight, Sundays, holidays and bad weather days not counted.

The 1907 Legislature passed 52 bills inflicting severe penalties, the effect of which was to decrease earnings, to increase expenses by inflicting penalties, forfeits, increased taxes, etc.

The demurrage laws of Alabama as enacted by the 1907 Legislature differ from the requirements of any other state, in that the maximum charge for car service is fixed at $10 per car. No other state imposes a maximum charge for car service, and under the state laws, when a receiver of freight has detained a car long enough to accumulate a demurrage charge of $10 he is at no expense for any additional detention of the car.

Among the penalties fixed by the 1907 Legislature are the following:

Penalty of $500 for each failure to give receipt for application for cars to be loaded.

Penalty of $1 per car per day, maximum $10 per car for failure to furnish cars for loading within the specified periods.

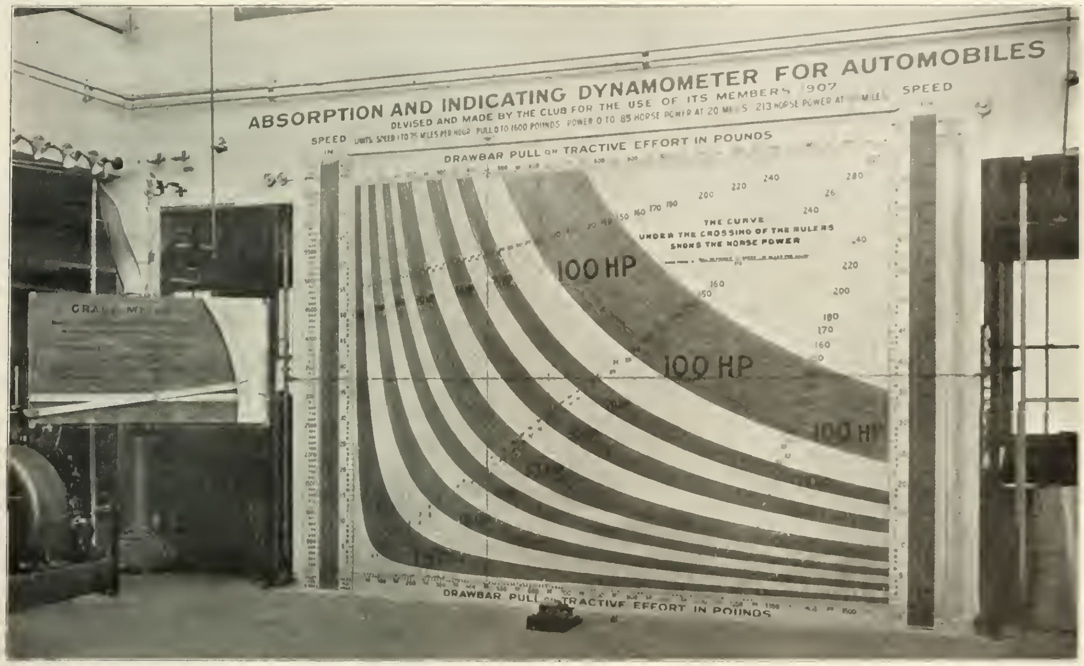
Penalty, carloads $1 per car per day, less than carloads 1 cent per 100 lbs. per day, for failure to receive freight and issue bills of lading therefor.

Penalty on carloads $1 per car per day, and on less than carloads 1 cent per 100 lbs. per day, maximum penalty $10, for failure to transport shipments at the rate of 50 miles per day of 24 hours, computing from 7 a.m. of the day following receipt of shipment.

Penalty on carloads $1 per car per day, less than carloads 1 cent per 100 lbs. per day, maximum penalty $10, for failure to give consignees notice of arrival within 24 hours after arrival of the shipment.

Penalty of $1 per car per day for failure to deliver freight or to place cars for unloading within 24 hours after arrival, computing from 7 a.m. of the day following arrival.

Carriers are not permitted to release cars by unloading carload freight for storage into their own warehouses or into public or



Wall Chart; Automobile Dynamometer.

private warehouses until $5 demurrage charges have accumulated. This practically means, until the carrier has suffered 10 days delay.

Penalty of 115 per cent. to 100 per cent. of the amount of the claim for failure to pay loss and damage claims within 60 days, the penalties varying with the amount of the claim.

Penalty of $1 per day maximum penalty $100, for failure to pay overcharge claims within 60 days.

Penalty for entering suit through federal court, cancelation of license to do business through the state of Alabama

Penalty for reissuance of license, one-tenth of 1 per cent. of corporation's capital stock

Franchise tax, foreign corporations with actual capital of over $1,000 employed within the state of Alabama to pay annual franchise tax of 25 per cent. of the first $100, 5 per cent. on the amount in excess of $100 up to and including $1,000, and one-tenth of 1 per cent. on the amount over $1,000, this applying only to that part of the capital employed in the state of Alabama.

Penalty of $100 per day for each day's failure to make annual reports of State Railroad Commission within specified time.

Penalty of $100 for each day's failure to file with the State Railroad Commission abstracts or lists of vouchers or receipts within specified time.

An act prohibiting carriers from entering into any bill of lading contract, stipulation, receipt, rule or regulation in any way limiting their liability for loss of or damage to property received for transportation, thereby requiring carriers to become responsible for acts of God and the public enemy.

FLORIDA.

The free time under car service rules is from 72 to 96 hours, according to the commodity. The Florida commission indulges in a system of fines when the railroads fail to move freight promptly; for diversion of business, and for other irregularities which might occur in the operation of the line through fault of agent, trainmen or workmen.

Penalty of $1 per car per day for failure to deliver freight or to place car for unloading within 72 hours, computing from 10 a.m. of the date following arrival.

Penalty of $2 per car per day for failure to furnish cars for loading within two days on perishables and four days on other freight.

Penalty on carloads $2 per car per day, and on less than carloads 1 cent per 100 lbs. per day for failure to transport freight 50 miles within two days, and each additional 50 miles within one day 24 hours additional time allowed for transfer to connecting line.

Penalty of 25 per cent. of the amount of claim for failure to settle claims within reasonable time.

GEORGIA.

Under car service rules the free time in Georgia is generally 48 hours. The penalty rules of Georgia were largely imposed by the State Railroad Commission in the year 1906, and they stand to-day as follows:

Penalty of $1 per car per day on carloads and 1 cent per 100 lbs. per day for less than carloads for failure to give notice of arrival within 24 hours.

Penalty of $1 per car per day for failure to furnish cars for loading within four days, Sundays and legal holidays excepted.

Penalty of $1 per car per day on carloads and 1 cent per 100 lbs. per day on less than carloads for failure to forward freight at the rate of 50 miles per day, computing from 7 a.m. of the day following receipt of shipment.

Penalty on carloads $1 per car per day, less than carloads 1 cent per 100 lbs. per day, for failure to deliver freight or to place cars for unloading within 48 hours from 7 a.m. following day of arrival.

Penalty of $1 per car per day for failure to deliver cars to switch connection within 24 hours after notice from consignee.

Penalty of $1 per car per day for failure to receive and place switch cars within 24 hours.

Forfeit of value of goods with interest at 10 per cent., penalty not to exceed actual damage plus 25 per cent. for failure to observe shipper's routing.

Penalty of double the amount of overcharge for failure to pay overcharge claim within 30 days.

Penalty of full damage to be paid by initial line regardless of place of damage for failure to trace freight and advise applicant within 30 days of the cause and place of delay or damage.

Penalty of $50 for failure to pay loss or damage claim intrastate within 60 days and interstate within 90 days.

NORTH CAROLINA.

The car service rules of the North Carolina commission allow 72 hours free time on fertilizers in sacks or in bulk, and on brick, cotton seed, cotton seed hulls, coal, coke, fertilizer materials, grain and lime and tanbark in bulk, and dressed lumber in box cars, and 48 hours free time on other freight, Sundays, holidays and bad weather days not included.

The following forfeit and penalty requirements are a result of legislative enactment

Penalty of $50 for failure to forward freight by route designated by shipper.

Penalty on carloads $15 first day and $20 each succeeding day and on less than carloads $10 first day and $1 each succeeding day for failure to transport and deliver freight within the time specified within the statute, this penalty being in addition to actual damages, if any, sustained by the claimant

Penalty of $50 for failure to deliver freight upon tender of legal freight charges.

Penalty of $50 for failure to pay loss and damage claims intrastate within 60 days and interstate within 90 days

Penalty of $5 per car per day for failure to furnish cars for loading within four days from 7 a.m. of the day following such application.

The 1907 Legislature of North Carolina passed a bill limiting hours of trainmen, enginemen and telegraphers to conform with the Federal law which becomes effective March 4, 1908

SOUTH CAROLINA.

Demurrage rules of the South Carolina Commission allow 48 hours free time in the case of personal notice, and 72 hours free time in the case of mail notice, except that 24 hours additional free times allowed on grain and grain products cotton seed, coal, lumber in box cars, brick, etc The various penalty laws and rules are as follows:

Penalty of $50 for failure to deliver freight upon tender of lawful freight charges.

Penalty of $500 for failure to pay loss and damage claims intrastate within 40 days, interstate within 90 days.

Penalty of $1 per car per day for failure to furnish cars for loading of dead freight within four days, and of perishable freight within three days.

Penalty of $1 per car for failure to deliver freight or to place cars for unloading within 48 hours from noon of the day following

Penalty of $1 per car for failure to issue bill of lading and forward dead freight within 48 hours, and perishable freight within 24 hours.

Penalty of $5 for each and every failure to bulletin passenger trains in accordance with the legislature's requirements.

Forfeit of five times the value of property so confiscated for confiscation by carrier of fuel or other property for its own use

Penalty of $25 for failure to advise consignee of live stock delayed more than three hours of the cause and extent of the delay and expected time of delivery.

Fine of $5,000 for each and every failure to provide union and other depots as required by State Railroad Commission.

Penalty of $5 per shipment per day (maximum value of goods and transportation charges) for failure to transport freight within the time specified within the state statute.

Penalty of $1 per day for failure to furnish consignee within 10 days information as to the cause of delay to delayed freight.

VIRGINIA.

Storage, demurrage and car service rules, including penalties, are made by the State Corporation Commission, and the current rules have been in effect since Aug. 15, 1903. The Commission has now under consideration changes that will not in any way lessen the burdens imposed upon the carriers by the existing rules. The existing rules provide, among other things, as follows:

Forfeit of $1 per car for failure to furnish car for loading within four days.

Forfeit of $1 per car per day on carloads, and 1 cent per 100 lbs. per day on less than carloads for failure to transport freight at rate of not less than 50 miles per day of 24 hours, computing from 7 a.m. of the day following receipt of a shipment.

Forfeit of $1 per car per day on carloads and 1 cent per 100 lbs per day on less than carloads for failure to give consignee notice of arrival of freight within 24 hours.

Forfeit of $1 per car per day for failure to place cars for unloading within 24 hours, computing from 7 a.m. of the day following arrival.

Free time on freight to be trans-shipped by water: 10 days on fertilizers, hay, coal, coke, brick and lumber in box cars, meat, potatoes, grain and grain products, cotton seed and cotton seed hulls in bulk 72 hours, and on other freight 48 hours, Sundays, holidays or bad weather days not included, and free time allowed

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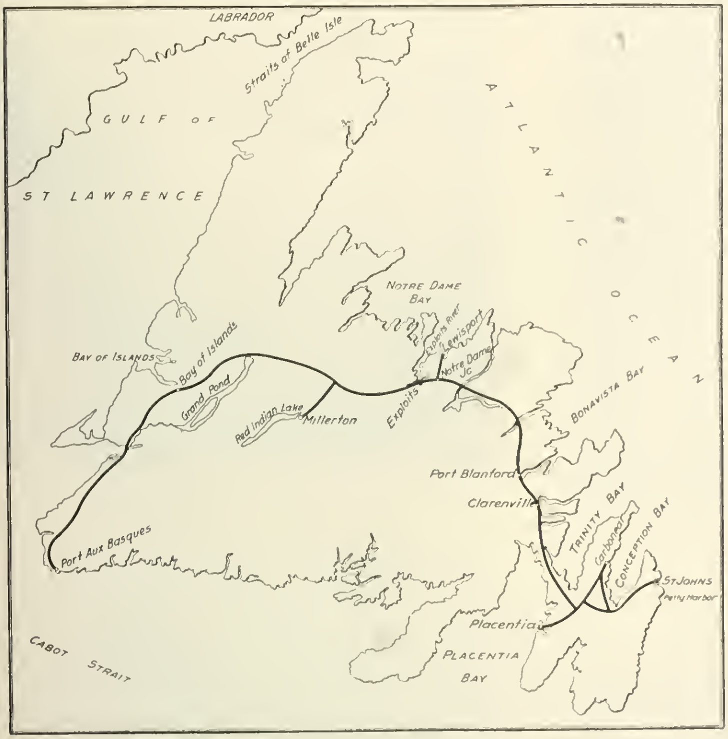
The estimates of the Prussian State Railroads for additions to rolling stock to be delivered before Oct. 1 next amount to the tidy sum of $31,423,140, to be expended for 710 locomotives at an average cost of $16,425 each, 2,105 passenger and baggage cars at $4,390 each, and 14,160 freight cars at $757 each—the latter nearly all four-wheeled cars of less than half the average capacity of our cars. It is expected that about 16,000 more cars will be needed between October and April.

The Railroad System of Newfoundland.

Newfoundland has a unique position in the railroad world. It has a narrow gage railroad system 635 miles long, with steamer connections to different parts of the island and to the peninsula of Labrador, making a total mileage of steamer lines of 3,364 miles. The railroad lines and the steamship lines are all under the same management. They are the property of the Reid Newfoundland Company, whose President, Sir Robert Reid, was recently knighted for his conspicuous services in the development of Newfoundland. The same company owns at St. Johns, the capital of the island and the eastern terminus of the railroad, a large dry dock, an electric light plant and the local street railway.



Newfoundland and Its Railroad System.

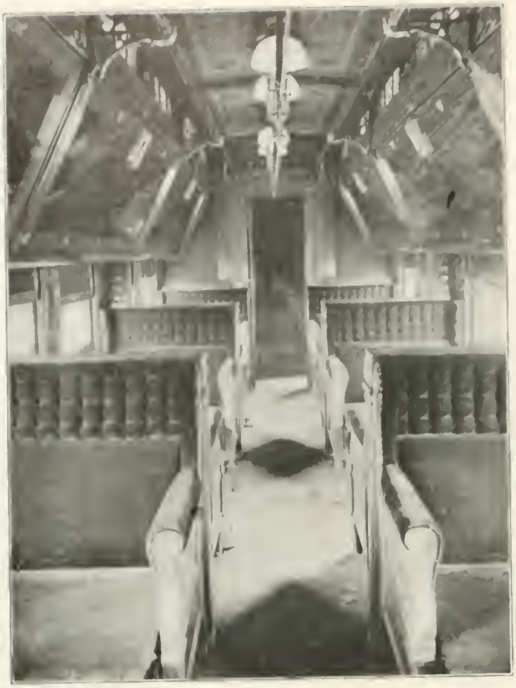
The railroad runs from St. Johns on the east coast of Newfoundland westward across the island to Port aux Basques, connecting either directly or by branches with most of the large bays with which Newfoundland is surrounded, which are served by special steamer services. Express trains which are scheduled to cross the island in 28 hours are run three times a week. The Reid Newfoundland Company's steamship "Bruce," a 17-knot flyer, plies nightly across the 90 miles of Cabot strait, which lies between Cape Breton island and the southwestern extremity of Newfoundland. This steamship connects with the Newfoundland system at Port aux Basques and with the Intercolonial Railway at North Sydney. On the other days of the week local railroad service is operated across the island. Other trains twice a day serve the more populous centers within 100 miles of St. Johns.

The railroad is equipped with 25 locomotives, 38 passenger cars and 364 freight cars. It has two rotary snow plows and other snow fighting equipment. A large granite station at St. Johns built at a cost of $100,000, holds the general offices of the company. The rolling stock is of modern construction and of good design. The locomotives were especially designed and built by the Baldwin Locomotive Works; the passenger cars were built by the Dayton Manufacturing Company, of Dayton, Ohio; Rhodes, Curry & Company, of Amherst, N. S., and by the company's own shops, which turn out cars equal to the best bought abroad. The best class of cars are mahogany finished inside and out. Through trains have sleeping, dining, colonist, day and baggage coaches. The roadbed is well built and has been considerably improved during the last ten years. The bridges are built on masonry abutments with steel girders.

The passenger traffic of the system is large and steadily growing. The colony of Newfoundland has 250,000 people and the movement of local passengers is one of the main sources of traffic. At certain seasons of the year a large number of the people of Newfoundland find employment in the steel works and coal mines on Cape Breton island, and this makes a considerable passenger movement. There is also a steadily growing tourist travel from Great Britain, Europe and the American continent.

The freight traffic is made up of lumber and the commodities required by a community scattered over 6,000 miles of coast line and of itself producing nothing except its catches of cod, seal, herring, lobster and whale. All other necessities of existence, such as food and clothing, come from St. Johns. A large increase of the freight business is assured through the recent establishment by two large corporations financed in London, the Harmsworth and the Albert Read companies, each capitalized at $5,000,000, of pulp mills on the Exploits river, inland from the coast. These two enterprises promise to become important factors in the industrial development of the colony. Near St. Johns are iron mines and in the northern part of the island copper mines which furnish traffic. Agricultural settlements also are springing up at various points along

Bay of Islands, Newfoundland.



Inside View of Narrow Gage Sleeper.

Caribou Crossing the Railroad.

Standard Passenger Train; Reid Newfoundland Company.

Upper Reaches of the Humber River in Newfoundland.

the railroad and large additions of traffic are expected from this source.

From Port aux Basques the steamer "Glencoe" plies eastwardly along the south coast to Placentia bay, 371 miles, where connection is made with a branch of the railroad connecting directly with St. Johns. From the railroad at Bay of Islands station, on the west coast, the steamer "Home" plies north to Battle Harbor, Labrador, on the straits of Belle Isle, 379 miles. The railroad connects with Notre Dame bay on the north coast by a branch from Notre Dame Junction to Lewisport, from which the steamer "Clyde" furnishes a weekly service around the bay. This trip is 362 miles long. From Port Blandford the steamer "Dundee" performs a similar service for Bonavista bay; a 148-mile trip. Trinity bay and the west side of Conception bay as far south as Carbonear, are served by the steamer "Ethie," which connects with the railroad at Clarenville and Carbonear. This is 152 miles. A branch of the railroad touches every important place on the rest of Conception bay. These last three bays are on the east coast. Placentia bay, on the southwest, is served by the steamer "Argyle." This route is 294 miles long. During the summer there is fortnightly service from St. Johns by the steamer "Virginia Lake" to Labrador, which is 1,021 miles away.

The operations of the Reid Newfoundland Company are large and varied. The steamship "Bruce," the connecting link for through traffic between Newfoundland and Cape Breton Island, was built on the Clyde for this particular service at a cost of $250,000. A photograph of this steamer is shown. The seven other steamers of the company's fleet represent an outlay of $1,000,000 more. The company is adding new railroad equipment at the rate of $250,000 a year. Owing to the increasing demands of traffic it is probable that

Reid Newfoundland Company's Steamship Bruce.

a daily train and steamship express service will be begun in the near future. Passenger and freight tariffs are made on a mileage basis, the distance by rail or by boat being counted as part of the one journey. Through tickets are on sale between all important points in Canada and the United States to Newfoundland points and baggage can be checked through on these tickets. Joint traffic arrangements for freight have been made with Canadian and American railroads and there is a steadily growing interchange business. The company has a monopoly of the public service facilities of the city of St. Johns, including the electric light system and the street railway, whose earnings in the calendar year 1907 were $31,948, an average of about $87 a day. During the year it carried 638,967 passengers, An electric power house has been built at Petty harbor, nine miles from the city, which furnishes power for both these operations and for various other industrial enterprises. The Colonial dry dock owned by the company is situated at the western end of the harbor and is capable of taking up the largest ocean going steamships. Here steamers can be found under repair the year round, for St. Johns is a noted haven for shipping in distress on the western ocean. The machine shops are near the dry dock and are used for both car and ship repairs. As an adjunct to the dry dock the company owns a powerful wrecking tug equipped for marine salvage work.

A large part of the company's expectations for future increases in traffic are based on the wonderful natural resources of the island as a tourist and sporting resort. It has beautiful scenery, bracing climate and a wide range of hunting and fishing opportunities. There is sport at Newfoundland at all seasons of the year. Of large game there are bears, wolves, caribou, otter, marten and beaver. Other game, migratory and indigenous, includes the hare, rabbit, ptarmigan, spruce partridge, Canada goose, ducks of many varieties, snipe and plover. There is fine trout and salmon fishing. Most of the interior of the island is untraveled. Only a few sportsmen have crossed its broad barrens and climbed its rugged mountains.

J. C. Millais, the English naturalist, son of the famous painter, has recently published an elaborate volume describing his journey in the untrodden interior of Newfoundland in which the joys of caribou hunting are enthusiastically described. This sport can be obtained more cheaply and with less discomfort than deer hunting can in other parts of the world. From New York and New England it is only a three days' journey to the best hunting grounds in the interior of Newfoundland. Guides and helpers can be obtained at rates much below those charged elsewhere, the only fee imposed by the colonial government on sport of any kind is one of $50 on visiting caribou hunters. Payment of this fee entitles one to shoot three stags. Every other form of sport with rod and gun is free. One of the photographs shows caribou near the railroad line. Moose have recently been introduced and are thriving well, but are still protected. The number and variety of wild fowl is very great.

For the summer tourist the air is bracing, the climate salubrious and the surroundings stimulating. A variety may be given to a visit to Newfoundland by cruising on the different steamers, visiting the various bays about the island and observing the fisher folk engaged in the operations which yield them subsistence. The cod and other fishing has many picturesque incidents, though tragedy often accompanies it, for the wind and sea are at their strongest in this region. One of the most remarkable attractions is the daily procession of majestic icebergs drifting south along the Newfoundland coast from the arctic region. These present the most striking pictures. The Labrador trip is also a remarkable one. The region compares with Norway, and besides the wonderful beauty of its scenery, offers fine sport for rod or rifle.

Signals and Automatic Train Stops in the Hudson & Manhattan Tunnel.

The signaling of the recently opened up-town tunnel of the Hudson & Manhattan Railroad under the Hudson river consists of automatic block signals and automatic train stops, covering the double-track line between Nineteenth street, New York, and Hoboken, N. J. Between Hoboken and Greenwich avenue, New York, the river section of the tunnels, signals are placed, on the average, 367 ft. apart, making 14 blocks to the mile. The minimum distance where speed is low is 115 ft., and the maximum is 1,620 ft. On steam railroads, block signal sections average 2,640 ft., or two to the mile; on the express tracks of the Interborough Rapid Transit Subway the distance is 800 ft., or nearly seven to the mile.

The signals give three indications: Proceed, indicated by a green light; proceed with caution, yellow light; stop, red light. There is an automatic stop at each stop signal. This device has two movable short arms or trips, one placed alongside each rail. When the signal is in the stop position, these arms are raised to engage with the trigger of a valve in the air-brake pipe of the train, releasing the air and setting the brakes. Each car is equipped with two of these valves, one at each end and on opposite sides of the car. When the signal moves again to the proceed position, the electric motor lowers the stop arms, permitting the train to pass without setting the brakes; the arms return to stop position by gravity after the train has entered the block. This device is used on the Boston Elevated and on the Interborough Rapid Transit subway express tracks, but on these lines only one arm is used.

The arrangement of the block sections is unusual and so designed to provide more train capacity without loss in safety. In steam railroad signaling, with few exceptions, the block sections end at the home signals, no clear space being provided at each signal in case a train should overrun it. In the Interborough Rapid Transit subway the block sections overlap each other for half their length. In the Hudson & Manhattan tunnel, one block section is the length of three overlaps. Thus each train is protected by three stop signals, four caution signals and two automatic train stops. The length of overlap is equal to the distance in which a train moving at maximum speed can be stopped, plus a 33⅓ per cent. safety margin.

Both rails of each track are used for the train propulsion current and also for the signal current. This constitutes broken rail protection.

There are seven interlocking plants: One, the largest, at the Hoboken terminal; two at caisson No. 1; two at caisson No. 2; one at Greenwich avenue, and one at Nineteenth street. The Taylor all-electric system is used. The signals are the same type as used in the block system. Illuminated track indicators are placed in front of each interlocking machine for the information of the operator.

In all, 90 home signals, 82 distant signals, 10 dwarf signals, 13 switches and 85 automatic train stops are used.

The signal system was furnished by the General Railway Signal Co., Rochester, N. Y., and the automatic stops by the Kinsman Block System Co., New York.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

IX.

The Organization of Ocean Carrying

We naturally think of the traffic of the land as being carried on by this or that railroad, and we think of the railroad as a carrying unit. Further than this the wide prevalence of the steamer lines tends to produce in the minds of those not directly interested, the idea that upon the ocean also the world's traffic is moved by the steamship line—as it is upon the land by the railroad line. Such an idea of marine uniformity is far from the facts, for the ocean traffic differs profoundly from that upon the land in that it has three distinct types of service. These are the common carriers, the merchant or private carriers and the charter carriers, the host of single independent ships that are for hire to any bidder.

The sea has a freedom and a cheapness unknown to the large scale land carriers and it profoundly affects the organization of the ocean carrying. The most pronounced and far-reaching difference between ocean transportation and land transportation arises from the fact that the ocean is a highway without the efforts of man, and the navigator has but to provide his vehicle. By land roads must be made even for a pack train. For carrying upon the ocean the completion of the ship is all that is necessary, and if she be a sailer the winds of Providence will drive her into all seas and around the world. This fundamental difference in the ocean trade produces many peculiarities unknown upon the land. Because of the smaller capital that is required upon the ocean, we find relatively more individuals and groups of individuals acting independently than we do in the railroad traffic of the land. The single vessel operated as a unit has as much independence as the great line of steamers, and in some respects more independence. Both are alike free to pass over the high seas, to take advantage of the government surveys thereupon, and to enter the harmors that connect with the land, for every port welcomes the greatest possible multitude of ships.

In closer examination of this traffic the first to be considered is the single vessel that is managed as an independent unit. Such vessels do not attract much attention. They come and go unnoticed in news columns of the public press unless perchance they meet with accident, and the reading and traveling layman does not often have his attention called to them. They do not carry his mail, his baggage or his person. These choice and exacting services are rendered by the aristocrats of the deep, the great lines, whose names and performances and owning companies are known by tens of thousands of people scattered over all parts of the reading world. The advertisements of these ships, photographs included, reach the inland hamlets of the five continents, and their movements are heralded as news by numerous journals. They are very important. They carry passengers, mail and much freight with speed, regularity and high cost, and for that reason they do not and cannot do all the ocean's work. The single ship gives a cheaper service and there is therefore a large part of the world's ocean carrying left for it to do, and it is done with little comment or public notice.

If every port in the world had a large trade, made up of a wide variety of articles shipped in fairly even quantities throughout the year, there would probably be no vessels operated singly. With such an even and dependable commerce ships could be organized into lines which would handle the traffic in regularly recurring shiploads. But those conditions of evenness and variety and dependableness do not exist. The nearest approach is in the great commercial ports such as New York, Liverpool, London, Hamburg. In these ports the per cent. of traffic in the line vessels is increasing and that in independent vessels is decreasing. One cannot generalize on world commerce from the world's great ports, for they are few in number and the small ones are very numerous.

During the decades that have made up the railroad era many new lands have been opened to commerce, new products introduced, new parts established. In the vast majority of the many hundred of ports upon the world ocean, the bulk of the commerce is limited to a very small variety of articles, often a single article, and that again is often shipped during only part of the year. It is most likely to be a raw product, cheap, and heavy, which must be carried at as low a rate as possible. This then is not work that can be done by the carefully organized line of vessels. This simpler, unorganized and cheaper service falls to the independent vessel that is for hire and works as a unit wherever there is work to be done. These vessels are built and owned for just this work. The contract that the lessor and lessee sign when the vessel is hired is called a charter, and the ship is spoken of as being chartered, but if regularly for hire she is commonly called a "tramp." Such vessels carry a large share of the world's trade and are utilized for any freight that may go in shipload lots. For the carrying of raw materials, and cheap, heavy or bulky goods the regularity and promptness of the line vessel are not often required. Cheapness is the prime factor. This is true of a long list of commodities lying at the very foundation of modern industry.

As the prime requisite of the charter traffic is cheapness with safety, the combined efforts of the marine architect and the shipowner have been toward economy in cost of operation, while the managers of lines are often striving for regularity and speed regardless of cost. The economics of the tramp steamer fall under three classes:

1. Construction.
2. Navigation.
3. Management.

1. The tramp steamer is built upon a sort of general average model to fit her for as many kinds of service as possible and to go into all oceans and ports. The first object of the designer is to fit her for holding much cargo rather than making high speed. These two diverse objects in design give a great difference in the resulting shape of the ship. The sharp bow and curved ribs of the fast line steamer are replaced in the tramp by a blunt bow, a flat bottom and straight sides, producing in her model a strong resemblance to the cubical form of a section of a squared log. The ship builders' term, "block coefficient of fineness," shows the per cent. that the ship's displacement is of the content of a circumscribing parallelopipedon of the following dimensions: length of ship on the load line, draft and breadth. This coefficient for an ocean greyhound is about sixty-two per cent.; for a nine-knot tramp steamer about eighty per cent. The keel of romance is replaced by a steel bottom as flat as the floor of a warehouse. The keel, as a center of construction, is inside rather than outside the line of the hull, enabling the ship to store freight in every foot of her depth. To prevent the rolling of the vessel, this freighter has bilge keels—fin-like strips of metal riveted to her hull near the blunt angles between the bottom and the sides. With her flat bottom she can cross bars to enter the shallow harbors of any ocean and engage in almost any trade.

Satsuma; Barber & Co., Typical of the Charter Fleet.

2. The economics of navigation group themselves around the central question of speed. It is a fact in mechanical engineering that high speed is attained at much greater expenditure of power per unit than that required to traverse the same distance at low speed. In automobile tests a four horse-power car has made fifteen miles per hour, but seventy horse-power was required for sixty miles per hour. The increase in fuel required is in a similarly high ratio, sometimes approaching in steamships the square of increase in knots per hour. The fast steamer, in addition to form that does not make resistance in passing through the water, must have enormous engines and heavy coal consumption, and larger crew to handle it. These factors mean more expensive construction, less space for freight because of engine room, coal storage and crew quarters; more expensive operation because of greater wear of machinery, and cost of coal and crew. The advantage side of the account arises from the fact that there are more voyages in a year and consequent greater carrying power and because of the speed higher freight rates may be charged. But at twenty, twenty-two or twenty-four knots per hour the cost of this service is more than traffic in raw materials can stand.

At the other extreme of the mechanical question is the fact that low speeds cost a surprisingly small sum. A steamer could make four knots per hour with modern engines at a very small percentage of the cost required for twenty knots, but she would make such a small number of voyages per year and command such low freights that it, like the high speeds, would not be profitable for freight carrying. For freight carrying there is a point of equilibrium in speed above which additional speed costs more in outlay than it adds in income, and below which a lessened speed costs more in loss of earning power than it saves in operating expenses. This point of equilibrium rises with every improvement in engine construction. At present the usual speed for tramp steamers is about nine to ten knots per hour, and it may be confidently expected to increase, some of the newest steamers being already somewhat above it.

These comparisons between the chartered vessels and the liner may be brought out more clearly by the examination of the actual facts of operation of typical vessels of each class.

The "Baron Eldon" is a British tramp steamer, built at Sunderland (1899) for general work. The gross tonnage is 3,705 net tonnage, 2,385 and the crew, 29 men, all told. Her dead weight capacity is 6,100 tons and she has actually carried as cargo 5,360 tons of coal on one voyage and on another 5,550 tons of rice. Her coal consumption at nine knots per hour is 22 tons per day. The "Kaiser Wilhelm II" and the "Cedric" are two modern ocean giants, and built for the North Atlantic line traffic. The "Cedric" is not a racer, however, and has a displacement of 37,870 tons, will carry 18,400 tons of freight, 3,000 passengers, a crew of 350 and has a coal consumption of 260 tons per day at 17 knots per hour. The "Kaiser Wilhelm II" built to break all records, has a displacement of 26,000 tons, will carry less than 1,000 tons of freight, 1,888 passengers, and has a crew of 600, with a coal consumption of 750 tons per day at 24 knots per hour. She could beat the "Cedric" by about two days in a voyage from New York to Liverpool, but to make this gain her crew is nearly doubled and the daily coal consumption nearly trebled. The coal consumed by the "Kaiser Wilhelm II" in one day would run the "Baron Eldon," with her large amount of freight for thirty days, and carry her from New York to Liverpool and back to New Orleans. In this comparison the fact should not be overlooked that the "Kaiser Wilhelm II" carries 1,888 passengers. The "Baron Eldon" carries none, but her gross tonnage of 3,705 tons is a disproportionately large fraction of the Kaiser's 19,500.

Baltic; White Star Line, 23,876 Tons. Best Type of Liner, Less Than Express Speed.

3. The economies of management are possible because of the lack of dependence upon other ships and because the work is always of a temporary nature. The tramp has no schedule, and is free from the exactions of any particular round of engagements or the disadvantages of any particular route. She undergoes no unnecessary dallying at ports waiting for sailing day. The coming of passengers, the arrival of mails, long time contracts to carry certain freight, none of these handicaps of the liner affect her movements. As soon as her special cargo is loaded she is dispatched without loss of time. No further time is lost in making unprofitable calls at intermediate ports, and as soon as her destination is reached she is free to unload and seek further employment. No announced schedule requires her to be run, half empty, over a certain route or to lie in port awaiting freight as advertised. She has the freedom of the seas to seek freight in any port in any continent, to take advantage of any local conditions, any single shipment, that may appear to her advantage. If a bad harvest in America cuts off the grain export, the tramp that has been working in the north Atlantic may seek freights at the mouth of the Danube or South Russia or in the Indian Ocean or in the East Indies; wherever freight is offering, there may she go.

As there is no effort to hold patrons and develop a clientele, there is little expensive advertising done, and the simplicity of the cargoes requires a minimum of office force.

The business of managing this charter traffic is one of the most characteristic developments of the world's commerce of the present era, the epoch of the ocean cable. Several thousands of ships are scattered over the ocean of the commercial world, engaged in the traffic that is supplied by hundreds of ports in all climes and all continents, from Greenland to New Zealand. Every day scores or even hundreds of these independent vessels are seeking freight to carry. It is a complicated world puzzle to bring together the ships and the freight so that the one may be most profitably employed, and the other most economically carried. The work is done by the ship brokers and steamship agents who receive their pay in the form of a commission or brokerage, a percentage on the transaction. In all shipowning countries these firms have their headquarters, and each one has agents and "correspondents" in many other countries, so that among them all they make a complicated web that reaches to all cities of commercial importance. The whole is so bound together by telegraph and cable, that, like a spider's web, if touched by anything of importance at any point, the whole structure vibrates with the news. The departure of a steamer loaded with sugar from a small port in Jave or ore from Chile, is reported by telegraph in Europe and America. There is practically a complete record of all vessel movements published daily by Lloyds, the great British Association of Underwriters. The men engaged in world commerce have, through their world telegraph, a world community of information.

The method of securing cargoes for ships, and ships for cargoes, is best described by the relation of some common incidents of every day occurrence. A Liverpool shipowner had a steamer in the Mediterranean loaded with jute, which she was carrying from Calcutta to Dundee. The owner desired another cargo for the steamer at the end of the voyage. Knowing there was nothing in Dundee he wrote to his agent in Newcastle, and himself made inquiries among the shippers of Liverpool. The Newcastle man suggested a cargo of coal to Hamburg, but this the owner declined, and sought the aid of his correspondents in Dumbarton, but the iron trade of Dumbarton was not promising. Meanwhile the days were passing, the vessel had reached Dundee and there was nothing provided for her. The Liverpool man was himself the correspondent of a London firm of ship brokers, who telegraphed him at this juncture that they had offers of a shipment of German coke to go from Rotterdam to Santa Rosalie, lower California, and of another of Cardiff coal for Buenos Ayres. The first the shipowner declined, as being only suitable for a sailing vessel, and because of news from across the Atlantic he allowed the second to go to a steamer then lying at Antwerp. Three days before this he had cabled to his New York correspondent a description of the steamer, and offering her services to carry grain to the United Kingdom at a certain rate and saying that she could load after a certain date or between certain dates. As New York freight was dull, the firm in that city telegraphed their Boston and Philadelphia agencies. At the same time a Chicago grain exporter decided to export 150,000 bushels of corn, and telegraphed to his agents in New York and Philadelphia to secure offers of transportation. In the shipping exchanges of those cities the representatives of the Chicago exporter and the Liverpool shipowner bargained face to face. Offers were, however, made at the same rate by the New York representative of the owner of a ship then off Rio Janeiro with a cargo of Chilean nitrate bound for New York, and also by a Philadelphia broker who sought future employment for a vessel then in the Red Sea with a cargo of Java sugar for Philadelphia. The Liverpool owner was informed of this competition, and still having nothing for his steamer he cabled that he would charter his ship for three pence (6 cents) less per ton than he had offered, or for the same rate he would take freight to continental ports as far as Copenhagen. He added to his cablegram the word "range" which means in cable code that he would send the ship to the Delaware Bay with the understanding that she might be ordered to New York, Philadelphia, Baltimore or Norfolk to load. This offer secured the freight for the representatives of the sugar ship and the nitrate ship having more time at their disposal preferred to take chances rather than cut rates. The steamer, which, pending negotiations, was still lying at Dundee, proceeded to Newcastle to coal, and departed thence in ballast for the Delaware. Meanwhile the Chicago exporter found that railroad conditions made Norfolk the most convenient port to deliver his corn at the appointed time. When the steamer reached the Delaware Breakwater (just inside Cape Henlopen) the captain received telegraphic instructions to go to Norfolk. There he loaded a full cargo of corn and, as the final destination of the corn was still undecided, he sailed to the Channel port of Falmouth for orders. There he was instructed by signal to proceed to Copenhagen, where the corn was discharged and the vessel was ready for another contract which the agents had been trying to arrange since the day they learned of the final destination of the corn cargo.

That operation is typical of scores that are enacted daily. In almost every exchange of ideas connected therewith, the ocean cable or land telegraph plays an important part. The manager of a merchant fleet may control his ships almost as perfectly from his office in London, Liverpool, Hamburg or New York as does a chess player the men on a board before him. There are signal stations over the greater part of the world where the captain of a ship can receive cabled instructions from the central office. It is common to send vessels to sea with the final destination unknown, the captain reporting at some prearranged signal station where he receives further instructions. This is also true with vessels without cargo and seeking it. Nearly all of the grain ships going from the Pacific Coast of the United States to the United Kingdom sail to Cork, southwest Ireland, "for orders" announcing the final destination. Whether the cargo is to be finally consigned to a port in Britain or any one of four or five continental countries is decided by the grain shipper according to the latest market conditions. Vessels bound for northwest Europe, via Suez, often receive final orders at Gibraltar or Falmouth or Lizard's Point. If coming up the South Atlantic, orders are received at Cape Verde or Madeira Islands. A typical case is that of a vessel, which, lying idle at Singapore, was ordered to proceed for orders to a signal station in Lower Burmah. While en route her owner in London sought cargo. By having the vessel go to Lower Burmah he had the possibility of getting a cargo of rice from Rangoon, or proceeding to Calcutta if cargo were offered there. By ordering his ships from station to station the owner or manager on the shores of the North Atlantic keeps in touch with his scattered fleet in the Indian Ocean, Eastern Asia, Australia or the East Indies almost as easily as if they were a mile or two away in the harbor of his own city. The recent equipment of oil barges with wireless telegraph suggests the arrival of the day when the ship owner may under normal conditions be in constant communication with his ship in all places.

The tramp vessel has earned the name by her absolute freedom of restraint to particular localities, routes or trades. In the constant search for freight she may traverse every sea, and in the course of years, often circumnavigates the globe many times. This roving tendency is increased by the fact that so much of the work done by these vessels is of a seasonable nature, a certain region shipping its product at a certain time only. California wheat is ready to ship at a different season from that of Argentine Republic or India. The corn of the Mississippi Valley is ready to ship later than the wheat from the same region. There is a different sugar season from Hawaii, Peru, Java and Germany. There is a cotton season and a nitrate season, the latter being decided by the greater demand for nitrate fertilizers in the spring planting of the northern hemisphere.

The seasonal nature of the traffic adds to the complexity of the business of ship management. The shipowner has to keep in mind not only the conditions of the contract he is making, but also the prospects ahead of the ship when she must again seek cargo. It is like a game of chess, in that each move must be made with regard to succeeding moves. The shipowner is glad to arrange a voyage that will release the ship in a good location to secure freight, and loath to send her to regions that are devoid of freight, and rates are made accordingly. A cargo of lumber would be taken at a lower rate to New Caledonia, with its export of ores, than to some coral isle in the Mid-Pacific with no export but a few cocoanuts. Thus the possibilities of two or even three voyages enter into the decision of the rates for one. The manager of vessels that happened to be in India or Java or South America would give, under usual conditions, a relatively more favorable rate for a full cargo to New York than to London because he is reasonably sure of getting a profitable freight cargo away from an American port, and an unprofitable coal or ballast cargo away from Great Britain. As a result of judgments of this character steamers are sometimes started upon a chain of voyages requiring months to complete. For example, a man in London, may have an opportunity to secure a cargo of goods from Liverpool to China, and he takes it because he thinks that by the time his ship has reached China he can arrange for a cargo of Java sugar to New York or Philadelphia, and from that point he can get grain back to Liverpool or London; or the same man might send out his ship from London with a cargo to Australia, because she could there get a cargo of coal and take it over to Chile in season to secure a cargo of nitrate for a European or American port.

The tendency of the tramp steamer to rove is intensified by the fact that none of the world's greatest trade routes has equal amounts of freight moving along in both directions. North America sends across the North Atlantic more than twice as many tons of freight as Europe sends back. China and Japan import twice or more than twice as much (in bulk) as they export and the Dutch East Indies, the west coast of South America and the Pacific Coast of the United States all export more than they import. As a consequence the tramp vessel cannot expect to secure cargo both ways and regularly run back and forth on the same route. Ordinarily the tramp must expect, if carrying a profitable cargo, to pass over a certain route in a certain direction, the direction of heaviest freight movement. The ideal of the manager is, therefore to have his ship always discharge one cargo at the profitable or freight surplus end of another trade route. This is clearly impossible. The world's freight can not be carried without sending vessels to places where there is no return cargo. The fewer the voyages of this character, the greater is the profit and skill of the manager. But voyages without cargo must be taken even under the most careful management.

Lacking cargo the vessel must take ballast to steady her, and for this cause thousands of tons of useless sand, earth, stone and water are carried from country to country. But rather than take ballast for nothing the tramp vessel can afford to carry bulky cargo very cheaply, so it happens that coal and sometimes ores are carried practically as ballast substitutes, and at or even less than, the actual cost of running the ship. The voyage must be made to secure profitable cargo at the other end, and the cheap coal freight is that much clear gain. Shipowners are sometimes compelled to send vessels from England to the Pacific Coast of the United States, with no choice but to carry sand or coal, and with plenty of competition for the coal. Under these conditions the product of the Welsh mines has been carried from Cardiff to San Francisco for eight shillings a ton, while the return cargo of wheat paid thirty-five or forty, or fifty or more shillings a ton, and gave the shipowner his profit.

Idaho; Wilson Line. Type of Freighter in Line Service.

The distribution of coal by ocean carriage may, in most cases, be considered a by-product of the charter traffic. There are some cases where coal is carried short distances in lines of vessels especially built for the purpose, but this represents but a small proportion of the total coal carriage. The consideration of the by-product phase of the carrying trade shows that nations are in the best position to export their products cheaply when they import a greater quantity of merchandise than they export, for there is then competition among the shipowners to get the outgoing freight. For this reason the greatest coal exporter is Great Britain, the greatest importer of bulky freight. Next, in respect of the wide distribution of this product, come Australia and Japan, both fourth-rate coal producers, but countries whose imports are more bulky though less valuable than their exports. These countries are able to export coal, widely, yet in none of them is coal so abundant or cheap as in the United States. The United States has not become an important coal exporter, except to adjacent countries, because the heavy exports of raw materials have employed more shipping than our imports required, so vessels come to us in ballast, and a ship that carries coal from an American port must usually return in ballast, making it necessary for the coal freight to pay for both voyages. This cannot be done, because the somewhat more expensive British coal is carried at very low rates as ballast cargo and undersells the American in most foreign ports. The American export of coal is limited almost entirely to Canada and Mexico and to the West Indies, whence we are importing iron ore, sugar and woods, all of them bulky articles, and the outgoing vessels carry the coal. In contrast to this British coal goes more than half way around the world. The tramp is cheap but slow and uncertain, she suffices for raw materials, but for a large share of the ocean work she cannot compete. The exchanges of articles of high value per ton, require, because of that value, the more dependable and expensive service of the line vessel.

The regular service in its turn stimulates trade by its regularity, and is a necessary part of the commerce of highly civilized states. Passengers cannot make their arrangements to sail on vessels whose time of departure is uncertain. Like the mails, the passenger traffic requires a definite schedule of sailings, which must be made out months in advance, and announcement made of the day and hour of sailing. Certain classes of valuable freight are scarcely less exacting and there are many lines of vessels carrying freight only that are made to follow an advertised schedule almost as punctually as do the passenger lines.

The distinction between line traffic and charter traffic is in some cases hard to point out. The difference between the work of the best Trans-Atlantic liners and that of a typical tramp steamer or sailing vessel is unmistakable, but there is a point where the two kinds of traffic approach each other closely and, from the standpoint of the vessel, there are many cases in which the distinction cannot be drawn at all, because many vessels pass repeatedly from one service to the other. This transition service is best explained by describing the methods of operating some of the cheaper all-freight lines.

With these, as all other lines, the amount of freight to be carried fluctuates, and the company will often do it all with chartered vessels or own only enough vessels to attend to a sure minimum of business, and when temporary increase of traffic comes the managers turn to the ship market for additional vessels to be taken on time charter, and operated in the line service so long as it seems expedient to do so. When trade decreases the charters of these vessels are allowed to lapse and the fleet is reduced. In this work steamers are often chartered for a year or even two years if rates promise, in the opinion of the charterer, to be steadily rising. Vessels are also taken into the line service for only a single voyage, particularly where there is much more traffic one way than the other. It is common for some of the lines regularly carrying freight from New York to Australia and the Orient to charter vessels for the out voyage only. On these routes returning freight is so scarce that even the vessels owned by the companies may become tramps or are "put upon the berth" at the end of the voyage, and work their way back to New York by whatever indirect route offers the best chance of earning freights. It is a common, almost a regular occurrence for some of the companies operating steamship lines in these trades to announce the date of a steamer's sailing when they cannot give her name, because the yhave not yet chartered her. Any good tramp steamer may be secured for the assignment at the latest available date.

New York; American Line, 10,798 Tons. Largest and Fastest Type Until 1893.

This elasticity of service is not possible with the lines having passenger service, specialized freight traffic and vessels especially adapted to the trade and built for it. A fleet of such vessels cannot be enlarged by chartering at will.

Despite the traffic of uncertain qualities there is a vast line traffic having pronounced differences from the charter traffic. From the standpoint of traffic these differences may be summarized in the two words, regularity and speed, or in two others, increased efficiency.

The efficiency of the line of steamers is only obtained by incurring certain expenses that are not necessary if the vessel is working independently and carrying special cargoes. These expenses may be classed under the heads: 1. Maintenance. 2. Management and advertising. 3. Costly construction. 4. Speed.

1. The most important single factor about line service, the schedule and its maintenance, is one of the great cares and costs of the managers. When a vessel is scheduled to sail on a certain date, her time may be up before she is fully loaded, or she may be loaded or ready to load and have to wait till the appointed time. Both are expensive to the owner. The making of a schedule must provide for the worst conditions of weather, and then in good weather, the vessels may lie idle in their expensive docks. In keeping up a regular schedule it may be necessary to enter ports when the freights do not warrant the delay and the cost.

In contrast to this is the freedom of the chartered vessel. She takes things as they come, she has made no promises, she sails as soon as she is ready, can be delayed without any further inconvenience than the loss of time, and proceeds only to such ports as best suit the particular conditions of a particular voyage.

Accidents fall with cumulative force upon a steamship line because of the effect upon the schedule. In addition to the direct loss due to the accident, the future sailings and service are often demoralized, and the fulfillment of outstanding contracts becomes a matter of great difficulty and financial loss rather than profit. If a ship is disabled a few days before time for putting to sea, her place must be filled, and it is difficult and often costly to secure a good steamer in an emergency or even to secure accommodation elsewhere for the passengers and freight that have been engaged. Such necessary shiftings may make a month or more of losses where high profits were expected.

2. Line traffic, particularly when an object is made of carrying passengers, requires a large amount of advertising to catch and keep the attention of the would-be traveler and to create the desire for travel. Allied to the advertising is the elaborate arrangement of offices and agencies in many cities for the selling of tickets and securing of freight. At the port of sailing, the office of the steamship agents managing a high grade steamship line requires an efficient force of clerks. The staff must be organized on the basis of its ability to manage the work at the times of greatest rush—sailing day—although it may be partly idle in the intervals.

To handle the line traffic in freight requires more clerical work and more warehouse room than the same amount of charter traffic, because of the greater number of shipments to be received, invoiced, cared for till loading time, placed safely in the hold of the ship and finally assembled at the point of discharging cargo. Such cargo is often spread out in separate lots over a large area of quay or warehouse space. The bulk equipment of grain or other uniform charter cargo can be discharged more easily into coasting or river craft alongside or it may be thrown in great heaps, so that it occupies less warehouse space than any other kind of cargo.

3. Many kinds of line traffic require special types of ship construction. First among these is the passenger service, which is provided for wherever the travel is sufficient to give passengers for a part of each year. Human freight is more exacting than inanimate cargo and while the business is very profitable, it adds greatly to the cost of construction of the steamer, increases the crew and decreases the freight space.

Many kinds of freight require nearly as much special construction as do passengers. This statement applies especially to perishable goods requiring refrigeration. There is a large traffic in frozen meat between Great Britain and the southern hemisphere. The frozen carcasses are taken from a cold-storage warehouse in Argentina or Australasia and carried to Europe in the ship's freezing chambers. Another division of the refrigerator traffic is the larger and rapidly growing use of chambers where the freight is chilled, but not frozen. In this manner is carried the American fresh meat en route to Europe, and the most of the ocean trade in fruits and dairy produce. Some other forms of special construction are found in ships prepared for carrying live cattle, and in tank steamers for the carriage of oil in bulk, and the fruit steamers that carry oranges and bananas from Caribbean and other tropical countries.

4. High speed is not a necessary part of all line traffic, but it is an essential factor and a large element of the cost in those lines carrying passengers and mail, and in some freight lines. The

increased consumption of coal has been referred to in the discussion of charter traffic. High speed requires, along with greater coal cost, greater crew to handle the coal, larger bunkers and machinery space, and consequent lessened freight space. Machinery running at high speed wears out sooner and requires more repairing per mile than when operated at lower speed. The fast vessel is also more liable than a slow one to accidents at sea, especially collisions.

As a compensation for the various costs the line steamer has several strong advantages over the chartered vessel. 1. It can charge higher rates of freight on some goods. 2. It can secure more advantageous loads through mixing cargo. 3. It wins patrons and develops trade through acquaintance.

1. The liner monopolizes the passenger traffic, the carriage of mails, and because of its speed or regularity, or both, it can charge a higher freight rate for much valuable express cargo in the transportation of which time is an important factor.

2. In the carriage of ordinary freight the liner has an advantage in its ability to secure mixed cargo, and stow into a given space more tons of freight than can usually be secured by the special cargo vessel, which ordinarily carries a cargo of one article only.

The question of the relation of the bulk of cargo to its weight is a very important one for the ocean carrier. The ship has a certain capacity in dead weight tons, and an absolutely inelastic amount of cubic space into which those tons must be stowed. It is important that both space capacity and weight capacity be utilized, and to do this there should be some heavy cargo to give the weight and some light to fill the space. A full cargo of either is unsatisfactory.

The ocean carrier solves the problem by basing his freight rate on two different units, one of weight and one of cubic contents. Both are called tons, the weight ton and the measurement ton, the latter consisting of 40 cubic feet. The shipowner exercises his discretion as to whether he receives freight on the weight or measurement basis, and, of course, uses the one most favorable to himself. The measurement ton happens to have its particular size because a weight ton of wheat occupies about 40 cubic feet, and as wheat has long been a staple, and often the greatest staple of ocean commerce, shipowners came to think of their vessels in terms of their wheat-carrying capacity, and this grain became the norm for measuring other commodities. Freight goes by weight or measure, at the discretion of the carrier. Hence a shipping company's report of the number of tons of freight carried, gives neither an accurate measure of weight nor cubic content of the traffic, because it is usually composed of unknown quantities of both kinds.

A mixed cargo will give a greater cargo tonnage than a full cargo of either kind, because all vessels will contain more heavy cargo than they can float, and they will float more light cargo than their space can contain. A vessel that can carry 1,000 tons dead weight would have four-fifths of her space empty when carrying a full cargo of iron. On the other extreme a full cargo of wagons or wooden manufactures would not weigh more than 300 or 400 tons. In one case the ship is wasting space, in the other carrying power; but with 700 tons of iron or steel in the bottom of the hold there is still space for possibly 700 tons of light measured cargo, say, wagons and furniture—1,400 freight tons in all. The possibility of making such combinations is constantly before the managers of line vessels, and freight is sought and rates are made with such arrangements in view. If 1,400 freight tons of wagons and steel rails can be put into the vessel that can only carry 1,000 tons of rails alone, the agents can well afford to take both articles at a rate somewhat lower than could have been offered for a full cargo of either, and yet have greater returns than would have come from a full cargo of a single commodity at the full rate—1,000 tons at \$5 per ton equals \$5,000 and 1,400 tons at \$4 per ton equals \$5,600.

The steamer is also much safer to navigate with a full dead weight rather than a light measurement load.

3. The line has also the advantage of getting regular patrons, of making contracts for long periods and of reaping the advantage of the increased trade that its regularity fosters, but it must also maintain its reputation and preserve that regularity of performance during periods of depression and loss.

(To be continued.)

Electrification of the Suburban Lines of the Western Railway of France.

As a result of the campaign which it has been conducting against delays to trains in the suburban work of the Western Railway of France, the Paris *Matin* has received a letter from the managing director, a portion of which might well have been written by any one of a dozen managers of American railroads who is dealing with congested terminal facilities. The writer states that inasmuch as *le Matin* has opened its columns to complaints of passengers that are made because of trains that are late in reaching the Saint Lazare station, he confides in the spirit of justice with which the paper is endowed to publish the reply of the railroad company.

In a station like that of Saint Lazare, where the engine and train movements are more than 1,200 a day, it is quite inevitable that there should be some incidents to delay operation. The complaint is that these delays are excessive, and the suburban patrons very properly insist that even the most insignificant of these delays interfere with the satisfactory performance of their daily work. What the public wants to know is whether the company has done all in its power to remedy the situation.

Negotiations were opened with the city of Paris in 1902 for the purpose of running the Auteuil line beneath the Rue de Rome, but the construction of the second Metropolitan line killed all hope of doing away with the Batignolles tunnel. From that time on every effort has been bent towards the suppression of the throat through which all traffic to the Saint Lazare station must pass. And as soon as it was understood that prompt action on the plans could be counted upon, a definite project was presented. This was done in July, 1906, but it was not until May, 1907, that the plans were approved whereupon work was undertaken at once. But while the execution of these works of improvement are being pushed as rapidly as possible, the suburban traffic is constantly increasing. It was 20,000,000 passengers in 1884; 40,000,000 in 1904, and 42,000,000 in 1906.

This expansion of the traffic has not been evenly distributed, as, for example, the line to Versailles and its branches have fallen far behind other portions of the system because of the competition of the tramway lines, whereas that of St. Germain d'Argenteuil has advanced by leaps and bounds. It was 11,100,000 in 1884; 26,000,000 in 1904, and 29,300,000 in 1906. The consequence of this has been an enlargement of the original program and an announcement that the road is prepared to electrify this line.

It is the expectation that the completion of these works will make an entire transformation of the service, not only in the case of the short distance runs, but also of the long ones, and that great elasticity will be given to the Saint Lazare station and its approaches.

The electric lines, starting from a subterranean station below the level of the Cour de Rome, will make it possible to run electric trains between the Saint Lazare station and Germain and Argenteuil without any grade crossings.

The rolling stock will be like that of the Metropolitan, but enlarged. It is estimated that the schedule time will be cut down one-half and that it will be possible to run 20 trains an hour.

The letter concludes with the statement that the Western Railway Company, against whom these constant recriminations have been hurled, has not ceased for an instant in spite of the difficult situation in which it has been placed to struggle for an improvement of its service, and this is manifested by the magnitude of the work which it has undertaken.

Coal Production in 1906.

According to the *Moniteur Industriel* the total coal production of the world for 1906 was about 905,000,000 tons. In this there has been a decided increase in some countries over the preceding year, Great Britain, for example, showed an increase of 15,000,000 tons, Germany of about 15,500,000 tons, and the United States nearly 19,000,000 tons. The production of the principal countries is given as follows:

	Tons
United States	370,000,000
Great Britain	251,000,000
Germany	135,000,000
France	33,500,000
Belgium	23,250,000
Russia	20,000,000
Other countries	72,250,000
Total	905,000,000

France produced about 1,000,000 tons less than in 1905, probably because of the trouble in the north at the beginning of the year, for, though the output was but 15,000,000 tons during the first six months, it rose to 18,500,000 tons in the last. The United States furnished 50 per cent. more than England; Germany about half as much, and France and Belgium scarcely more than a quarter. If, on the other hand, these figures are compared on the basis of the population of the interested countries, we find that the production in England amounts to 4.75 tons per capita, while that of the United States yields but 4.50 tons; Belgium, 3.25 tons; Germany, 2.25 tons, and France less than a ton. England, which holds the first place in this proportional production, exported, during the first nine months of last year, 46,884,000 tons of fuel, a figure that indicates a considerable advance over the same period for the two preceding years. This was

	Tons
For 1905	35,309,000
For 1906	41,230,000
For 1907	46,884,000

The increase of 1906 over 1905 was due to large orders from France, Italy, Belgium, Russia and Argentina; while that of 1907 over 1906 came from exportations into Germany, Holland, Belgium, France and Italy; orders from Argentina having been comparatively insignificant.

GENERAL NEWS SECTION

NOTES.

The Chicago & North-Western has issued an executive order prohibiting throwing rice and other missiles at or around any bridal party entering or leaving trains.

The Pittsburgh Car Service Association reports that 122,130 cars were handled in its territory during January, 1908, as against 220,654 cars in January, 1907, a reduction of about 44 per cent.

The Supreme Court of Montana, on February 25, declared valid the state law providing that employees must not be worked for more than 16 hours without eight consecutive hours for rest.

The Rock Island has reopened its traffic office at the city of Mexico, indicating apparently another change of policy by the road, which had temporarily withdrawn from the Mexican field.

Announcement is made that the Seaboard Air Line, beginning April 1, will act independently in the matter of party rates and will give a flat rate of 2 cents a mile for parties of 10 or more persons.

It is understood that 85 per cent. of the telegraph operators on the Northern Pacific voted against the proposition made by the road in regard to the new schedule of hours and wages, to become effective this week.

It is understood that the Per Diem Commission to be named by the executive committee of the American Railway Association will consist of Lucius Tuttle, Marvin Hughitt, James McCrea, W. W. Finley and Howard Elliott.

The Nebraska Railroad Commission has ordered the railroads of that state to show cause by March 10 why certain radical reductions should not be made in freight rates and why a maximum distance tariff should not be established.

Announcement is made that there will be a rail connection between the Hudson & Manhattan tunnel at Jersey City and the Erie station, with the ultimate intention of running Erie suburban electric trains of special type into New York City.

The Union Pacific is now charging passengers not holding tickets, 3 cents a mile for 10 miles or less in Kansas and 25 cents excess fare where the regular rate is between 50 cents and $1.50. If the rate is more than $1.50, 50 cents excess fare is charged.

The Louisville & Nashville and the Atlantic Coast Line have instigated a friendly suit in Alabama to test the new franchise tax of the state. The Louisville & Nashville paid approximately $23,659 on account of this tax on February 2 and at once brought suit to recover it.

The Inland Empire System, operating approximately 150 miles of road by steam and electricity in the state of Washington, has adopted a compact rate schedule card for class rates out of Spokane, which is designed to be simple enough so that the shipper can use it himself without difficulty.

Effective March 1, it is understood that a 10 per cent. reduction will be made in the salaries of officers and subordinates on the New York, New Haven & Hartford receiving $2,000 and upward per year, and that a 5 per cent. reduction will be made in salaries between $1,200 and $2,000 a year.

Attorney-General Bonaparte, on March 2, directed United States attorneys to institute suits against 27 railroad companies to recover penalties incurred by them for alleged violations of the safety appliance law, as reported to the Interstate Commerce Commission by its inspectors of safety appliances.

On February 25 the House committee on interstate and foreign commerce authorized a favorable report on the Esch bill, requiring railroads to make reports monthly of all accidents on their lines to the Interstate Commerce Commission, and authorizing the publication of those reports by the commission.

The Erie allows members of the faculty of the Cornell College of Agriculture, who are traveling through the state in the interests of good farming, to travel free on its trains, and also carries seed samples and agricultural matter free when sent to the college for examination, or when sent from the college to the farmer.

The Central Freight Association has agreed to reduce the rate on grain and wheat originating west of St. Louis $1\frac{1}{2}$ cents, and on oats, flour and other grain products, destined to the Atlantic seaboard, half a cent, effective April 15, to protect the St. Louis market, since St. Louis has no direct lake route for eastbound traffic.

A local surgeon of the Union Pacific in Nebraska, and the editor of the Gothenberg (Neb.) *Independent*, have been bound over for trial for accepting free transportation from the Union Pacific. These are regarded as test cases, in which the company will make a strong fight against the validity of the state anti-pass law.

Announcement is made that the Burlington has abolished its industrial department, effective March 1. The department was created by W. H. Manss, now with the Chicago Association of Commerce, and for several years the company made large expenditures in educating farmers in various branches of farming along the route.

The Texas Railroad Commission has given the Texas & Pacific until March 15 to make answer whether or not it will comply with the commission's order to make improvements to its physical property in Texas, costing about $2,000,000. If the railroad refuses to obey the order, the state will seek to have a receiver appointed for it.

The Western Union Telegraph Company has instituted suit against the state of Wisconsin to recover $12,886, which it alleged was paid as excessive taxes in October, 1907. The complaint says that under the ad valorem law the company's property within the state was assessed at $1,800,000, whereas the true value was but $653,544.

Circulars have been sent to shippers in New York providing for a reduction on the charge for all split deliveries from $9.00 to $3.00, this action having been made possible by the Interstate Commerce Commission in authorizing the trunk lines terminating at New York to make changes in rates under certain conditions on one and three days' notice.

The Long Island Railroad announces that a year's experience has proved that the refunding of fares because of the failure of commuters to have their commutation tickets with them causes a greater loss of revenue than anticipated or warranted by the legitimate accommodation thus afforded. Therefore these refunds have been discontinued since March 1.

On February 29 the Louisville & Nashville rescinded its recent order reducing the pay of engineers and conductors 10 per cent. on all its lines. The engineers had declined to accept the cut, but the conductors had agreed to a compromise at a reduction from the former scale. Both classes will continue for the present to receive pay on the former basis.

A series of joint rate meetings is to be held, beginning with one in Chicago, March 9, at which the revision of the Chicago joint passenger rate sheet will be undertaken. As soon as this is completed the revision of the St. Louis sheet will begin and others will follow, in accordance with an agreement reached by the Central, Western and Southwestern passenger association lines.

It is not true, as currently reported, that the Erie has abolished piece work in its shops. After a year's trial it has made certain modifications to meet service conditions, but retains the principle as strongly as before. General laborers working in and about the shops have had a reduction of 10 per cent. in their pay but no reduction has been made on the piece work scale.

The Union Pacific is standing firm in its refusal to make any changes in its system of elevating charges on grain, as opposed to the efforts of certain grain-carrying roads south of the Ohio river to reduce the elevation charge to the shipper. The Union Pacific believes that the assumption of the maximum part of this charge by the railroad has its principal effect in furthering speculation.

Five bishops of the African Methodist Episcopal Church have complained to the Interstate Commerce Commission about the accommodations furnished negro passengers on trains in the South, alleging that the cars are dirty and have inadequate accommodations, and that negroes are not allowed to buy sleeping car tickets or to eat in dining cars, although they pay the full first class fare.

As a result of the reduction in per diem from 50 cents to 25 cents a day, the New York, New Haven & Hartford has re-entered the American Railway Association, but with the proviso that in any future change of rate it shall receive notice a sufficient time ahead to give it opportunity to withdraw from the association if it should desire to do so. The New Haven has stood aloof since October 1, but has charged to itself over $600,000 per diem at the 50-cent rate.

The Texas Railroad Commission is in a state of mind at the criticism it has received because of its extreme requirements of the railroads at a time when they are unable to raise funds, contributing to the causes of the International & Great Northern receivership. The commission declares that it will put every railroad in Texas in receivers' hands rather than permit operation under hazardous conditions, forgetting, perhaps, that from time immemorial operation on bankrupt roads has been more hazardous than on roads able to provide for the upkeep of the property.

The Chicago, Milwaukee & St. Paul has asked authority to cancel through passenger tariffs from eastern points to Seattle, via Portland, owing to the recent opinion of Commissioner Clark that through tariffs, involving travel over more than one line, must have the sanction of all the roads involved. The commission has had the question of the establishment of a through rate and joint rate via Portland before it since last summer.

At a labor mass meeting of 1,500 men at Atlanta, Ga., February 21, President Roosevelt's action in ordering an investigation of reductions in railroad wages was endorsed. On the following day the Georgia Railroad Commission ordered all carriers contemplating reductions to furnish the commission with a statement of the proposed reductions and the reasons for them in full. The order is issued under the state law which requires carriers to maintain reasonable service, the commission holding that the reduction of wages without sufficient reason would tend to produce discord and prevent carriers from maintaining a satisfactory service.

At the same time that Georgia was strenuously opposing wage reductions, last week, a delegation of railroad men had an audience with the House committee in Mississippi, protesting against any legislation that would interfere with the management of Mississippi railroads and give the corporation an excuse to reduce wages. When the Mississippi legislature, now in session, first assembled, the Governor sent a message strongly urging a 2-cent law, but the Senate committee, to which this part of the message was referred, has recommended that no action be taken, expressing the opinion that no rate lower than 3 cents is advisable under present conditions in the state, and this report has been adopted by the Senate, to the great encouragement of the railroads.

At a hearing on the nine-hour law before the Interstate Commerce Commission, February 27, the representative of the St. Louis & San Francisco testified that the company would have to increase its rates to offset the charge. The representative of the Southern Railway testified that it would be necessary under the law to employ 220 additional operators, and that the company was unable to do this and meet its other obligations. Similar arguments were presented by a large number of other roads, but the commission showed no desire to help, and on March 2 definitely denied all petitions. It is understood that the Pennsylvania will require 700 additional operators to meet the requirements of the law. The immediate results of this legislation, effective March 4, have been the closing of an exceedingly large number of small telegraph stations all over the country.

The chairman of the Public Service Commission for New York City called attention in a recent address to the very urgent need for new subways in New York and to the fact that under present conditions nobody is interested in building these lines. He felt it was necessary that the state constitution should be so amended as to enable the city to build the subways directly, or else that laws should be passed that would allow private capital to build and operate new lines under conditions which would tempt capital instead of frightening it away. The commission in its recent report to the legislature said that it was necessary to start with the idea that the city's rights were to be protected, and then to make a reasonable and safe contract with the man who is willing to risk his money. If a capitalist is shown that his principal is safe, and that he is reasonably sure of a fair profit on his investment, he will take hold; otherwise he will not.

Reducing Liquor Sale on Pullman Cars.

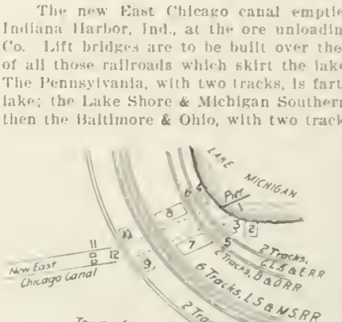
There are now only about eight states where the Pullman Company is selling liquor on its cars. Partly because of state prohibition laws and partly on account of changing public sentiment, the company has for ten years been reducing gradually its liquor business, and has recently added Pennsylvania to the non-liquor list.

Acetylene Insurance Rules.

The rules formulated by the National Board of Fire Underwriters for the use of acetylene have hitherto required outside installation of acetylene generators. Although in most sections throughout the United States this rule has not been insisted on, in certain limited sections it has been rigidly enforced. At a meeting on January 30 the board, after considering reports submitted to it by its various committees, amended these rules by striking out such words as prohibited inside installation and substituting the following: "Generators, especially in closely built up districts, should preferably be placed outside of insured buildings in generator houses constructed and located in compliance with Rule 9." Where outside installation is preferred, as above, the rule regarding construction of generator houses has been modified. Such houses formerly had to be fireproof, built of brick and located as far as practicable from other buildings; they may now be located adjoining an insured building, and fireproof construction is not required.

Lift Bridge Foundation Work at Indiana Harbor.

The new East Chicago canal empties into Lake Michigan at Indiana Harbor, Ind., at the ore unloading slip of the Inland Steel Co. Lift bridges are to be built over the canal to carry the tracks of all those railroads which skirt the lake shore on their way east. The Pennsylvania, with two tracks, is farthest from the shore of the lake; the Lake Shore & Michigan Southern, with six tracks, is next; then the Baltimore & Ohio, with two tracks; and nearest the lake is the Chicago, Lake Shore & Eastern, with two tracks. The accompanying plan shows the tracks and the foundations for the bridges.

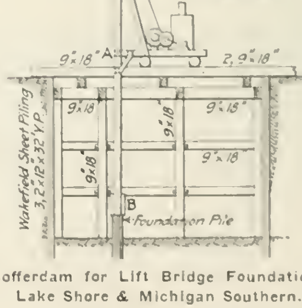


Location of Foundations for Lift Bridges Over New East Chicago Canal.

The average amount of excavation for the piers of these lift bridges is about 5,000 cu. yds. for each two-track lift bridge. On the Lake Shore three double-track bridges are to be built side by side, so the excavation work is obviously less for each bridge than in the case of the other three roads, which have only one double-track bridge each.

At the beginning of the work on the Lake Shore, Wakefield sheet piling, consisting of 2 x 12 yellow pine timbers, 32 ft. long, was driven and jetted. As shown in the accompanying section of the cofferdam, which is 42 ft. x 105 ft., the piling is 6 in. thick, the joints between the planks being staggered. One 2,000-lb. drop hammer, with a gang of 12 men, at an average of $2.45 per day, drove 15 ft. of the sheet piling each day. The piling generally sank under the weight of the hammer because of the jetting, and little driving was needed. Excavation began about the middle of September; by the first week in November the work had been carried down 26 ft. and foundation pile-driving started. Ten men at $1.60 per day, one hoisting engineer at $3 per day and two men at the gondola car, dumping the 1-yd. cylindrical buckets, constituted the gang for this work. The first 8 ft. was dry sand. Six feet below the top of the sheet piling, 9 x 18 in. walling pieces, with the wider sides against the sheet piles, were placed all the way round the cofferdam. As cross bracing, 9 x 18 timbers, with the greater dimension vertical, were then strung across at intervals of every 15 ft., along the longer dimension of the excavation, and every 14 ft. along its shorter dimension. Vertical posts were set at the junctions of the longitudinal and transverse bracing; these posts were secured to the bracing timbers with ½ in. x 4 in. forged angles, each leg 5 in. long, with two holes for 8-in. lag screws. The 9 x 18 in. timbers used in the cofferdam were taken from old bridges and trestles.

As the excavation was carried down, new walling pieces were added at intervals of about 5 ft. until the full depth of 28 ft. was reached. These lower walling pieces, however, were composed of two 9 x 18 in. timbers lagged together and placed on edge against the sheet piling to gain additional strength. Beneath the points of intersection of the walling pieces and the cross bracing vertical 8 x 16 in. timbers were lagged on with the wider side against the sheet piling.



Cofferdam for Lift Bridge Foundation; Lake Shore & Michigan Southern.

About 8 ft. below the surface, water was found, and two type B Emerson Junior pumps, 180 gals. per minute capacity, each with 4-in. suction and 3-in. discharge pipes, were hung from the upper timbers. These kept the excavation dry down to its lowest level, 25 ft. below the water line, during the time the foundation piles were being driven. Two other Emerson pumps were used also in the cofferdam for the smaller pier. These weighed 250 lbs. each.

A total of 1,200 piles were driven in the main and minor excavations and 24 men, averaging $2.45 per day, with one 2,800-lb. and one 2,000-lb. drop hammer in 65-ft. guides, drove an average of 30 piles a day, each pile about 45 ft. long. The method of mounting the pile-drivers is shown in one of the drawings. Two chords, 9 x 18 in. each, were lagged together, with joints staggered, and in about 30-ft. lengths, so as to make an 18 x 18 in. beam 60 ft. long. Two of these, spaced about 10 ft. apart, rested on the transverse and vertical cross bracing of the upper tier. Across these two were laid two extra heavy 10-in. wrought-iron pipes which served as rollers for the hoisting engine which operated the drop. Since the piles were not driven until the excavation had reached its lowest level, there were four different tiers of cross bracing which interfered with the lateral movement of the pile-driver guides; instead, therefore, of lifting the entire 65-ft. length out of the excavation whenever the progress of the pile-driving made it necessary to cross a longitudinal or transverse bracing timber, the lower 30-ft. section of the pile-driver guides was made detachable. By taking out eight bolts the hoisting engine could lift this lower section above the upper tier of cross bracing and the engine was pushed over into the next shaftway, where the lower section was again dropped into place, attached, and the pile-driving resumed. The change required a little over five minutes.

A 1-yd. Hayward orange peel bucket was used in the excavation for the Pennsylvania bridge. One No. 3 Emerson standard pump, with 725 gals. capacity, 5-in. suction, 4-in. discharge and 1¼-in. steam pipe was used. A similar size was used in the B. & O. excavation and another of the same size in the C., L. S. & E. excavation.

Southern Pacific Service Accelerated.

The Southern Pacific rail and water lines have put into effect the following revised service:

Freight leaving Boston Tuesday by New England Steamship Co. or Metropolitan line will go forward from New York on Morgan line steamer, sailing the following Thursday.

Freight leaving Boston Thursday by New England Steamship Co. or Metropolitan line will go forward from New York on Morgan line steamer, sailing the following Saturday.

Freight leaving Boston Saturday by New England Steamship Co. or Metropolitan line will go forward from New York on Morgan line steamer, sailing the following Tuesday.

Freight leaving Philadelphia Monday and Tuesday by Clyde line will go forward from New York on Morgan line steamer, sailing Thursday.

Freight leaving Philadelphia Wednesday or Thursday by Clyde line will go forward from New York on Morgan line steamer, sailing Saturday.

Freight leaving Philadelphia Friday and Saturday by Clyde line will go forward from New York on Morgan line steamer, sailing the following Tuesday.

Freight leaving Baltimore Monday by New York and Baltimore Transportation line will go forward from New York on Morgan line steamer, sailing the following Thursday.

Freight leaving Baltimore Wednesday by New York and Baltimore Transportation line will go forward from New York on Morgan line steamer, sailing the following Saturday.

Freight leaving Baltimore Saturday by New York and Baltimore Transportation line will go forward from New York on Morgan line steamer, sailing the following Tuesday.

Freight leaving Richmond Monday by Old Dominion line will go forward from New York on Morgan line steamer, sailing the following Thursday.

Freight leaving Richmond Wednesday by Old Dominion line will go forward from New York on Morgan line steamer, sailing the following Saturday.

Freight leaving Richmond Friday by Old Dominion line will go forward from New York on Morgan line steamer, sailing the following Tuesday.

President Urges Improvement of Inland Waterways.

President Roosevelt has transmitted to Congress the preliminary report of the Inland Waterways Commission and accompanies the report with a message of considerable length in which he reviews the whole subject. He says, in part:

"Our river systems are better adapted to the needs of the people than those of any other country. In extent, distribution, navigability and ease of use, they stand first. Yet the rivers of no other civilized country are so poorly developed, so little used, or play so small a part in the industrial life of the nation as those of the United States. In view of the use made of rivers elsewhere, the failure to use our own is astonishing, and no thoughtful man can believe that it will last.

"The Commission finds that it was unregulated railroad competition which prevented or destroyed the development of commerce on our inland waterways. The Mississippi, our greatest natural highway, is a case in point. At one time the traffic upon it was without a rival in any country. The report shows that commerce was driven from the Mississippi by the railroads. While production was limited, the railroads, with their convenient terminals, gave quicker and more satisfactory service than the waterways. Later they prevented the restoration of river traffic by keeping down their rates along the rivers, recouping themselves by higher charges elsewhere. They also acquired water fronts and terminals to an extent which made water competition impossible. Throughout the country the railroads have secured such control of canal and steamboat lines that to-day inland waterway transportation is largely in their hands. This was natural and doubtless inevitable under the circumstances, but it should not be allowed to continue unless under careful Government regulation.

"Comparatively little inland freight is carried by boat which is not carried a part of its journey by rail also. As the report shows, the successful development and use of our interstate waterways will require intelligent regulation of the relations between rail and water traffic. When this is done the railroads and waterways will assist instead of injuring each other. Both will benefit, but the chief benefit will accrue to the people in general through quicker and cheaper transportation."

Mr. Truesdale on the Railroad Situation.

The following comments are taken from the current annual report of the Delaware, Lackawanna & Western:

The two great political parties of the country, in planning their forthcoming presidential campaigns, make the sins of the railroads and their management, and drastic correction of the same, their leading issues, and herein may be found the real underlying cause of the general, indiscriminate abuse of the railroads and of their management, and of the paralytic stroke which they and all interests connected with them have suffered. With great foresight and shrewdness those who have planned and are responsible for this political program have alienated from the railroads the chief political influence that they might and should have every reason to expect would use their influence to protect them against a campaign of this kind, their own employees. This has been accomplished by the passage of certain laws governing the hours of service, wages, conditions of employment generally, and others more far-reaching have been promised and are now pending.

After declaring that the sweeping denunciation of the managing authorities has weakened their authority over their employees, Mr. Truesdale added:

"No greater blow has been dealt the railroad interests of the country, none that will react more quickly or with greater permanency on the public at large, than the legislation that has been enacted and that is proposed and pending, the effect of which is to take from those in charge of the management of railroads the reasonable and proper control of these properties, including especially the army of employees engaged in their service in various capacities. The tendency, furthermore, to place the control of the railroads and their operations, down to the minutest detail, in the hands of public officers, boards or commissions, all of which are subject to political influences to a greater or less degree, is by no means hopeful or reassuring as respects the future value or efficiency of the transportation facilities of the country."

TRADE CATALOGUES.

Spiral Riveted Pipe.—The American Spiral Pipe Works, Chicago, has issued circular No. 21, showing some of the many uses, as well as the advantages and economies, of Taylor's spiral riveted pipe with forged steel flanges. It is claimed to be the strongest riveted pipe made, by 30 to 50 per cent. A half-tone from a photograph shows a section of 12-in. pipe, 16-gage steel, which is stated to have withstood a hydraulic pressure of 650 lbs. per sq. in. The parts between seams bulged ¾ in., but the seams were practically unaffected. Strength to resist collapse under vacuum or heavy fills, and strength and rigidity against bending are other good qualities claimed. Many photographic views of the pipe in use in various applications are shown, and details of the different joints, and other details, are illustrated and described. The circular is 8 in. x 10 in. and has 20 pages.

Shoulder Flange Tie Plates.—The Railroad Supply Co., Chicago, has issued an attractive 16-page pamphlet on Wolhaupter shoulder flange tie plates. This is a new form of tie plate, being the standard Wolhaupter plate with a shoulder rolled on it. The results of some interesting tests made by R. W. Hunt & Co., Chicago, are recorded. A compression test to determine the comparative loads required to imbed the Wolhaupter and a flat-bottom plate in a tie showed a difference in favor of the former of 9,100 lbs. Other tests were for track spreading and for transverse bending strength.

Missouri Pacific.—The passenger department has issued a pamphlet describing the attractions of Hot Springs, Ark. It treats the resort from different points of view as it appeals to different classes of travelers—those who go to get the benefit of the springs, those who are looking for open air combined with rest and comfort, or those who want to play golf. The pamphlet gives estimates of living expenses, and a list of hotels and their characteristics and rates. The passenger department is to be complimented on the taste shown in the photographs selected for illustrating the pamphlet and for such a high grade of press work that the views lose nothing in reproduction.

Santa Fe Employees' Magazine. The February number has 60 pages and is full of interesting matter. The run of the "Scott Special," made in July, 1905, which holds the world's long-distance speed record, is re-described. Other articles are "Teamwork—Avoiding Claims"; "Investing Money," reprinted from the *Outlook;* "Locating Piston Valve Defects"; "The Past, Present and Future"; "Brave Work in the Rockies," the first prize winner in the short-story contest, and a number of shorter articles, with the usual items and notes of interest.

Switchboards.—Bulletin No. 4,558 of the General Electric Co., Schenectady, N. Y., describes and illustrates isolated switchboard panels with circuit breakers. These panels are for controlling 125-volt generators of from 5 to 120 k.w. capacity, and 250-volt generators of from 10 to 240 k.w. capacity. Bulletin No. 4,544 is devoted to direct-current switchboards for railroad use, which include generator panels, rotary converters, panel circuit breakers, etc.

Journal Boxes.—The T. H. Symington Co., Baltimore, Md., has issued a pamphlet describing and illustrating, with half-tones, different types of journal boxes, including the torsion spring lid box for freight service, and the pivot lid box for locomotives, tenders, steam passenger cars and electric cars. The company is also prepared to furnish boxes with M. C. B. pressed steel or malleable lids, Fletcher lids and lids of special design.

Air Compressors.—Bulletin No. 4,564 of the General Electric Co., Schenectady, N. Y., is devoted to centrifugal air compressors for industrial air blast and exhauster service. These compressors are made to deliver air at pressures from 0.88 to 4 lbs. per sq. in., and in capacities of from 750 to 10,000 cu. ft. of free air per minute. The compressors are driven by Curtis steam turbines or electric motors.

Steel Rail Specifications.—The American Bureau of Inspection and Tests, Monadnock block, Chicago, has prepared a booklet containing the specifications for standard Bessemer steel rails recently adopted by the manufacturers of the United States and Canada. The booklet also contains useful tables for figuring quantities of track material. Copies may be had on request.

Electrical Switch Indicators.—Bulletin No. 4,563 of the General Electric Co., Schenectady, N. Y., illustrates and describes S. I. 104 switch indicators.

MANUFACTURING AND BUSINESS.

The main office and works of the Pennsylvania Brake-Beam Co. have been moved from Easton, Pa., to Danville, Pa.

The offices of the American Car & Foundry Co., New York, will, about May 1, be moved from 25 Broad street to the new City Investing building.

The Wisconsin Engine Co., Corliss, Wis., has established a branch office in the Candler building, Atlanta, Ga. Julius M. Dashiell has been appointed Sales Manager.

The American Water Softener Co., Philadelphia, Pa., has opened a filtration department under the management of George F. Hodkinson. The company is prepared to install filtration plants of any capacity.

L. R. Pomeroy, who has been for a number of years special representative of the railroad department of the General Electric Co., Schenectady, N. Y., has gone to the Safety Car Heating & Lighting Co., New York, as Assistant to the President.

Frank Engelhardt, in charge of the Chicago sales office of the Wisconsin Engine Co., Corliss, Wis., has resigned. The company has closed the office and, for the time being, the business from that district will be under the direct charge of C. T. Myers, General Sales Manager, at Corliss.

The Southern Railway Supply Co. has bought the business and good will of the H. F. Vogel Contracting & Railway Supply Co., St. Louis, Mo. The new company will do a general railroad supply business. The management is in the hands of J. F. Hartman, Secretary, and the offices and storerooms are at 117 Walnut street, St. Louis.

E. H. Symington, Manager of Western Sales of The T. H. Symington Co., Baltimore, Md., who suffered a fractured skull by being thrown from his horse in Chicago nearly a year ago, has returned from a trip around the world which he took to regain his health. Under the advice of doctors, however, he is about to make another tour of the world, expecting to be at work again in his office in Chicago by next fall.

The Ward-Packer Supply Co., recently organized, with office at 1107 Fisher building, Chicago, has elected the following officers: President, A. D. Ward, St. Paul, Minn.; Vice-President, A. A. Packer, Chicago. J. E. Chisholm, formerly with the motive power department of the Chicago Great Western, is mechanical engineer. The company was organized to deal in railroad, factory, mill and general supplies, and has secured exclusive control of a number of articles of merit, including boiler compounds, bell ringers, metallic piston rod packing, boiler feed pump and vacuum car cleaner.

An Ohio paper mill which had ordered several engine type generators of the Northern Electrical Manufacturing Co., Madison, Wis., did not specify who should mount the armature on the engine shaft. When the generator was being erected it was found that no jobbing shop was in a position to make the force fit of about 150 tons required for mounting the armature. Accordingly, the manufacturer sent a motor-driven hydraulic press, with necessary rigging, for pressing the armature on the shaft. A small generator was rigged up to furnish current, and the work was quickly done, thus saving the time and expense of shipping parts back to the factory for mounting.

The United States Circuit Court of Appeals for the Third circuit in a decision just handed down has reversed the federal Circuit Court for the District of New Jersey in the suit of the Ajax Metal Co., Philadelphia, Pa., vs. the Brady Brass Co., Jersey City, N. J. The Appellate Circuit finds that the Ajax patent on which infringement was claimed is invalid. The case has been in the courts since 1903. The Ajax Metal Co. claimed that it had invented and patented an alloy capable of holding up within itself more lead than had been previously possible without the use of nickel and had thus produced a bearing consisting of less than 7 per cent. of tin, more than 20 per cent. of lead, and the balance of copper. The validity of the patent had been sustained by the trial court. The recent decision says, in passing on the claims of the plaintiff, that "the patent is for a product and not for a process. There is no claim for any particular method of combining the constituents of this alloy, and the specification only states the ordinary foundry practice well-known and recognized by those skilled in the art." The written opinions and evidence of experts are quoted to confirm the main point, that the alloy in question was not patentable as it "differed in degree and not in kind" from that which had been on the market for a long time. Testimony is quoted to show that the so-called "critical point" in copper-tin alloys was known at least three years prior to the application for the patent. The opinion also says: "A mere difference in the proportions of the constituents of an alloy, however useful the result may be, does not entitle the originator to the monopoly of a patent, in the absence of other circumstances than those here disclosed. Being of the opinion that the patent in suit is invalid, it is unnecessary to consider other grounds of defense, though we may be permitted to say that the prior public use, set up in the answer of the defendant, seems to us to have been sustained by the testimony."

Iron and Steel.

The Great Northern has ordered 10,000 tons of rails from the Cambria Steel Co. and 5,000 tons from the Bethlehem Steel Co., these orders being in addition to those for 45,000 tons placed with other companies recently.

OBITUARY NOTICES.

Russell Harding, formerly Vice-President and General Manager of the Missouri Pacific system, and later President of the Pere Marquette and Vice-President of the Cincinnati, Hamilton & Dayton, died on March 3 in New York City. A fuller record of his railroad career will be published later.

William A. Washburne, New York rail sales agent of the Cambria Steel Company, died at his country home in Salisbury, Conn., on February 26. Mr. Washburne had been ill for nearly two months, but continued to come to his office in New York until a week before his death. He had represented the Cambria Steel Company and its predecessor, the Cambria Iron Company, for 14 years. Before this he was in the rail department of the New York sales office of the Pennsylvania Steel Company.

Charles T. Hempstead, formerly General Passenger Agent of the New York, New Haven & Hartford, died at his home in Glenbrook, near Stamford, Conn., on March 4, from Bright's disease. He was 61 years old. When Mr. Hempstead retired in 1905 on account of ill health, he had completed a service of 43 years, his first position being ticket agent at Hartford. He became Paymaster of the old Hartford & New Haven Railroad, Paymaster of the New Haven system, and, finally, General Passenger Agent.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Railway Club of Pittsburgh.

At the meeting of this club, Feb. 28, a paper on Steel Car Construction and Maintenance, by G. E. Carson (P. & L. E.) was read.

Canadian Society of Civil Engineers.

At the meeting of this society, Feb. 27, a paper on the Mechanical Equipment of the Ottawa Mint, illustrated by lantern slides, was read by the author, A. H. W. Cleave.

Railway Signal Association.

The March meeting of this association will be held at the Great Northern Hotel, Chicago, on Monday, the 16th, beginning at 10 a.m. The subjects to be discussed are the report on specifications for electric interlocking, beginning at No. 60; the report on specifications for automatic block signals; also the paper on storage batteries which was presented at New York in January. All these reports have been discussed in part at previous meetings. In this announcement the Executive Committee gives the names of representative members of the association who have been appointed by 25 railroads. The committee also gives the result of the letter ballot, ordered at the Milwaukee meeting, last October, the result of which is the adoption of the report of the special committee on interlocking and block signals, which was presented at Milwaukee, and which was given in the *Railroad Gazette* of October 18. This report, it will be remembered, presented a comprehensive scheme of uniform signal indications. The letter ballot was as follows:

Active members		394
Representative votes cast	225	
Individual votes cast	119	
		344
Affirmative		257
Negative		87

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Pacific.—F. W. Peters, Assistant Freight Traffic Manager of the western lines, has been appointed Assistant to the Second Vice-President, with office at Winnipeg, Man.

Chicago Great Western.—See Minneapolis, St. Paul & Sault Ste. Marie.

Delaware, Lackawanna & Western.—W. S. Jenny, General Attorney, has been elected also a Vice-President. The other two Vice-Presidents are in charge, respectively, of the coal department and of the traffic department.

Illinois Central.—Joseph F. Titus, Assistant to the President, was elected a Director at the adjourned annual meeting held March 3, succeeding Stuyvesant Fish. Mr. Titus is to resign shortly and be succeeded by J. Ogden Armour, who is not yet a stockholder of record.

Minneapolis, St. Paul & Sault Ste. Marie.—J. L. Erdall, Assistant General Solicitor of the Chicago Great Western, has been appointed Assistant General Solicitor of the Minneapolis, St. Paul & Sault Ste. Marie.

Philadelphia & Reading.—Llewellyn Snowden, Assistant Auditor of Passenger Traffic, has been appointed Auditor of Passenger Traffic, succeeding Charles H. Quarles, retired.

Operating Officers.

Boston & Maine.—Fred A. Hortter has been appointed Superintendent of Car Service, succeeding H. E. Howard, relieved from service at his own request. Mr. Hortter will report to the Second Vice-President and General Traffic Manager on matters relating to car distribution, and to the Fourth Vice-President and General Auditor on matters relating to car accounting.

Canadian Pacific.—J. W. Leonard, Assistant General Manager of Eastern Lines, has been appointed to the new office of General Manager of the eastern lines in charge of maintenance of way and operation, with office at Montreal, Que. G. J. Bury, Assistant General Manager of Western Lines, has been appointed to the new office of General Manager of Western lines, in charge of maintenance of way and operation, with office at Winnipeg, Man.

J. G. Taylor, Superintendent of Terminals at Ft. William, Ont., has been appointed Superintendent of the Moose Jaw division, succeeding J. Brownlee, transferred.

C. S. Maharg, Superintendent at Souris, Man., has been appointed Superintendent of Operation and Construction on the new Saskatchewan division.

See this company under Special Officers.

Chicago, Burlington & Quincy.—F. L. Johnson, General Inspector of Stations, has been appointed Superintendent at St. Louis, Mo., succeeding J. A. Somerville, resigned to go to another company. See Missouri Pacific.

Cleveland, Cincinnati, Chicago & St. Louis.—See Lake Erie & Western.

Lake Erie & Western.—C. S. Rhoads, Superintendent of Telegraph, of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Indianapolis, Ind., has had his authority extended over the Lake Erie & Western.

Mexican Central.—Ralph Nelson Elliott, who was recently appointed Superintendent of the Torreon division of the Mexican Central, was born on July 28, 1871, at Marysville, Kan. In his early boyhood he lived at San Antonio, Tex., where he had a common school education, and, at the age of 15, entered railroad service on the Texas-Mexican Railroad, part of the National Railroad of Mexico. Two years later he went from Texas to the Northwest, where he was employed on the Columbia & Puget Sound Railroad, a small line belonging to the Oregon Improvement Company. He then served on the Northern Pacific and the Great Northern and was employed by the Puget Sound Reduction Company. In 1894 he went to the National of Mexico, but soon left railroad service again to go to the Waters-Pierce Oil Company. He returned to railroad work in 1902 on the Interoceanic of Mexico, from which he went to the Tehuantepec National. In 1903 he was on the Durango Central and since 1904 has been on the Mexican Central.

Missouri Pacific.—J. A. Somerville, Superintendent of Terminals of the Chicago, Burlington & Quincy at St. Louis, Mo., has been appointed Superintendent of Terminals of the Missouri Pacific at Kansas City, Mo., succeeding C. E. Carson, resigned.

Traffic Officers.

Chicago, Indianapolis & Louisville.—A. C. Tumy has been appointed Assistant General Freight Agent, with office at Chicago, a position which has been vacant since the death of N. Staat last November.

Norfolk & Western.—DeLos Thomas, Division Freight Agent at Winston-Salem, N. C., has been appointed Assistant General Freight Agent, with office at Roanoke, Va., succeeding O. H. Rogers, deceased.

Engineering and Rolling Stock Officers.

Chicago & Alton.—See Toledo, St. Louis & Western.

Grand Trunk.—See Grand Trunk Pacific.

Grand Trunk Pacific.—Wm. Gell, Master Mechanic of the Grand Trunk at Ottawa, Ont., has been appointed Master Mechanic of the Grand Trunk Pacific, in charge of motive power, cars and shops, with temporary office at Winnipeg, Man.

Mexican Central.—O. R. Hale, Master Mechanic of the Torreon division, has been appointed Master Mechanic of the San Luis division, with office at Cardenas, San Luis Potosi, succeeding C. F. Roberts.

Missouri Pacific.—F. T. Carberry, Master Mechanic at St. Louis, Mo., has been appointed Master Mechanic at Fort Scott, Kan., succeeding J. J. Reid, transferred.

New York, New Haven & Hartford.—On the reorganized divisions named in this column on February 14, maintenance of way officers have been appointed as follows: New York division, H. A. Weaver, Division Engineer, office at Harlem River, N. Y.; Shore Line division, F. H. Ellsworth, Division Engineer, New Haven, Conn.; Providence division, J. S. Browne, Division Engineer, Providence, R. I.; Boston-Midland division, G. T. Sampson, Division Engineer, Boston, Mass.; C. J. Bennett, Assistant Engineer, Hartford, Conn.; Old Colony division, J. W. Pearson, Division Engineer, Taunton, Mass., Western division, W. T. Spencer, Division Engineer, New Haven, Conn.

E. W. Wiggin has been appointed Superintendent of Bridges and Buildings, with office at New Haven, Conn., vice E. E. Pratt, Jr., resigned.

Toledo, St. Louis & Western.—H. H. Eggleston, Supervisor of Bridges and Buildings of the Eastern division of the Chicago & Alton, has been appointed Acting Superintendent of Bridges and Buildings, being also in charge of water station service and interlocking plants, with office at Frankfort, Ind., succeeding C. H. Kinney, temporarily relieved on account of ill health.

Special Officers.

Canadian Pacific.—G. Erickson, Superintendent at Cranbrook, B. C., has been transferred to the forestry department.

LOCOMOTIVE BUILDING.

Dr. Barrioslde Lacarda, Pernambuco, Brazil, has ordered from the American Locomotive Co., through Ellerton D. Hitch & Co., New York, two 2-4-0 type locomotives, with cylinders 9 in. x 16 in.

The South Manchurian has ordered five locomotives from the American Locomotive Co. The motive power ordered by this road last spring was built and shipped some time ago, but five locomotives were lost in a shipwreck and the above order is to replace them.

CAR BUILDING.

The Northern Pacific is figuring on 200 refrigerator cars.

The Great Northern is asking prices on from 40 to 45 passenger cars.

The Chicago, Milwaukee & St. Paul is asking prices on 15 passenger cars.

The Cold Blast Transportation Co., Chicago, is in the market for 200 stock cars.

The Atlantic Coast Line is understood to be figuring on 100 ventilated box cars.

The Cadiz Company, Cadiz, Ky., has ordered one passenger car from the Hicks Locomotive & Car Works.

The Toledo & Indiana has ordered five flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

A Japanese railroad has ordered through Frazar & Sale, New York, 168 coal cars from the American Car & Foundry Co.

The Chilian State Railroads have ordered, through W. R. Grace & Co., New York, 20 passenger cars from the American Car & Foundry Co.

The Independent Packing Co., St. Louis, Mo., is in the market for 75 second-hand refrigerator cars, but will buy new cars if it cannot secure good second-hand cars.

New York City Railway.—Frederick W. Whitridge, Receiver of two subsidiary street railways of this company, has ordered 75 cars for these roads from the J. G. Brill Co.

The Canadian Pacific is building, at its own shops, one sleeping car, 72 ft. 2 in. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; two first class cars, with smoking room, 72 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; two tourist cars, 72 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; one colonist car, 67 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; one baggage car, 60 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; five mail and express cars, 60 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; six mail cars, 60 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; 84 thirty-ton box cars, 36 ft. 8 in. long and 9 ft. $\frac{5}{8}$ in. wide over frame; four refrigerator cars, 41 ft. long and 9 ft. $1\frac{5}{8}$ in. wide over frame; 22 stock cars, 36 ft. 8 in. long and 9 ft. 5 in. wide over frame; 162 thirty-ton flat cars, 36 ft. 8 in. long and 8 ft. 10 in. wide over frame; two Hart convertible cars, 36 ft. 8 in. long and 8 ft. 10 in. wide over frame; 12 baggage cars 29 ft. long and 9 ft. wide over frame; three baggage and smoking cars, 65 ft. long and 9 ft. $10\frac{1}{2}$ in. wide over frame; one pile driver, 45 ft. long and 8 ft. 9 in. wide over frame. Bodies and underframes will be of wood. The special equipment includes:

Bolsters (for freight equipment)	Simplex
Brake-beams	Simplex
Brake shoes (for passenger cars)	Flanged steel back diamond S
Brake shoes (for freight equipment and baggage cars)	Steel back, diamond S
Brakes	Westinghouse
Center bearings (for box and Hart convertible cars)	One malleable and one steel
Couplers	Tower
Curtain fixtures	Forsyth
Curtain material	Pantasote
Door fasteners (for box cars)	Positive
Doors (for box cars)	Security
Doors (for refrigerator cars)	Refrigerator standard, with La Flare insulation
Draft rigging	Miner tandem
Dust guards (for freight cars)	Harrison
Journal boxes	McCord
Lighting	Pintsch
Platforms	Standard Coupler Co.
Roofs	Canvas, Canadian Pacific standard
Seats (for sleeping cars)	Pullman standard
Seats (for tourist and colonist cars)	Slatted wood
Side bearings (for freight cars)	Susemihl
Roofs (for box cars)	Chicago
Trucks (for freight cars)	Barber roller Simplex
Trucks (for baggage cars)	Goff
Vestibules	Pullman wide
Wheels (for passenger equipment)	Steel tired

The New York, Ontario & Western has ordered nine passenger coaches and one chair car from the Pullman Company. The specifications for this equipment were published in the *Railroad Gazette* of October 18, when bids were first asked, the purchase having been, at that time, postponed.

RAILROAD STRUCTURES.

ALTOONA, PA.—Plans are made and now under consideration for putting up a combined highway and street car bridge at Seventh street, to be 160 ft. long and 50 ft. wide, to cost about $[illegible],000.

BEACON PARK, MASS.—Work is under way by the Boston & Albany putting up a new engine house here, to cost about $250,000. Similar work has been authorized at Worcester, to cost $200,000.

ELLWOOD, PA.—The town council has passed an ordinance requiring the Pittsburgh, Harmony, Butler & New Castle railroad to pay for the construction of a subway on Fifth street.

SCRANTON, PA.—The Scranton Railway Company will provide a temporary bridge during the construction of the new bridge over the Lackawanna river.

WINNIPEG, MAN.—The Grand Trunk Pacific, it is said, is making soundings for a proposed bridge over the Red river.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BOW RIVER COLLIERIES.—Application is being made to incorporate this company to build a line from the Bow River collieries to a point on the main line of the Canadian Pacific near Cassils, Alb., about 47 miles. The incorporators include: R. F. Reeve, W. C. Simmons, W. L. Hamilton, C. V. Bennet, B. C. Moore, of Lethbridge, Alb., and Harry P. Cherry, Winnipeg, Man.

CAPE BRETON.—Surveys are under way for an extension to be made early this spring from St. Peter's, N. S., to Louisburg, 31 miles. G. E. Johnson, St. Peter's, General Manager.

CHICAGO, MILWAUKEE & ST. PAUL.—This company, it is said, is operating its Pacific coast line from Mobridge, S. Dak., west to Terry, Mont., about 250 miles.

CHICAGO, SOUTH BEND & NORTHERN INDIANA (ELECTRIC).—This company has decided to let contracts and push work on the extension from South Bend, Ind., west to Laporte, 28 miles, at which point connection will be made with its line in operation from Laporte northwest to Michigan City.

CHICAGO RAILWAYS COMPANY.—This company, it is said, will reconstruct many subways beneath the rivers on the North and West sides, to permit the use of larger cars.

CLEAR LAKE & SOUTHERN (ELECTRIC).—Surveys are under way and rights of way are being secured for this proposed electric line from San Francisco, Cal., north via Napa, to Lake Port, 135 miles. Grading is expected to be started this summer. LeGrand Brown, Chief Engineer, 31 Ellis street, San Francisco, Cal.

CROWS' NEST & NORTHERN.—Incorporated to build from a point on the Crows' Nest line to Michel, B. C., about 27 miles. E. V. Bodwell, the attorney representing the company, says that construction will be started at once. R. G. Belden, J. A. Hemphill, C. L. Butterfield, E. A. Wayland, all of Spokane, Wash., are incorporators.

EASTON & SOUTH BETHLEHEM TRANSIT CO.—This company has given a mortgage, the proceeds of which are to be used for finishing the line from Easton, Pa., through Freemansburgh to South Bethlehem.

INDIANAPOLIS, LOGANSPORT & OHIO.—This company, which has been projected from Indianapolis, Ind., north via Sheridan, Russiaville and Kemptin, to Logansport, 68 miles, has been granted franchises by the city of Indianapolis, and expects to let grading contracts in June. W. A. Osmer, C. E., Logansport.

KANSAS CITY TERMINAL CO.—This company, which was incorporated to build a new passenger station for the railroads entering Kansas City, Mo., is now negotiating with the city authorities for the necessary franchises. The work will include a number of yards and retaining walls, highway viaducts and railroad viaducts. Detail plans are not yet made. John V. Hanna, Chief Engineer, Kansas City, Mo.

LONG ISLAND.—See Pennsylvania.

MEXICO MILLING & TRANSPORTATION COMPANY.—This company has been authorized to build railroads in the municipalities of Guanajuato, La Paz and Santa Rosa, with branches, a total of about 50 miles. Six miles must be built this year, and a similar amount each year until the line is finished. The Department of Communication and Public Works and Geo. W. Bryant will build the line.

PENNSYLVANIA.—The report of this company for the year ended December 31, 1907, shows that the four track system on the main line between Pittsburgh, Pa., and Jersey City was extended, and also the revision of the low grade freight line, formerly the Western Pennsylvania, along the Conemaugh river. There were also improvements to yards and terminal facilities at various points. Rights of way for additional relief lines were bought. On the Middle division, between Van Dyke, Pa., and Port Royal, the four-track system was put in operation early in 1907. Similar work has been continued during the year between Ryde and Mt. Union. This includes building a new 10-mile line, also two stone arches over the Juniata river, the elimination of grade crossings in the borough of Mt. Union, and a reduction in grade and curvature. The section from Ryde to Vineyard was put in service in October, and from Newton Hamilton to a point west of Mt. Union, at the end of 1907. It is expected to have the section between Vineyard and Newton Hamilton finished in May. This will give a continuous four-track system on the Middle division, from Harrisburg to Petersburg, where connection is made with the double-track relief freight line over the Allegheny mountain, also from Petersburg to Altoona, except on about 6½ miles between Spruce Creek tunnel and Tyrone Forge, where there are only three tracks.

On the Pittsburgh division the four-tracking was finished in October from Sang Hollow to Bolivar, including a revision of grade and alinement on about 14 miles. The revision work on the Sang Hollow extension, and laying second track from Dornock Point to Bolivar Junction was finished. Grade reduction work and double-tracking on the Conemaugh division, from Bolivar Junction, west six miles, including a new single-track bridge over the Conemaugh river, was finished. Similar work is under way on this line between Blairsville and Tunnelton, eight miles. On this section, five double-track stone arches have been built over the Conemaugh, and double-track laid on the steel bridge at Social Hall. A new double-track tunnel 760 ft. long has been built west of Bow Station, and grade crossings on this section in the town of Blairsville are to be eliminated. This work is to be finished this summer.

Four tracks between Beatty and Southwest Junction were put in service during the year. A new line was built from Beatty to George, four miles, and an additional track from that point to Southwest Junction. As a result, passenger and through freight service no longer pass through the double-track tunnel at Donohoe. The westbound classification yard at Hollidaysburg was finished, and considerable progress made on the eastbound gravity yard at Pitcairn, part of which is now in use.

On the New Jersey division, track elevation was continued through Camden to eliminate grade crossings between the Delaware river and Cooper's Creek. Similar work was started on the Kensington branch in the northeast part of Philadelphia. The storage and classification yards at Greenville, N. J., were finished and work is being continued on the Pacific street terminal yard in Brooklyn, N. Y.

Improvements finished on the Western New York & Pennsylvania included building the Ebenezer branch in South Buffalo to connect the main line with the ore docks on the lake front so as not to carry freight through the city of Buffalo. Improvements to yards and shops at Olean, N. Y., and at Buffalo were also made.

The Brownsville extension, of the Monongahela division, was built for 4½ miles up the river to a connection with the Pennsylvania, Monongahela & Southern, which is finished to Rice's Landing, Pa., 7½ miles. The Ten-Mile Run branch, which is ultimately to extend from Ellsworth, on the Monongahela division, to Millsboro, on the Pennsylvania, Monongahela & Southern, 15½ miles, has been finished from Ellsworth south for eight miles, and from Millsboro north for 1.6 miles. From the old Redstone extension, the Grindestone branch has also been built. Both these branches were built to supply facilities for extensive coal and coke operations.

Work is now under way on a connecting line at Newberry, along Lycoming creek, between the main line of the Erie division and the Elmira division of the Northern Central; and the line between Jersey Shore and McElhattan is being improved in grade and curvature.

On the tunnel extensions to the new terminal in New York satisfactory progress has been made, and it is expected to finish the work in 1910. From the New Jersey division at Harrison, east of Newark, to the west portal of the Bergen Hill tunnels considerable progress was made on the masonry, superstructure and embankment necessary to carry the line over the railroad tracks on the meadows and the streets. The two tunnels through Bergen Hill, except for about 700 ft., have been excavated, and concrete lining is being put in. The two tubes under the Hudson river are also being lined. Excavation work is finished from the river to the tunnel station approach at Tenth avenue in New York City. Between Tenth avenue and Ninth avenue over half the work has been finished, and on the terminal station site between Seventh and Ninth avenues all the retaining walls and foundations are in place. Steel viaducts are also nearing completion to support adjoining streets and avenues crossing the station site, and work on the steel structure of the station itself is under way. From the terminal site east, tunnel excavation work is finished to the First avenue shafts on the west side of the East river, with the exception of the section between Fifth and Sixth avenues, and about one-half the concrete lining, and other work is finished. On the four tunnels under the East river two of the iron tubes have now (March 4) been finished, and it is expected to connect the remaining tubes within two months or less. The tunnels under Long Island City from the East river to the East avenue shaft in the borough of Queens have been excavated and iron lined, and two-thirds of the concrete lining is in place. Work is under way between the East avenue shaft and the western end of the Sunnyside yard, near Thompson avenue, where the tunnels reach the surface. This work is being done by the Pennsylvania Tunnel & Terminal Railroad. Work on the Sunnyside yard has been delayed by the necessary relocation of city streets and the construction of highways across the yards to eliminate grade crossings. Work on the viaduct and embankments and bridge masonry is under way. Near the Sunnyside yard, which will be 5,500 ft. long and 1,550 ft. wide, there will be a connection with the Long Island Railroad and the New York Connecting Railroad.

During the year the elevation of the Philadelphia, Baltimore & Washington road through Wilmington, Del., and the new passenger station at that place was finished; also the joint coach yard and north approach to the new union station at Washington, D. C., and revision of the line through Washington.

On the West Jersey & Seashore, grade elevation work and revision of the line was carried out and a freight connection built between Haddonfield, N. J., and Westville.

On the Long Island Railroad additional tracks were put in at various points and yard improvements made. The Bay Ridge line was also improved and the Atlantic avenue improvement was finished.

Pennsylvania Lines West.—The most important work carried out by this company, as shown in its annual report, for the year ended December 31, 1907, was track revision work in Chicago and in Allegheny City; revision of line and construction of second and third tracks on the Pittsburgh, Cincinnati, Chicago & St. Louis; improvements of yards, docks and other terminal facilities, increased sidings and securing new rights of way.

Pennsylvania Tunnel & Terminal.—See Pennsylvania.

Philadelphia, Baltimore & Washington.—See Pennsylvania.

Quebec Eastern.—Right of way secured and surveys made by this company for a line from Lyster, Que., on the Grand Trunk, to Lime Ridge, and thence to Sherbrooke, 110 miles. Address W. H. Lamby, Secretary, Inverness, Que.

Southern Pacific.—It is said that this company has authorized the relaying of about 50 miles of track with 75-lb. rails on the West Side division from Beaverton, Ore., south to McCoy.

West Jersey & Seashore.—See Pennsylvania.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—Gross earnings for January decreased 6 per cent.; operating expenses increased 3 per cent., leaving a decrease in net earnings of 25 per cent.

Baltimore & Ohio.—The Baltimore & Ohio, which since 1901 has owned about 75 per cent. of the stock of the Cleveland, Lorain & Wheeling, has bought the minority stock. The Chicago, Lorain & Wheeling has 192 miles of line. Its gross earnings in the year ended June 30, 1907, averaged $24,000 a mile. In January, 1908, a semi-annual dividend of 2½ per cent. was declared on its common stock, which was the first dividend on this stock. The Baltimore & Ohio has sold $1,000,000 one-year notes, $1,000,000 two-year notes and $1,000,000 three-year notes, secured by the newly purchased Cleveland, Lorain & Wheeling stock.

Canadian Pacific.—According to report from Spokane, Wash., the Canadian Pacific is planning a line from Spokane to Pacific tidewater, through purchase of the right of way of the projected North Coast Railway.

Chicago Railways Company.—The National City Bank and N. W. Harris & Company, of New York, recently offered at a price to yield about 5½ per cent., $2,500,000 first mortgage 5 per cent. bonds of this company, which recently took over the West Chicago and the North Chicago street railway companies. This offering was six times oversubscribed.

Chicago, Rock Island & Pacific.—A quarterly dividend of 1½ per cent. has been declared on the stock of the Chicago, Rock Island & Pacific Railway. In January, quarterly dividend of 1 per cent. was paid. In 1907, 1 per cent. was paid in January, 1½ per cent. in April, 1 per cent. in July, 1¾ per cent. in October. This year's record, thus far, is, therefore, the same as that of 1907.

Gross earnings for January were $16,000,000, against $18,000,000 in 1907. Net earnings, after taxes, were $1,100,000, against $1,300,000 in 1907.

Delaware & Hudson.—Gross railroad earnings for January were $1,500,000 against $1,400,000 in 1907 Net railroad earnings after taxes were $481,000 against $459,000 in 1907 There was a falling off in net earnings of the coal department from $129,000 in 1907 to $69,000, so that the total net earnings from all departments were $551,000 against $587,000 in 1907.

Detroit, Toledo & Ironton.—The issue of $300,000 receivers' certificates was, on February 25, authorized by the United States Circuit Court at Detroit, Mich. Of these, $100,000 are to be issued at once. There has been a falling off of 50 per cent. in gross earnings, but owing to economies the loss in net income has been only 15 per cent.

Erie.—Gross earnings of the lines in New York State for the three months ended December 31, 1907, were $11,800,000 against $12,500,000 in 1906. Net earnings were $1,700,000 against $4,100,000 in 1906.

The Erie's cash on hand on December 31, 1907, was $4,000,000 against $6,300,000 on June 30, 1907. Bills payable were $5,575,000 against $6,500,000 in June.

The New York Public Service Commission of the Second district has denied the application of the Erie Railroad for permission to issue 4 per cent. interest-bearing dividend warrants, payable in 1917, covering the semi-annual dividend of 2 per cent. on the first preferred stock and the annual dividend of 4 per cent. on the second preferred, declared August 28, 1907. See editorial columns.

Grand Trunk.—A new issue of $5,000,000 4 per cent. guaranteed stock has been sold at 92½, a yield of about 4½ per cent., in London. There was already $8,392,200 of this stock outstanding out of an authorized issue of $50,000,000 (£10,000,000). The new issue, whose proceeds are to be used for double-tracking and other improvements of the line and for new rolling stock, was oversubscribed by about 50 per cent. Its success indicates the advantage which the Canadian roads have at this time over roads in the United States, both in having a market for their securities in London and in being freer from legislation, actual and threatened.

Gulf & Ship Island.—Fisk & Robinson, of New York, have offered, at a price to yield 6¾ per cent., $750,000 of the $1,000,000 authorized 6 per cent. mortgage bonds of 1909-1911.

Gross earnings for January were $161,000 against $225,000 in 1907. Net earnings were $28,000 against $68,000 in the earlier year.

Hocking Valley.—William Salomon & Co., of New York, have offered at a price to yield 6 per cent., $500,000 4 per cent. equipment notes due semi-annually from August 15, 1908, to February 15, 1918. These notes are secured by 500 new steel underframe drop bottom gondola cars, whose cost exceeds by 23.5 per cent. the total par value of the notes.

Gross earnings for January were $329,000 against $522,000 in 1907, a decrease of 37 per cent. Net earnings were $42,000 against $123,000, a decrease of 66 per cent.

Interborough Rapid Transit.—The stockholders of this company at a special meeting to be held March 17, will vote on making a new mortgage, securing $50,000,000 5 per cent. bonds, covering the power houses and rolling stock, the Steinway tunnel from Manhattan to Long Island City and the Long Island traction properties owned by the company, and that $20,000,000 of these bonds will at once be issued. Of these, $15,000,000 will be used to meet the $15,000,000 notes maturing on May 1 and the rest to pay off the floating debt, which now stands about $5,000,000.

Louisiana & Arkansas.—Gross earnings for January were $79,000 against $88,000 in 1907. Net earnings were $21,800 against $21,500 in 1907

Louisville & Nashville.—Gross earnings for January were $3,300,000 against $4,100,000 in 1907, a decrease of $800,000. Operating expenses decreased $73,000. Net earnings were $621,000 against $1,326,000 in 1907, a loss of $705,000, or 47 per cent.

Mexican International.—Gross earnings for January were $716,000 against $711,000 in 1907. Operating expenses decreased $60,000, leaving net earnings of $263,000 against $199,000 in 1907

National Railways of Mexico.—The merger plan for the consolidation of the Mexican Central, the National of Mexico, the Mexican International, the Interoceanic of Mexico and the Hidalgo & North Eastern was ratified on February 28 at the city of Mexico. It is reported that the terms of the agreement are little changed from those previously announced (July 12, 1907, page 54).

New York Central Lines.—Gross earnings for the month of December, 1907, and for the year ended December 31, 1907, were as follows:

Month of December 1907

	1907	—— Change ——	
New York Central & Hudson River	$7,432,066	Dec	$520,711
Lake Shore & Michigan Southern	3,308,011	"	254,369
Lake Erie & Western	344,424	"	68,630
Chicago, Indiana & Southern	259,508	Inc	25,390
New York, Chicago & St Louis	868,248	Inc	62,493
Michigan Central	2,108,729	"	202,503
Cleveland, Cincinnati, Chicago & St Louis	1,967,658	"	292,081
Peoria & Eastern	230,450	"	38,568
Cincinnati Northern	97,395	"	15,230
Pittsburgh & Lake Erie	716,047	"	413,118
Rutland	200,939	"	10,129

Year Ended December 31 1907

	1907	—— Change ——	
New York Central & Hudson River	$98,369,090	Inc	$6,279,291
Lake Shore & Michigan Southern	41,953,475		2,406,087
Lake Erie & Western	5,066,940	Dec	145,872
Chicago, Indiana & Southern	3,004,483	Inc	671,751
New York, Chicago & St Louis	10,465,671	"	563,462
Michigan Central	28,547,110	"	2,271,522
Cleveland, Cincinnati, Chicago & St Louis	26,447,804	"	1,852,888
Peoria & Eastern	3,010,347	Dec	48,934
Cincinnati Northern	1,005,158	"	22,530
Pittsburgh & Lake Erie	14,804,401	Inc	422,905
Rutland	3,058,087	"	258,878

New York, New Haven & Hartford.—The Hartford & New York Transportation Co., which owns the line of steamers running between Hartford and New York and is owned by the New Haven, is to take over the United States Transportation Co., which controls several steamship lines affiliated with the New York, New Haven & Hartford. These are the Joy line, between New York and Providence; the Neptune Line, between New York and Fall River, and the Maine Steamship Co., between New York and Portland, Me.

New York, Ontario & Western.—The operating ratio (taxes included in operating expenses) was 80 per cent in January, 1908, as compared with 72.6 per cent. in January, 1907. Net earnings for January decreased 30 per cent., and net income after charges, 50 per cent.

New York-Philadelphia Company (Electric).—J. Kearney Rice, of New Brunswick, N. J., was on February 21 appointed by Judge Lanning, in the United States Circuit Court, Receiver of the New York-Philadelphia Company, and David F. Carver, of Newark, was appointed Receiver of the Trenton & New Brunswick and the New Jersey Short Line. Wilbur F. Sadler, Jr., of Trenton, was, on February 18, appointed Receiver of the Camden & Trenton, another subsidiary of the New York-Philadelphia Company. (*Railroad Gazette*, Feb. 28, p. 298.) The various companies have 63 miles of road in operation and 20 under construction out of Trenton south toward Camden and north toward New York. The parent company has contracts with the Public Service Corporation by which it operates cars between New York and Philadelphia.

Pennsylvania.—The annual dividend rate on the $9,641,600 common stock of the West Jersey & Seashore has been reduced by the declaration of a semi-annual dividend of 2 per cent. In 1906 and 1907 6 per cent. a year was paid; in 1905, 5½ per cent.; from 1897 to 1904, inclusive, 5 per cent., and in September, 1896, 2½ per cent.

Pere Marquette.—This company is now reorganized and has arranged to exchange its 6 per cent. equipment notes, secured also by $500,000 refunding mortgage 4 per cent. bonds, for the $2,600,000 5 per cent. equipment bonds of the Eastern Equipment Company which fell due March 1, 1908. These notes cover equipment bought in 1903 and 1904 and now insured for $2,745,000.

Philadelphia & Reading.—Gross earnings of the Philadelphia & Reading Railway for January decreased 17 per cent., operating expenses decreased 17 per cent., and net earnings decreased 16 per cent., as compared with the corresponding month of 1907.

Seaboard Air Line.—The coupons which fell due on March 1 on the three-year 5 per cent. collateral trust bonds of 1911 and the series H car trust certificates, as well as the interest due January 1, 1908 on the first mortgage Seaboard & Roanoke 5 per cent. bonds, have been paid by the Receivers.

Southern.—Gross earnings for January decreased 14 per cent., operating expenses, 11 per cent.; and net earnings, 28 per cent. Net earnings after taxes decreased 37 per cent. The operating ratio was 89 per cent., against 85 per cent. in the corresponding month of 1907

Union Pacific.—The Oregon Railroad & Navigation Company has declared an extra dividend of 75 per cent. on its $11,000,000 4 per cent. non-cumulative preferred stock, almost all of which, as well as the common, is owned by the Union Pacific. This appears to be similar to the 50 per cent. dividend declared in 1906 by the Oregon Short Line.

West Jersey & Seashore.—See Pennsylvania.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 11. FRIDAY, MARCH 13, 1908

RAIL CIRCUITS AND TREATED TIES.

The report that a well-known road which is planning to build a timber preserving plant is hesitating about adopting a zinc-chloride process through fear of trouble to the track circuits of automatic signals, is drawing attention anew to a phenomenon first observed several years ago, and noted in these columns at the time. In view of the present interest in the matter and of the fact that most people have forgotten the investigation referred to, it seems worth while to give again the essential points reported at that time.

The investigation was made by V. I. Smart, then signal inspector of the Illinois Central. The trouble is, of course, caused by the greatly increased conductivity of a zinc-treated tie. By introducing enough of these ties, the leakage between rails becomes so great that there is not enough current to hold the relay. As this leakage is directly proportional to the number of ties in track, a temporary reduction in the length of the section relieves the trouble by increasing the resistance between rails. The trouble disappears after a time, when the section may again be extended to its original length. The reason for the disappearance of the trouble after the track circuits have been working for a while was explained in the report. The ties lose in conductivity, because the electric current causes electrolysis of the zinc solution (ZnCl, HO). "The Cl is freed at the positive pole, which in this case is one of the iron spikes holding the rail to the tie. Zn is deposited at the other spike, the negative pole. The Cl enters into combination with the H in HO, forming HCl, or hydrochloric acid. This attacks the iron of the spike, producing FeCl, or chloride of iron, which is deposited on the spike, or rather between the spike and the wood of the tie, in greenish-blue, hydrated crystals. This deposit of chloride of iron offers sufficient resistance to the weak track circuit to reduce the conductivity of the tie to such an extent that the track section may be lenghened considerably without trouble to the relay reappearing." It is therefore suggested that where track circuits are to be installed in conjunction with a large number of such ties, trouble to the signal circuit may be obviated by putting several cells of the battery in series on the track for some time before the signals are put in service in order to insulate the spike in the manner described; but care must be taken not to change the polarity of the rails afterward. It must be remembered, also, that the trouble will return if the spikes on the positive rail are renewed, since the presence of the FeCl crystals is essential to successful working.

The foregoing, as it specifically states, applies only to the use of a large number of these ties. For ordinary renewals—12 to 15 per cent. a year, and even up to 25 per cent.—there seems to be no trouble. In addition to the effect already described, signal engineers claim recently to have established the fact that there is a storage battery effect from these ties, but that it does not interfere with the working of the circuits under the renewal conditions mentioned. It is reported that on long circuits—4,000 ft. or over, say—where there are a good many of these ties in track, there is considerable leakage. But track circuits of this length are uncertain in their operation under any circumstances and need to be shortened where possible. We understand that on the Santa Fe, which was perhaps the largest user of zinc-treated ties in the country until its recent change to the creosote process, the track circuits were reduced to a maximum of half a mile.

There seems to be apprehension in some quarters that creosoted ties, as well as zinc-treated ties, will have a bad effect on the track circuits; in fact, some signal men claim to have had experience proving that creosoted ties act as partial conductors, and they say that a sufficient number will cause a short circuit. There seems to be no reliable data on the subject, however. On one of the Southern Pacific lines a few tests were made of untreated ties, of zinc chloride and of creosote-treated ties, to determine their relative resistances. There was such a wide variation in results, however, under apparently like conditions, that it was not considered safe to draw any conclusion but the very general one that the resistance of the zinc-treated tie is considerably less than that of the creosoted or of the untreated tie. At the 1907 convention of the Southwestern Electric and Gas Association, its president vouched for the fact that creosoted poles are good conductors. He stated that in Galveston, Tex., where they are compelled to use creosoted poles because of the soil conditions, the linemen have a practice of mounting and dismounting from the poles with a jump so as not to have a spur in the pole and a foot on the ground at the same time.

One signal engineer who was asked about his experience with treated ties responded that he was having far more trouble from the brine from refrigerator cars. This long-standing trouble the signal men share with the bridge men. The only effective remedy is one such as a committee of the Superintendents of Bridges and Buildings recommended at the last convention, namely that instead of allowing the brine to drip on the track it should be caught in a receptacle to be emptied at intervals by the trainmen. We understand that a committee of the Signal Association now has the subject in hand for the collection of data and report. It is interesting to note, in this connection, that trouble was experienced with the track circuits on the trestles on the Ogden-Lucin cut-off across Great Salt Lake from salt water dashing over the track and wetting the tops of the ties. During a quiet period, when the ties were dry, they were given a coating of crude oil on top, which ended the difficulty.

NEW RAILROAD BUILDING

The fourteenth regular Construction Record of the *Railroad Gazette* is published in this issue. This comprehensive list of railroad construction work was compiled semi-annually from the spring of 1898 until March, 1902, when it was made an annual record.

A change of policy in its compilation has this year been carried out. In earlier years the list included, besides lines on which work was actually under way, projects not yet undertaken and new companies incorporated since the previous Construction Record was issued; it was, in short, a complete summary in condensed form of all the information printed during the year in our railroad construction columns. This sort of a record, though complete, contained many companies which never had built, and, as experience proved to us, never would, build a mile of railroad. This year the aim has been to list only such work as is actually being carried out or which there is strong likelihood will soon be undertaken. A very large majority of the items in this year's Construction Record—probably as large a proportion as 95 per cent.—are made up of official information sent us. The small proportion remaining is made up of projects on which we know work is under way, projected lines of companies which built railroad last year and seem likely to carry on construction, and a very few projects of large railroads which, although they are not likely soon to be undertaken, are so important in showing the direction of their future expansion, that they should be included in the record. By following out this policy the length of the Construction Record has been reduced but its convenience and value greatly increased. The list has been prepared with great care, by experienced men, under an improved system for securing official information. It is, we believe, the best summary in existence of actual railroad construction in America.

This record of new railroad construction accurately reflects the present financial and industrial conditions. Not a single new project of large importance has recently been undertaken. Certain important companies operating thousands of miles of line do not appear in the record at all. Many of the larger railroads which are included in the list are simply finishing small improvements or extensions which were begun a year or more ago. The big undertakings in the United States, the extension of the Chicago, Milwaukee & St. Paul to the Pacific coast, the Western Pacific, the Denver, North-Western & Pacific and the Spokane, Portland & Seattle, which is the new name of the Hill low grade line down the north bank of the Columbia river to Portland, were already begun back as far as 1905 or earlier, and have to be carried on to completion in order to make the already large investments profitable.

The hard times have, however, brought one important advantage to those companies which have funds on hand for carrying on extensions and improvements. During 1906 and the first half of 1907 construction work was carried on at the largest expense both for labor and materials ever known. Now prices have gone down and large savings accrue as compared with the cost of construction a year ago. President Earling, of the St. Paul, estimates that present costs of labor and materials are fully 30 per cent. less than those which prevailed when work was begun on the extension in 1905 and 1906.

But this is small comfort to the average railroad. For lack of credit almost all of even the strongest railroads have reduced construction expenditures to the lowest possible minimum. The present situation of a road like the Southern Railway is particularly unfortunate. A little more than a year ago its tracks and yards were literally swamped with traffic. One yard at the junction of a through main line and a branch line was so full that for days more than 100 cars were stored on the main line of the branch and had to be shifted on to the through main line and back for every branch line train. Per diem and penalties on many cars more than ate up the freight charges. To-day, when all is changed and there is little traffic, is the time that a large campaign of double tracking and yard enlargement should be undertaken and pushed to completion with all possible speed. But the Southern neither has any funds nor can secure them for such work.

North of the Canadian boundary line the outlook is different. Although even there construction plans have been modified by the present financial situation, the large undertaking of the Grand Trunk Pacific, backed by the Dominion government, for a new line from ocean to ocean, is being fast advanced, and important extensions and improvements are being continued on the Canadian Pacific. A great deal of progress has been made by the Grand Trunk Pacific during the year 1907 not only in the complete location of the 3,5?? miles of line, but in laying more than 500 miles of track, 100 miles on the Lake Superior branch from Winnipeg, Man., to Fort William, Ont., and 415 miles from Portage La Prairie, Man., to Saskatoon, Sask. The Canadian Northern was not so active during 1907, and is going more slowly than in recent years in its plans for extensions.

In Mexico also there is extensive work under way. The Southern Pacific forces are pushing construction of a line south along the west coast of the Republic which, when completed, will connect the United States boundary over the Sonora Railway with Guadalajara, state of Jalisco, Mex., nearly 1,000 miles south. Now that the merger of the principal Mexican roads has been formally carried out, it is probable that certain important pieces of new construction which have been postponed while the merger negotiations were pending, will shortly be undertaken and carried through, the most important of these being the construction of a cut-off which will furnish a direct line between the city of Mexico and the very important port of Tampico and be less than one-third as long as the Mexican Central's present route.

RAILROAD TRACK TANKS

Although track tanks have been a feature of railroad operation for 50 years, and have been used in America for nearly 40 years, there is little published information on the subject, at least in this country. This is doubtless due principally to their limited use, since at present there are only seven or eight roads, all eastern lines, which have them. But although comparatively few in number they have been developed and improved wonderfully, so that the track tank installation of to-day is an elaborate and expensive plant as compared with its prototype of a generation ago. Hence the article on another page, which describes present practice, especially as found on the Lake Shore, presents much that is new and brings the record up to date.

A feature of special interest in that article is the record of scooping tests, graphically shown. Data thus obtained gives information on three essential points. The efficiency of the design of the scoop, its correct adjustment, and the most effective scooping speeds. The importance from the money standpoint of having these right is referred to in the article. An interesting point is suggested by these records: Each road has its own design of scoop and it is fair to assume that they are not all equally efficient. Tests of this character for all designs would enable their relative efficiencies to be determined and would suggest improvements in the less efficient designs that might mean a material saving in operating costs.

Another interesting point is the evolution in trough dimensions and the reasons the Lake Shore has for preferring a trough 28 in. wide, 7½ in. deep and 2,000 ft. long. The Pennsylvania once experimented on its Philadelphia division with a trough 29 in. wide, but the results were unsatisfactory and no change was made from the standard of 19 in. Trains running at ordinary speeds wasted more water and received less than with the standard trough. To correct this, flanges were put along the top of the trough extending inwardly so that the opening provided for the scoop was about the same as with the standard trough. This put more water into the locomotive tank than the standard trough but also wasted more. It was decided from these results that any saving in water would have to be made by a modification of the scoop, rather than of the trough. The experiments included the placing of deflectors on each side of the scoop, but they did not reduce the waste appreciably and were objectionable because they impeded inspection and repairs to the scoop details.

While track tanks are installed primarily for passenger service some of the lines having them consider it almost as essential to water freight trains from them as well, since this expedites all train movement, particularly on congested sections. It also lessens the number of stops of long, heavy freight trains, and the roads which have tried it believe that the saving from the use of track tanks is greater in freight traffic than it is in passenger traffic. With the improvement in design, equipment and size of track tanks the cost has, of course, increased considerably. A double track installation on the Baltimore & Ohio 16 or 17 years ago cost around $10,000. Now a modern plant will cost $15,000 to $30,000, exclusive of grading and track work, depending on the width and length of troughs and the methods used for filling and for heating. The total cost is greater than this by the amount spent on grading, drainage, ballasting and track work, which is different for each job. The maintenance, we understand, will probably average about 8 per cent. of the cost. Track at troughs costs about twice as much for maintenance as elsewhere. The cost of operation varies considerably. The labor cost is about double that at a station of equal importance without track tanks; the fuel for pumping will probably be at least double because of the waste of water, and of the heating. The heating cost is a great variable, not only as between stations, depending on local conditions, but for the same station for different years. As regards local conditions, a station supplied from a river will need more heat than where the water comes from a well; the regularity of train movements also has considerable effect, frequent scooping being a great help in cold weather.

The Lake Shore at present has nine track tank stations between Chicago and Buffalo. There are some pretty long stretches between some stations, and we understand these will be broken up, the ultimate plan being to have track tanks or regular stops at intervals of about 20 miles. This is to meet the requirements of freight service, passenger trains not needing intervals shorter than 10 miles.

KEEPING PERMANENT WAY MAINTENANCE DOWN.

It was in 1900 that the quantity of traffic carried by our great transportation systems began to advance in ever increasing strides, so that in the years 1901, 1902 and 1903, the amount was so great as to well nigh swamp even the best managed and best equipped railroads, and cause those years to be ever after remembered as strenuous ones. This increase was slightly checked in the latter part of 1903, but the struggle to make the improvements and additions surpass or "get ahead of" the business had already begun in 1900, and the work was advancing with ever increasing vigor. Money was literally poured in for additional facilities, and the increasing tonnage together with the increasing rapidity of the service, the units which hammer down the permanent way, caused the expenditure of heavy sums for the maintenance and improvement of the roadbeds and tracks, which were the foundations for this mighty business. These heavy expenditures were kept up with scarcely a halt to the very threshold of the panic of 1907, when they were brought to an end more suddenly than has been known before in the memory of the present railroad officers, although the signs were apparent for some time in advance.

We have been examining into the record of maintenance of way and structures expenses given in the annual reports of some roads, and have reduced those of one of them for several years back to the cost per mile of all tracks, and the cost per train mile, both passenger and freight, in order to facilitate comparison, and present the results in the accompanying tables:

TABLE 1.—*Maintenance of Way and Structures Expenses.*

Year.	Per mile, all tracks included.	Per train mile, pass. & frt., cts.
1895	$946	....
1896	875	....
1897	933	....
1898	1,165	....
1899	1,220	19.451
1900	1,298	21.571
1901	1,247	20.616
1902	1,363	21.906
1903	1,363	21.343
1904	1,218	19.730
1905	1,421	23.164
1906	1,610	25.506

By examining Table I, it will be seen that the expenditures from 1895 to 1897 were moderate, at $875 to $946 per mile, but that with 1898 they began to increase, and in 1906 reached the large expenditure of $1,610 per mile of all tracks, including sidings and yard tracks. There is evidence of a slight check in 1904 but it is well known that some companies did not even check their new construction work in that year. It is to be noted that the expenditure per train mile unit increased as well, indicating that for every train run over the road more money was being spent for an improved roadbed and track. It reached 25½ cents per train mile in 1906.

In Table II, the maintenance expenditures have been separated into their component parts, and in addition to the expenditure per unit of track and of traffic, the percentage which each account bears to the total M. of W. & S. expenses is shown. The main object of the statement is to show how large a proportion of the expenses is on account of labor directly employed by the railroad company. Of course, labor enters into the manufacture of articles which are regarded strictly as materials, but in such a case it is not directly employed by the railroad company. Accounts Nos 3 and 4, amounting to from 25 to 30 per cent. of the total, are, therefore, to be regarded as strictly material accounts, and are for rails, track appliances and cross ties; the labor for applying them is not charged to the material.

Accounts Nos. 2, 5, 6 and 7 are partly material and partly labor, while No. 1, amounting to from 30 to 40 per cent., is wholly for labor. It is thus probable that from fully 50 to 65 per cent. of the entire M. of W. & S. expenses are on account of labor actually employed by the railroad company. In times of depression, it is quite possible and entirely safe to cut the rail and track appliance allotment, because a large percentage of rail is removed from the tracks, not because it is worn out, but because its surface has become impaired, and trains do not ride quite as smoothly as the administration desires. By referring to the table, it will be observed that from 1896 to 1899 the expenditures to this account varied within narrow limits, $139 to $170 per mile of track, while from 1900 to 1906, both inclusive, with the exception of two years, the expenditures were much larger, $216 to $268 per mile of track.

In the case of ties, it is necessary to carry on the renewals with more regularity, as will be observed, because their replacement is governed by the law of decay, not of traffic units, but even in the case of ties, it is possible to reduce the requirements somewhat by the exercise of close scrutiny. There will also be irregularities in the tabular record due to the necessity from time to time for beginning the renewal of a large number of the ties in tracks which were built a few years before, and are now ready for the first replacements. An interesting feature of the table is the increase in expenditures per mile for account No. 2, bridges, and all kinds of buildings and structures, for the past ten years, due largely to the increase in the size and weight of rolling stock. It has been necessary to replace bridges which were only from ten to twenty years old, to enlarge round houses, turntables and shop buildings, and to improve the coaling stations and freight houses. It has been a transition stage with which the transportation lines have had to contend during the period of greatest expansion of traffic in a short time in their history.

Item No. 1, Section Labor, is noteworthy. Since 1896, or in ten years, the expenditure for keeping the roadbed and tracks in good condition has doubled. From expenses of $300 to $396 per mile of track between 1895 and 1901, the amount jumped to $485 in 1902, $498 in 1903, dropped back to $442 during the slight depression in 1904, rose higher than ever to $573 in 1905, and reached a maximum

TABLE II.—*Maintenance of Way and Structures Expenditures Separated into Their Component Parts.*

Year.	1. Section labor. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train-mile pass. & frt.	2. Bridges and buildings. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train-mile pass. & frt.	3. Rails and track appliances. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train mile pass. & frt.	4. Cross ties. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train mile pass. & frt.	5. Miscellaneous labor & material. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train mile pass. & frt.	6. Signals, teleg. & telep. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train mile pass. & frt.	7. General. Pr ct. of total M. of W. exp.	Per mile all tracks.	Per train mile pass. & frt.
	Pr ct.		Cts.	Pr ct.		Cts.	Pr ct.		Cts.	Pr ct.		Cts.	Pr ct.		Cts.	Pr ct.		Cts.	Pr ct.		Cts.
1895	36.0	$341	....	20.2	$192	....	12.4	$118	...	14.2	$134	...	6.9	$65		3.0	$28		7.3	$69	
1896	33.5	294	....	18.6	156	....	15.9	139	...	15.4	135	...	6.8	59		2.9	33		6.9	59	
1897	34.4	313	....	16.1	147	...	14.3	130	....	15.1	138	...	7.3	66	.	3.3	30		9.5	109	
1898	27.9	325	....	18.4	215	....	14.6	170	...	11.4	133	.	6.0	70	....	[illegible]	41	...	18.2	212	
1899	30.6	373	5.96	30.0	366	5.84	12.2	148	2.36	12.0	146	2.33	6.4	79	1.26	3.5	43	0.68	5.3	65	1.[illegible]
1900	28.9	374	6.22	19.6	255	4.23	20.7	268	4.45	14.9	193	3.21	8.0	104	1.72	3.9	51	.84	4.0	[illegible]	[illegible]
1901	31.6	396	6.51	21.8	274	4.51	17.9	225	3.69	13.9	175	2.87	6.6	75	1.36	3.5	43	.71	4.7	58	.96
1902	35.7	485	7.79	23.0	312	5.01	13.7	185	2.98	12.4	168	2.70	6.9	100	1.00	3.8	52	.83	4.5	61	.88
1903	36.5	498	7.80	18.2	248	3.89	15.8	216	3.38	13.5	183	2.87	6.5	89	1.40	5.2	71	1.11	4.[illegible]	57	.84
1904	36.3	442	7.17	16.5	201	4.25	20.3	248	4.01	12.4	151	2.45	5.4	66	1.07	4.2	50	.81	4.9	50	.97
1905	40.4	573	9.34	17.1	243	3.95	11.5	164	2.67	13.4	190	3.10	8.1	115	1.88	5.0	72	1.16	4.[illegible]	64	1.[illegible]6
1906	39.2	632	9.98	16.1	259	1.09	14.8	236	3.77	11.6	187	2.95	9.0	156	2.30	5.2	83	1.32	4.1	67	1.01

of $632 in 1906. This certainly indicates an excellent condition of permanent way. The cost per train mile points out, too, a steadily increasing quality of roadbed and track. Whereas about six cents were spent for labor in 1899 for each train run one mile, in 1906 almost ten cents were spent on the roadbed and track for each train run one mile.

There is no task so pleasant to the operating officer as that of employing a large number of men to keep his property in line condition at all times. This has been the characteristic task of the past seven or eight years, but now storm clouds have arisen and it has become necessary to close-reef and sail under almost bare poles on account of a reduction in earnings which has amounted to 20 per cent. and more. No such drop in earnings has taken place since the depression of 1893 and the railroad manager has before him the plain duty of reducing his expenses to an extent that will enable him, so far as possible, to show a profit from operating under the changed conditions. The disbursement during the last decade has been so generous and open handed that railroad companies in making these reductions have to go back ten years to establish a comparison. The tables we have quoted prove amply that liberal reductions can be made without impairing the efficiency of the property. They show also that the very high cost which has been paid for labor, both by unit of time and by unit of performance, must certainly bear its share of the reduction—were any other evidence needed to prove this than that of the many workmen now without employment.

A DECADE OF BRIDGE DESIGN AND CONSTRUCTION.

The introduction, about a dozen years ago, of modern freight cars of large capacity, and the practice of hauling heavy train loads to reduce the most of operation, led to a rapid increase in the weight of locomotives, which in turn required extensive rebuilding of bridges on the principal railroads of the country. Whenever it was possible to reduce the span by the addition of extra piers, plate girders replaced old pin trusses as well as plate girders designed for light loading. In building new railroads, the plate girder has likewise been favored, so that during the past decade the construction of bridges of this class has been unprecedented. As the span and loading have been increased, new forms of flange sections as well as more effective web splices were designed. The most decided change relates to the extensive adoption of pin bearings and segmental expansion rollers. In several important particulars, theoretic considerations are given more consideration than formerly.

In order to secure greater stiffness as well as strength, riveted truss bridges have been substituted for pin bridges and gradually their span has been increased to about 160 ft. and occasionally to nearly 200 ft. Increasing attention has been paid to the design of details calculated to develop the full strength of the main sections of members. In pin-connected trusses, the widths of eye bars for short spans are now equal to those formerly used for spans two or three times as long. The sizes of pins have been similarly increased, while the reinforcing pin plates are more scientifically designed, not merely to furnish adequate bearing, but to distribute the stresses properly among the shapes composing the members. Secondary stresses are reduced as far as practicable by making the axes of connecting members intersect in a point. Not only are adjustable members in short pin spans more generally avoided in the main trusses, but the lateral systems as well as the portal and sway bracing are built of shapes designed to resist both tension and compression.

There has been a tendency to increase the depth of the floor system and to lengthen the panels, the maximum length for simple trusses now being 37 ft. for a span of 407 ft. The use of end floor beams for short spans is coming into more extensive use, although originally designed for only long span truss bridges. A reaction has set in against the extreme curvature of the upper chord of long span trusses that was in vogue for some years. The relative reduction in depth adds some metal to the chords but secures posts of greater stiffness. At the same time the general appearance of such trusses is improved. A good illustration of this may be seen in the bridges at Port Perry and at Brilliant, Pa., on the Pennsylvania Railroad.

Several railroads are now designing all their bridges for Cooper's E 60 loading. Class E 50 was the highest loading tabulated in the 1906 revised edition of Cooper's Specifications; E 40 in the edition of 1896. The latest specifications designate E 40 as the minimum loading for railroad bridges.

An important step in the progress of bridge design was the adoption in 1906 of general specifications for steel railroad bridges by the American Railway Engineering and Maintenance of Way Association. The details of design were under discussion by the committee and before the Association for several years, while the specifications on materials and workmanship were under consideration for six years. Special studies of the literature and the latest practice regarding some topics were made before the adoption of the corresponding paragraphs of the specifications. The adoption of these recommended standard specifications by the railroads will help to secure still further improvement in details and in the general character of bridge structures.

Last summer the Association, through its Committee on Iron and Steel Structures, began to determine experimentally the actual stresses in bridge members when trains cross the structures at different speeds, in order to find the effect of impact or the dynamic increment to be added to the computed live load stresses. During the previous year the Association secured the co-operation of many railroad companies in defraying the necessary expenses, and it is expected that these tests will be continued during the coming summer. The allowances made for impact in specifications prepared by various prominent engineers differ widely from each other and it is gratifying to look forward to the early elimination of this element of uncertainty from the design of railroad bridges. The need for such tests has been advocated for a long time by competent critics. A beginning was made in a small way a number of years ago, and more recently over two thousand records were obtained on the Baltimore & Ohio Railroad, but, unfortunately, they were destroyed in the Baltimore fire before they could be thoroughly studied.

During the decade, 1888-1898, a large amount of solid floor construction of various designs was introduced in connection with the abolition of grade crossings in several large cities, notably in Chicago, while a few railroads adopted it as the standard for other bridges also. Observation of these structures has shown that in most cases the solid floors as designed were too shallow either for stiffness or for durability, so that the more recent designs employ greater depths and simpler details, affording more convenient inspection of the steel work. The substitution of creosoted timber and water-proofing in place of steel plates has been made to reduce to a minimum the metal subject to corrosion and thereby to diminish the cost of maintenance.

A more radical change in the design of solid floors consists in placing reinforced concrete slabs on the metal floor system in order to support the ordinary railroad track with ballast. This construction has been adopted experimentally with a view to more extensive use if experience proves it to be satisfactory. Some bridge engineers are of the opinion that ballasted floors should finally replace all open floors in railroad bridges. There is an impression that the use of ballasted floors will materially reduce the effect of impact for live loads and the results of experiments on this subject will be awaited with keen interest.

One of the most characteristic features in bridge development during the past decade is the extensive adoption of the lift bridge both for railroad and for highway traffic. Only three bridges of the type known as the Scherzer rolling lift bridge were in use before 1898, all of these being located in Chicago, while since that time more than thirty of the same type have been built in various parts of the country, nearly half of them carrying railroad traffic. During this period the greatest span has been increased from 127 to 275 ft. A modification of this type known as the Cowing lift bridge was introduced a few years ago, the first one being built at Cleveland.

Since 1901, more than a score of trunnion bascule bridges have been built, including some of the Page and of the Strauss forms, but most of them were designed by the bridge departments of municipalities, especially Milwaukee and Chicago. The spans range from about 33 ft. to 205 ft. 7 in.

The hinged lift bridge has been revived to some extent with different counterweight arrangements than those used in ancient times. Some improvements have likewise been made to the direct lift bridges, a type which, with one exception, is used only for very short spans crossing canals. In these modern forms both the trusses and floor are lifted vertically, air-tight pontoons replacing the counterweights in some cases. The most novel form of movable bridge is the aerial ferry bridge crossing the ship canal at Duluth, completed in 1905. The movable car is supported by a track on the lower chord of a truss having a clearance of 135 ft. above the ordinary stage of the water.

The advances made in the design of swing bridges have been mainly those required to keep pace with the increase in live loads and in improving the mechanical details so as to reduce the cost of operation and maintenance. Only nine swing spans over 400 ft. long were built in the last decade, the maximum span being raised exactly one foot over that reached before. More cantilever bridges with spans exceeding 400 ft. were erected than in the decade immediately preceding—in fact, almost as many as were built in the two previous decades, a period extending back to the introduction of the cantilever in this country, in 1877. Counting short as well as long spans, ten cantilever bridges were erected between 1877 and 1897, 25 between 1888 and 1897, and 19 between 1898 and 1907, exclusive of the Blackwell's Island bridge, not yet completed.

The Blackwell's Island bridge has a span of 1,182 ft., which is 370 ft. longer than the next in order, the Monongahela river bridge at Pittsburgh. This 182-ft. span was in turn to be exceeded 618 ft. by that of the Quebec bridge, nearly one-half of which had been erected when it collapsed August 29, 1907. The design of the Quebec bridge has covered nearly the entire decade just closed. Its collapse has been properly characterized as the greatest engineering disaster of the period.

The engineering profession awaited anxiously the publication of the complete report of the Investigating Commission of the Canadian government, the findings of which are printed this week in another column. That the profession will take the lessons of this disaster to heart is indicated in many ways. Hardly a week has passed without the publication of articles in the technical periodicals on the design of compression members, including that of lacing, and on full-size tests, some of which were made many years ago and ought to have been published then for the benefit of bridge design. Prominent engineers representing the interests involved in both the design and manufacture of bridges, are trying to induce the government to build a testing machine of far greater capacity than any now in use, in order to extend materially the investigation of full-sized compression members. It may not be amiss in this connection to call attention to the tendency to cut down the weights of details of other than great cantilever bridges which, like lacing, have not been subjected heretofore to a satisfactory theoretic treatment. The careful analysis of the weights of details of bridges of all classes would do much to correct mistaken ideas of economy where they exist.

Only three suspension bridges with spans over 600 ft. long have been erected in this country in the last ten years. The Williamsburg bridge belongs to this decade. While its span is only seven inches longer than that of the Brooklyn bridge, completed 21 years before, it was designed for a much greater traffic.

Although the Chestnut street cast iron bridge in Philadelphia was completed 42 years ago, and the famous Eads bridge at St. Louis was begun a year later, one-half of all the metallic arch bridges without hinges have been built within the last decade. The number of such structures is comparatively small, American engineers preferring the use of two or three hinges. The first bridge with two-hinged arches in this country is only about 20 years old; hence it is not surprising that at least one-half of the bridges of this type were built during the past 10 years, the span being increased 290 ft. over that reached in 1897. The progress in the design of this class of structures is indicated by the projected four-track bridge for the New York Connecting Railroad over the East river at Hell Gate and Wards' Island, the span being 977½ ft. between centers of end pins.

About one-third of the existing three-hinged arch bridges were built during the last decade, while 75 per cent. of the balance belong to the previous one. Only one bridge of this type has been built with a larger span than that reached as early as 1889, the difference being 84 ft. Undoubtedly the number of metallic arch bridges is smaller than it would have been if concrete construction had not assumed such large proportions. Nearly 30 per cent. of those with three hinges are used for railroad service.

The most characteristic feature of bridge construction in the period under consideration is the enormous development in the use of both plain and reinforced concrete for arches with spans ranging from those of small culverts to 233 ft. This length is the clear span of the main arch of the Walnut Lane bridge in Fairmount Park, Philadelphia, which is approaching completion, and is the largest concrete arch in the world. The problem of the erection of an arch of such magnitude required as careful study by the designing engineer as the proportioning of the structure itself. The method of erection was made the subject of definite specifications, as no contractor had sufficient experience to enable him to build the structure without the advice and direction of a competent engineer. In this case two narrow arches are built near together and the intervening space is bridged over by the floor system.

Another example worthy of especial mention is the Connecticut avenue bridge in Washington, D. C. The outside blocks were cast separately and hoisted into position, while the remaining concrete was deposited in place in the usual way. By using yellow sand in some parts of the exposed surface and bluish crushed stone in place of sand in other parts, two tints are shown according to a definite color scheme instead of the ordinary single color of concrete.

A view of a train crossing a concrete arch viaduct which carries it out of sight of land, has recently been published in the *Railroad Gazette*. This novel structure is two miles long and consists of a series of reinforced concrete arches of 50-ft. in span. It is known as the Long Key viaduct on the Key West extension of the Florida East Coast. As several other viaducts more than a mile long, besides numerous shorter ones on this railroad, are to be built, some idea may be gained of the part which concrete, either with or without reinforcement, plays at present in the development of bridge construction. When the number of concrete bridges now in use is considered, it seems surprising that the first one in this country was designed as recently as 1895 and built in 1896. Study of this problem by a large group of engineers has produced many changes in form and arrangement, effecting the arch ring, spandrel walls, spandrel arches, columns, floor beams and slabs, and reinforcement and the surface treatment of the concrete. In first-class practice the elastic theory is applied in the design of the arches.

While the extensive development of concrete bridges has been in progress, a considerable number of stone arch bridges and viaducts have been built, notably in rebuilding the Pennsylvania Railroad, in replacing many short metal structures, and in eliminating grade crossings. Some of these bridges are of unusual magnitude, like those crossing the Susquehanna river at Rockville and Shock's Mills. The bridge at Hartford, Conn., is a corresponding example of a large highway structure. In the design of statically indeterminate structures, it is now recognized that special means should be used to complete the erection in such a manner as to make the actual conditions agree closely with those assumed in making the design. Excellent examples of this are given by the means adopted to close the great arches of the Niagara and Clifton bridge; by the erection of the floor system and stiffening trusses of the Williamsburg suspension bridge, and by the manner in which the arch rings of the Walnut Lane bridge were completed by filling in the narrow keys between the segments of the concrete ring previously placed.

In reply to charges made by Social-Democratic members of the Diet of the German Empire that accidents are caused by too long hours of service, Dr. Schulz, President of the Railroad Bureau, said that the accident statistics showed that much the larger number of accidents occurred, not in the later hours of the employees' days' service, as would be the case if due to over-fatigue, but in the earlier hours, when the men are fresh.

The American Railway Engineering and Maintenance of Way Association differs from kindred railroad associations in one important respect, in that its active membership includes a good many men who are not, and never have been, connected with railroads. These men form some of the most valued members of the committees. To get the best results from committee work there must be full meetings and all the members must work. But every committee meeting means a railroad trip, and some incidental expense, at least, to the members attending. The railroad men having passes are, ordinarily, at only a nominal expense for such a meeting unless the session is prolonged. But for the member who cannot have a pass the railroad fare may be a considerable item of expense, which he probably must pay himself. In most instances such members will feel that they cannot afford to attend many committee meetings, perhaps not any, if they intend going to the convention. Committee work naturally suffers under these circumstances. Just how the situation can best be helped is a matter for some thought, and it needs to be thought about, for the valuable work this association is doing for the railroads should be freed from such hindrances as much as possible. As a matter of fact, a good many of the railroad men who do committee work cannot afford the expense incident to this work. It is enough if they give of their time and energy. Some means should be provided for reimbursing members of committees for any personal outlay incident to their work. The association cannot do this; it hasn't the means. As the chief beneficiaries of this work the railroads might well feel that they can afford to subscribe to a special fund to be used by the association for this purpose. In thus aiding the activities of this organization they are materially furthering their own interests.

NEW PUBLICATIONS.

Electric Railways. Vol. II. By Sidney W. Ashe, B.S., E.E. New York: D. Van Nostrand Co. 282 pp.; 5¼ x 7½ in.; 115 illustrations. Cloth. Price, $2.00.

This volume, while forming the second of a series that the author has in preparation, is complete in itself and deals, in the early chapters, with the engineering preliminaries that must be taken into consideration in locating and building electric railways, closing with a discussion of direct-current sub-station work. The first volume of the series, which was issued some time ago, dealt with the subject of rolling stock.

The first consideration in the location of an electric railway should be, will it pay? And in the discussion of the preliminary investigations that should be made, the author outlines the methods to be pursued. These include a study of the character and amount of population, the probable number of passengers the territory will contribute, the type of cars and motors, the speed and load diagrams, and many other items of first cost and operation that will have an influence in the solution of the problem. The empirical basis for the work is given in a long list of electric railways, located all over the United States from Maine to California and from the Lakes to the Gulf. There are 46 centers of propulsion thus selected, and from the summary prepared, it appears that the railways carry, annually, about 68 passengers per inhabitant. Having determined the present population, the next step is to consider future growth, and instances are cited to show the method of plotting the curves.

When the probable traffic has been estimated, the next step is to determine the electrical features and the type of rolling stock to be used, and various methods for accomplishing this are explained and discussed, including the speed, acceleration and power curves of various cars and motors, followed by the methods of arranging for schedules and the load diagrams of the power plant.

This part of the work occupies the first four chapters. In the fifth, the power house location takes first place, and in this is included that of the sub-stations. In this the capacity is taken up, as well as the cost. Examples are given of the range of these costs per kilowatt, which shows such great variance that it is evident that no calculations for a specific case can be made on general principles or from average data, but each one must be worked out from its own local conditions.

In this treatment of the subject no attempt is made to discuss the electrical features or the details of the apparatus used. The work is confined to the arrangement of the buildings, the purposes to be served by the station, and the only reference to the construction of the apparatus occurs in connection with this arrangement. For example, in considering the local storage battery, the voltage and amperage that are giving good results, the author states the methods of charging, the usual arrangement and the switch connections. In chapters VII. and VIII. the rotary converter and transformer and their methods of operation are described, but this is in connection with their functions rather than in the details of their construction.

In chapter IX. specifications are given for insulating oils, in which greater emphasis is put upon purity than on any other quality. In fact, they are based upon the proposition that, "all oils whether mineral, vegetable or animal, when pure, are good insulators," and the wide range found in the insulating qualities "seems to be due, not to the chemical composition of the oil but to its purity." The book closes with a brief description of the auxiliary sub-station apparatus and the methods of its operation.

Cram's Standard American Railway System Atlas, 1908. World edition, with detailed Maps of Foreign Countries. 612 pp., 14 x 18½ in. Cloth, $12.50. George F. Cram, 130 Fulton St., New York, and 55 Market St., Chicago.

Cram's atlas has several excellent features; it shows interurban trolley lines, indicates important towns with a red circle, prints its railroad lines in colors, so that they may be more readily distinguished, and uses type that is easy to read. We have always found it serviceable and accurate.

CONTRIBUTIONS

Car Wheels.

Philadelphia, March 10, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The work done in the last five years by the Master Car Builders' Association's standing committee on car wheels has resulted in efforts by the makers of cast iron wheels to improve their product so as to make them serviceable under cars of 100,000 lbs. capacity. There has been, however, so little improvement that it is now time to admit that the passing of the use of cast iron wheels under high capacity cars is as sure as is the passing of the wooden car affirmed by A. M. Waitt in his recent paper on steel cars.

It has been said that 72 per cent. of the cars built last year were of either steel or steel underframe construction. Probably 50 per cent. of these were of 100,000 lbs. capacity. Investigations have proved that steel wheels under these cars are safe and because of longer life cheaper per car mile than cast iron wheels. If it is felt necessary or advisable to try something still better than the steel wheel, or as good and cheaper, then let all efforts be bent to this end. But someone must take the lead. A number of years ago a standing committee of the Master Car Builders' Association was appointed to design steel underframes and steel cars. This committee went on from year to year making progress reports but no definite progress. The problem was finally taken up by a manufacturer, who put into it all the energy and enthusiasm he had. What he did not know he hired. As a result there are to-day, probably $500,000,000 worth of these cars in use in this country. On many roads they mean the difference between a deficit and a dividend; and in all cases, increased profits. The car wheel will be developed in the same way. In the meantime let us all put our energy into going ahead on the lines already proved best, instead of criticising and wondering if this or that thing could not be better done in some other way. If we put off doing anything at all as long as any one has a theory that other ways may be better, we shall never get anywhere. CHAS. T. SCHOEN.

What Are We Going to Do About Accidents?

TO THE EDITOR OF THE RAILROAD GAZETTE:

The correspondence on "What are we going to do about accidents" in your issue of February 28, does not, I think, fix any large measure of responsibility for accidents on railroad labor organizations. The inference to be drawn from "General Manager's" letter dated Feb. 15th, is that on the road with which he is connected discipline is maintained and that just decisions made by Superintendents are not reversed at the behest of the "Brotherhoods."

The other "General Manager" who writes under date of Feb. 16th seems to me to place most of the responsibility on those officials who either kept incapable Superintendents in place or failed to support capable officers in the proper disciplining of their subordinates. In the final paragraph of this letter, "General Manager" sets forth plainly how good discipline may be obtained and maintained.

My knowledge of military affairs is superficial and I may be mistaken in thinking the likeness between an army and a railroad equally so, but even in the army is there no method of appealing from disciplinary decisions? If the sentry accused of falling asleep at post protests his innocence, can the sergeant forthwith put him in clink for 30 days? And if the group of corporals believed their lieutenant had set them tasks not provided for in the articles of war, or whatever the form of their contract with the state may be named, have they no appeal? And if they have and use it, does the discipline of the army suffer thereby? Do you think the grant of arbitrary power to the Superintendent will bring about order and good service from subordinates?

On one of the best managed roads in this section, the right of appeal was recognized. In minor cases the appeal from the Superintendent's decision was to the General Superintendent only, but should the employee's position be in jeopardy he might have his case reviewed by the General Manager. This rule involved no humiliation to the Superintendent, its operation occasioned no retaliation by him on the subordinate. Appeals were frequent, reversals rare and discipline well maintained. The possibility of appeal from a Superintendent's decision and practical certainty that, if well founded, it will be enforced should and will serve to make that official more careful in his investigations and more secure in his authority.

It is not unusual for railroad officials to disregard the violation of rules when there is apparently no danger to result therefrom and when some immediate advantage is to be gained. A train on which I was traveling recently was stopped between stations by the bursting of an air hose. One of the principal operating officers of the road who was in his car at the end of the train came out and looked on while conductor and brakemen replaced the hose. He apparently did not note the failure of the flagman to comply with the rule.

Do you not think the laxity of discipline, and consequent accidents, may arise from an indisposition on the part of officials always and indiscriminately to enforce train and other rules, and enforce them whether the offender be a Brotherhood man or not? Appeals, even though backed by "Brotherhoods," don't mean reversals; one "General Manager" gives testimony to that, and the other "General Manager" shows us how to build up discipline, enforce rules and minimize accidents. To his general recommendations, I would add one more: appoint one or more experienced railroad men as inspectors (not detectives) reporting to the chief executive officer of the road direct. Require the Inspector to note not only how the men obey, or disobey, the rules, but how officials enforce the rules.

VICE-PRESIDENT.

Railroad Track Tanks.

BY H. H. ROSS,
Assistant Engineer, Lake Shore & Michigan Southern.

Track tanks have been used since 1857, when they were installed on the London & North Western Railway of England. In the United States, the New York Central used track tanks in 1870. The practice in England is to use troughs of sheet steel, or iron; in a few cases cast iron is used, and one road—the Great Northern of England—uses troughs of creosoted wood fastened by cast iron brackets to the ties. The English trough is usually supported upon wooden stringers fastened to the ties, the top edge of the trough being bent over and bolted to the top of these stringers. In the United States, troughs are of sheet steel and are supported directly upon the ties, although at one time the Chicago, Milwaukee & St. Paul had a track tank between Chicago and Milwaukee made up of cast iron sections, each section being 6 ft. long.

The relative elevation of the top of rail and top of trough is governed by circumstances. In England the trough is about 3 in. higher than the rail and at the ends the rail is raised 6 in., this change in grade being made very rapidly, usually in 180 ft. In the United States the top of rail and top of trough are about the same height. The main advantage of English practice is that the scoop does not have to work through such extreme limits, and there is no necessity for inclines at the ends of the trough, but this would not be practicable on our railroads, as the bottoms of hopper cars, the brake rigging and other apparatus do not have as great clearance as in England and the troughs would be injured. American practice is to allow nothing between the rails which projects above the rails. It is entirely possible to maintain track tanks on curves—English roads not hesitating to place them thus, and there are several in this country—but it is not advisable to do this unless absolutely necessary, as much better results are secured on tangents.

Fig. 1—Passenger Train on the Lake Shore & Michigan Southern Taking Water.

Track tanks must be located where the supply of water is abundant as well as of good quality, as, under the best conditions we can hope to obtain, at least 15 or 20 per cent. of the water put into them is wasted by being forced out over the sides and ends by the engine scoops; and if engines scoop at too slow or too great speed, or if the scoops are not kept adjusted, but are allowed to drag on the bottom of the trough, a greater percentage is wasted, probably averaging 50 per cent. for all engines scooping. This difference in adjustment makes more difference in scooping than one would imagine. An engine with scoop properly adjusted will not throw the water badly even at high speed, whereas one too low will throw water all over the right-of-way. Another curious feature is that an engine seems to scoop as much when the water in the trough is an inch or so low as when the trough is full, the reason probably being that the scoop piles up the water ahead of it or else the force of the water pulls the scoop down deeper. The photograph, Fig. 1, shows about the average amount of water thrown out by the scoop of a passenger engine running 40 or 50 m.p.h.; this amounts to 15 or 20 per cent. of the total taken out of the trough.

Prof. I. P. Church, of Cornell University, made a mathematical investigation of water scoops, and later our road made some practical tests which checked up almost exactly with Prof. Church's formula, viz., that 22 m.p.h. is the minimum speed for taking water and at 25 m.p.h. water is scooped satisfactorily, although more water is forced into the tender at higher speeds, 40 to 50 m.p.h. working about the best, speeds exceeding this are apt to spill the water badly unless the scoop is very carefully adjusted. The grades approaching track tanks must therefore be such that all trains which are to take water can easily attain a speed of 25 m.p.h., and for this reason track tanks should be away from stations, yards, railroad crossings, drawbridges, etc.

The results of the latest Lake Shore tests are shown graphically in Fig. 2. Curve 1 of this figure shows the amount of water theoretically possible to take; that is, the depth of water above the scoop, multiplied by the width of the scoop, multiplied by the distance the scoop is in the water. Curve 2 shows the actual amount of water taken out of the trough by measurement before and after scooping. No. 3 shows the amount actually put into the engine tank. No. 4 shows the depth of water above the tip of the scoop for each of the tests, which explains the irregularities of the curves. No. 5 shows the amount of water taken up by the scoop in percentage of the theoretical amount. No. 6 shows the amount of water taken up by the scoop in percentage of the amount actually taken out of the trough. No. 7 shows the gallons of water delivered per inch of dip of scoop.

Of the above diagrams, No. 6 is the most interesting as it shows that the amount of water actually wasted is about 15 per cent. for a scoop in adjustment and running at a speed of 40 to 45 m.p.h. It is evident from this diagram that speeds below 25 and above 60 m.p.h. waste a good deal of water. This is more important to the maintenance of way department than to the motive power depart-

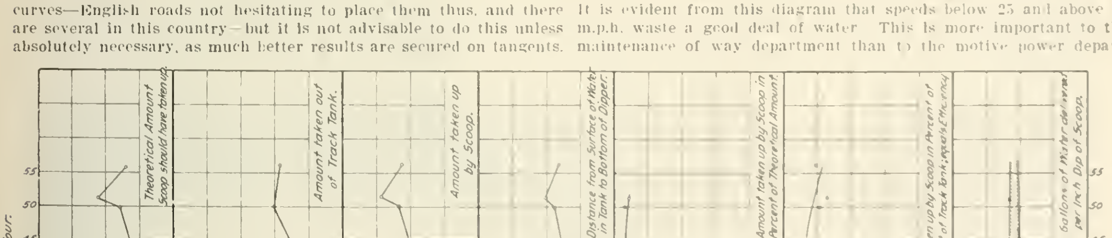


Fig. 2—Graphic Results of Water Scoop Tests on the Lake Shore & Michigan Southern.

ment, as is shown by curve No. 7, from which it is evident that an engine will get nearly as much water at 25 m.p.h. as it will at 50 m.p.h. All of this reduced to dollars and cents means that if trains are run at proper speeds for scooping, the bills for water will be 10 to 20 per cent. less than if they try to scoop at speeds below 25 or above 60 m.p.h. Fig. 3 shows the outlines of the scoops used in these tests.

Next to the problem of water supply, that of drainage is most important. The large amount of water wasted keeps the ground under the troughs continually soaked. Therefore unless the sub-grade for a considerable depth is composed of material that will drain itself quickly and thoroughly, artificial means to this end must be provided. This has always been one of the hardest obstacles to overcome. The track would ride badly even if it were being continually worked over. At the present time the construction used on the Lake Shore, which is shown in Fig. 4, seems to meet all requirements. The essential points are to carry away quickly, by means of tile laid between tracks, such water as gets into the bank, and to minimize this amount of water by covering the ballast with large flat stones, so placed that the water will run off rapidly. These flat stones answer another purpose also, as, being very heavy, the force of the water cannot dislodge them and they hold the ballast from being washed out from between and under the ties. Since the Lake Shore track tanks have been paved in this way the track over the troughs rides as well as elsewhere.

Ties for track tanks should be heavier than those on ordinary track to allow for the recess in which the trough rests, and should be sawed so that there will be a minimum amount of work to get everything lined up. These ties should be of white oak or some other hard wood, and all ties should be tie plated. The practice on the Lake Shore is to use ties 8 in. x 10 in. by 8½ ft. long. It is very essential to do this part of the work well, as the expense of renewing ties in such a place is very great; therefore any reasonable increase in first cost will soon be offset by the saving on maintenance charges. The track should be thoroughly surfaced and filled in with stone ballast and the same quality of ballast should be continued for at least a 1,000 ft. beyond the troughs on the trailing end on account of the large amount of water that will be spilled from the engine tanks for that distance. The photograph of one of the older steam heated troughs (Fig. 5) shows the above features of paving and type of ties, all of these ties being tie plated.

Water for track tanks is usually supplied from elevated tanks,

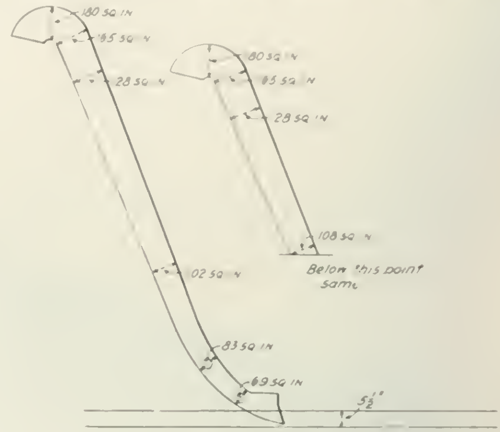


Fig. 3—Outlines of Scoops Used in Tests.

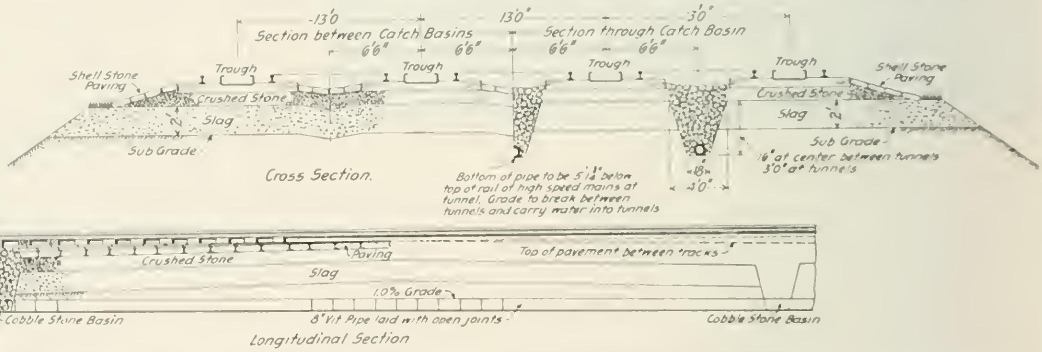


Fig. 4—Details of Track at Troughs; Lake Shore & Michigan Southern.

Fig. 5—Track Tanks at Springfield, Pa.; Lake Shore & Michigan Southern.

the size of the pipe supplying the troughs being determined by the minimum time in which it is desired to fill them. On the Lake Shore a 12 in. main is used, reducing this for the different inlets, and it takes 1½ to 2 minutes to refill the newer troughs after a locomotive has scooped. This filling is done automatically, the valves opening as soon as the water in the trough falls below a fixed level. On the older troughs the water is controlled by a man at the pump house, but on account of the personal equation of pump operators it is found much more satisfactory to make this filling automatic. In England a float system is used for keeping the troughs full and the same object is attained as with our automatic valves.

The number of automatic valves per trough varies according to local conditions and class of traffic. The practice on the Lake Shore is to put in three or four valves per trough—three where the inlets are a part of the heating system, and four where a separate heating system is provided. These valves are placed in small pits at the side of the track and are controlled by an equalizing pipe from the trough, connected to a small tank over each valve. In this small tank a float operates a pilot valve that in turn controls the main valve. From the main valve a pipe is run to each trough, being connected to the latter by a short piece of corrugated rubber hose. All of these pipes are run in small cross tunnels under the tracks. By the use of these tunnels and flexible connections all piping is easily got at, and changes due to expansion and contraction, as well as changes in the level of the track, do not cause leaks or broken connections. Another advantage of these cross tunnels is that all the drains between tracks are connected to them and are thus much more easily maintained. The tunnels will also take care of the water in case of broken pipes and prevent the track from being washed out.

Troughs vary in width from 18 in. to 28 in. and in depth from 6 in. to 7½ in. The majority of troughs at the present time average 19 in. wide, 7 in. deep and 1,400 ft. long. The New York Central and the Lake Shore are using troughs 28 in. wide and 7 in. to 7½ in. deep, the length varying according to conditions. The experience on the Lake Shore favors a trough 28 in. wide, 7½ in. deep and 2,000 ft. long. The old style trough was 19 in. wide, 7½ in. deep and 1,400 ft. long. This was all right for passenger trains, but freight trains running 25 or 30 m.p.h and needing 5,000 to 6,000 gals. of water in the tender required a greater length. The length was then increased to 2,500 ft. and was satisfactory from a freight train standpoint, but the difficulty of keeping the troughs level for this distance was great and it was finally thought best to reduce the length to 2,000 ft. and make the section wider. The main advantage of this wider section is in the greater quantity of water it holds. If a train takes water and for any reason the trough is not immediately refilled, a following train can still get water; furthermore, it is possible to scoop with a double header, the rear engine getting all of the water needed. Other advantages are the possibility of using a wider scoop as larger engines are put in service, and making a stiffer and more rigid construction in the trough itself. The main disadvantages of the wide section are, that with a badly adjusted scoop the waste is greater, and the cost of heating the water in winter is greater on account of the larger surface exposed. This increase in cost of heating is greater than the difference in exposed surfaces would lead one to believe, probably due to the action of the wind.

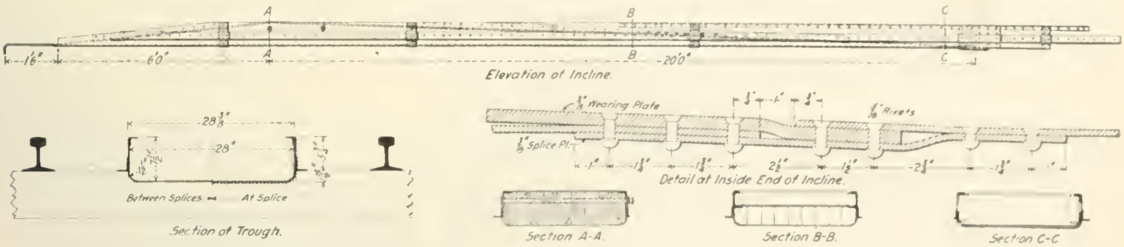
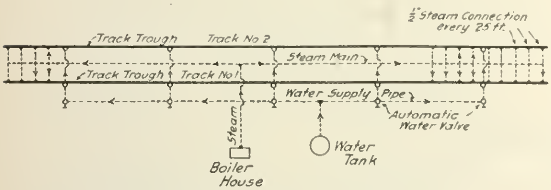


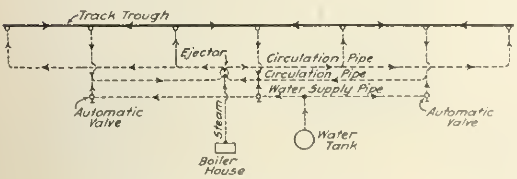
Fig. 6—Details of Incline for Track Troughs; Lake Shore & Michigan Southern.

The question of a satisfactory incline at the ends of the trough to raise the scoop, if for any reason it is not raised before the end is reached, has always been one that has caused the maintenance departments a good deal of trouble and annoyance from the loss of ends and breaking of scoops, and other incidental damage. In England, where the practice of lowering the rails at track tanks is in vogue, there is very little possibility of this part of the trough causing trouble. On the Lake Shore the earliest inclines were quite short, consisting of a steel plate running over the end of the trough and spiked to the ties. These were replaced with an incline 12 ft. long, made of cast-iron and riveted to the bottom of the trough, with a steel plate beyond the end, spiked to the ties. Then for a while no incline at all was used; instead simply a board fastened to the end of the trough, and an auxiliary gate so arranged that if the board end was taken out this gate would swing around and stop the flow of water until the end could be replaced. Beyond the end of the trough a piece of sheet steel was fastened to the ties, and two short pieces of rail in line with the edges of the trough to guard against dragging brake rigging. These board ends have been quite satisfactory, but require a good deal of watching. At the present time the incline shown in Fig. 6 is being used. This incline is built in a very substantial manner, has been deliberately and severely tested, and has withstood all attempts to plow it out; also, on account of the length—20 ft.—it is found that at reasonable speeds scoops are not injured. The construction of this incline is virtually carrying the bottom of the trough up and over the end. A sheet of ⅜-in. steel plate is used and this plate is riveted to the sides of a standard trough section, the space between the plate and bottom being packed with oak fillers. The length of the incline is 20 ft. in the direction of traffic and 6 ft. on the outside to guard against dragging brake-beams, etc., on trains running against the current of traffic. This incline is used at both ends of the trough.

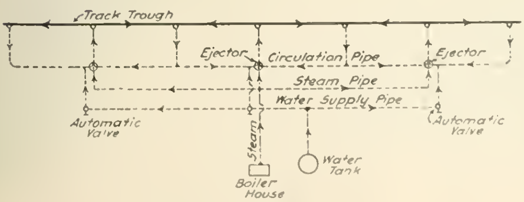
When track tanks are used in cold climates it is, of course, necessary to heat the water in some way to prevent freezing. The practice in England is to station men along the track and keep the troughs open by shoveling out the ice. Also, as their trains run at shorter intervals than ours, their troughs are being filled with warmer water more frequently. If the weather becomes too severe the track tanks are kept out of service. On one English road the



Steam Heating Method.
Diagram No. 1.



Two Pipe Circulation Method.
Diagram No. 2.



One Pipe Circulation Method.
Diagram No. 3.

Fig. 7—Diagrams of Heating Systems.

Lancashire & Yorkshire) steam pipes are carried underneath the trough midway between the stringers on which the trough rests, and the water is kept from freezing by indirect radiation. This is possible with the English troughs, as they are higher than the rail, but it would not be practicable with the construction used in America. In this country there are two methods of keeping the water from freezing: (1) By blowing steam into the water at short intervals, and (2) by circulating the water in the trough by means of a pump and heater, or an ejector. Fig. 7 shows diagrammatically the different methods at present employed, and also a proposed method of circulating. Diagram 1 of this figure shows the usual method of blowing steam into the trough. A steam main is run from the boiler house to a box between tracks. In this box a covered steam pipe runs the full length of the trough and at intervals of 25 or 30 ft. a small pipe runs to the trough. The diagram also shows the automatic valves and water lines.

Figs. 8 and 9 show the details of a four-track steam-heated installation on the Lake Shore at Springfield, Pa., Fig. 5 being a photograph of the same. In a general way this covers all track tanks heated directly by steam. The difference between this and earlier installations is that here the steam pipe is carried above the level of trough and does not become filled with water, whereas the old method was to carry the steam main below the surface, and occasionally it would be split from end to end by freezing. The water connections are controlled by automatic valves and all piping under tracks is placed in concrete tunnels and joined to the trough

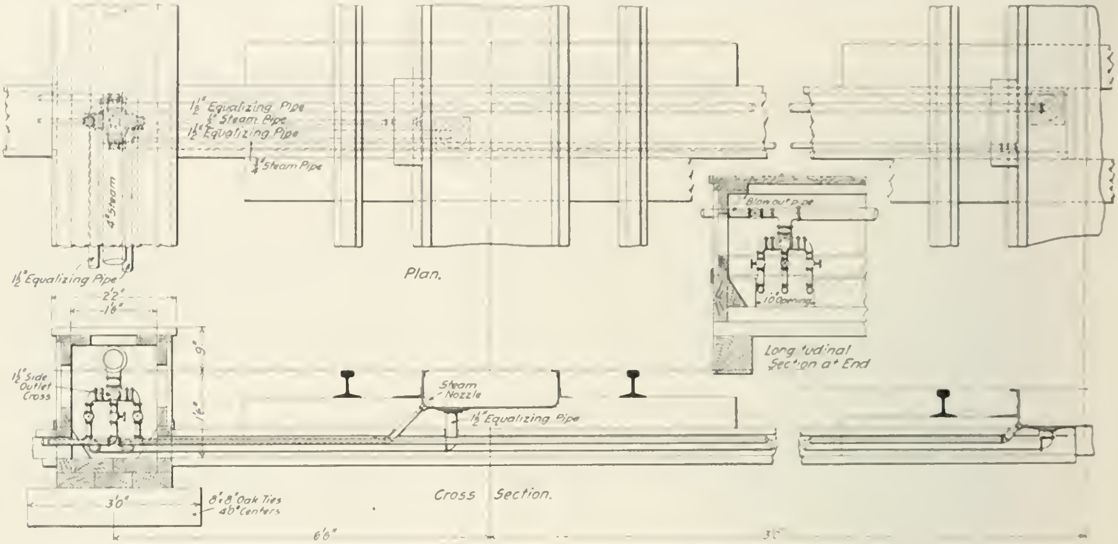


Fig. 8—Details of Typical Direct Steam Heated Installation; Lake Shore & Michigan Southern Track Tanks.

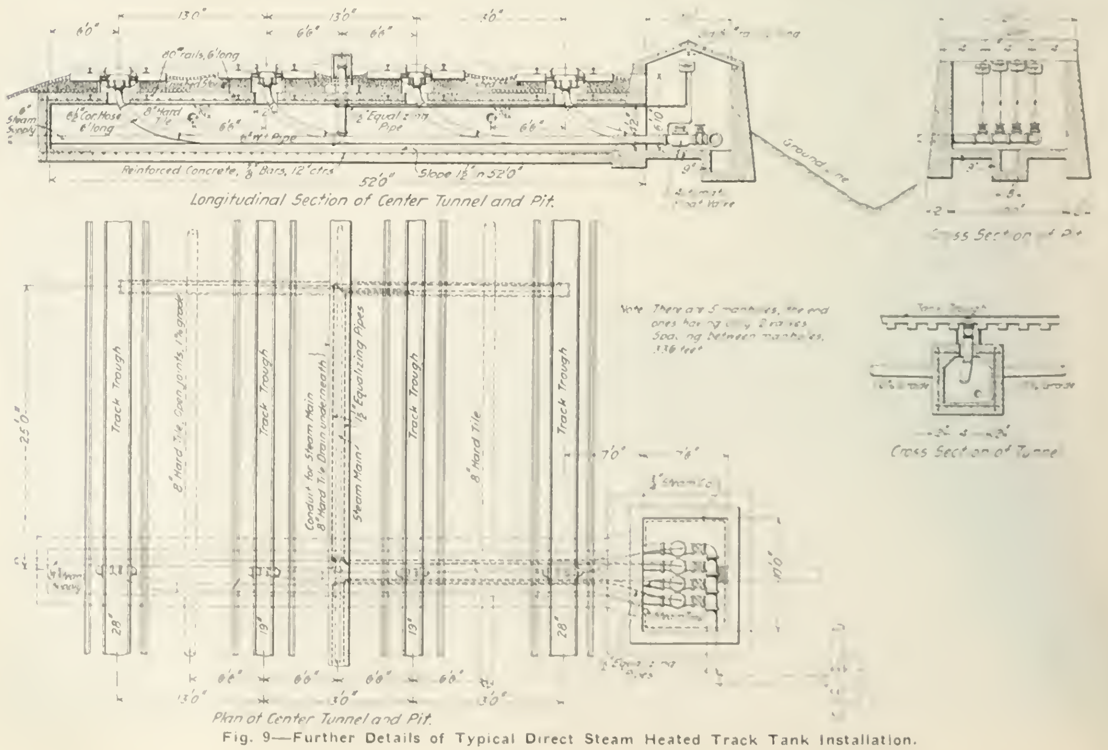


Fig. 9—Further Details of Typical Direct Steam Heated Track Tank Installation.

by flexible connections. The drawings show these features distinctly. In Fig. 5 the valve pits can be seen at the side of the track; also the inclines show plainly in the foreground. It should be explained that the troughs of the two inner tracks in this view are the old, or 19-in., width, and, as may be seen, have been shortened to the present standard length. The outer troughs are the 28-in. width. Markers for night time are placed 150 ft. inside the ends of the troughs. They are switch lights, mounted on a short length of wrought iron pipe having its lower end embedded in concrete, as shown in Fig. 10.

Diagram 2, Fig. 7, shows diagrammatically the double-pipe circulating system used on the Pennsylvania and the Lake Shore.

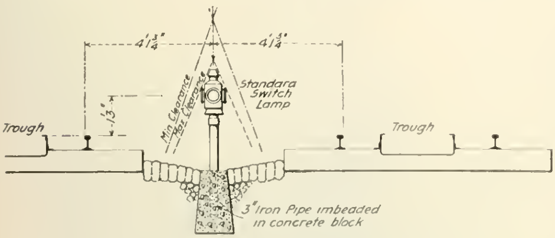


Fig. 10—Standard Marker for Track Troughs.

The water is circulated by an ejector and is heated by the steam while passing through the ejector. The arrows show the direction of flow of water. The water pipes and automatic valves are shown also.

Fig. 11 shows the principal details of this double-pipe system. The top system of piping carries the hot water, and the bottom one brings back the cold water. The advantage of this system over the direct steam is that the track, as far as the maintenance work is concerned, can be handled in the same way as at other points, as there are no steam pipe connections in the way to be easily broken, and there is nothing between the tracks. The piping is all below the surface of the ground and wherever it is connected to the trough a flexible connection is used, so that neither expansion and contraction of trough or piping, nor section men working on the track, interfere with its functions. Trains passing over the direct-steam troughs occasionally have a loose brake rod and this may catch in the steam piping and pull loose all the connections to the trough.

In diagram 3, Fig. 7, is shown a proposed improvement on the double-pipe system. It is proposed to use a single pipe the entire length of the trough for each trough. A steam main will be carried to the next-to-last manhole and ejectors installed as indicated. This will cause a local circulation as shown by the arrows, and if one end of the trough requires more heat it can be easily furnished. The idea is to install all water pipes and the steam pipe in a common conduit underground so that whatever heat is lost by radiation from the steam pipe will be absorbed by

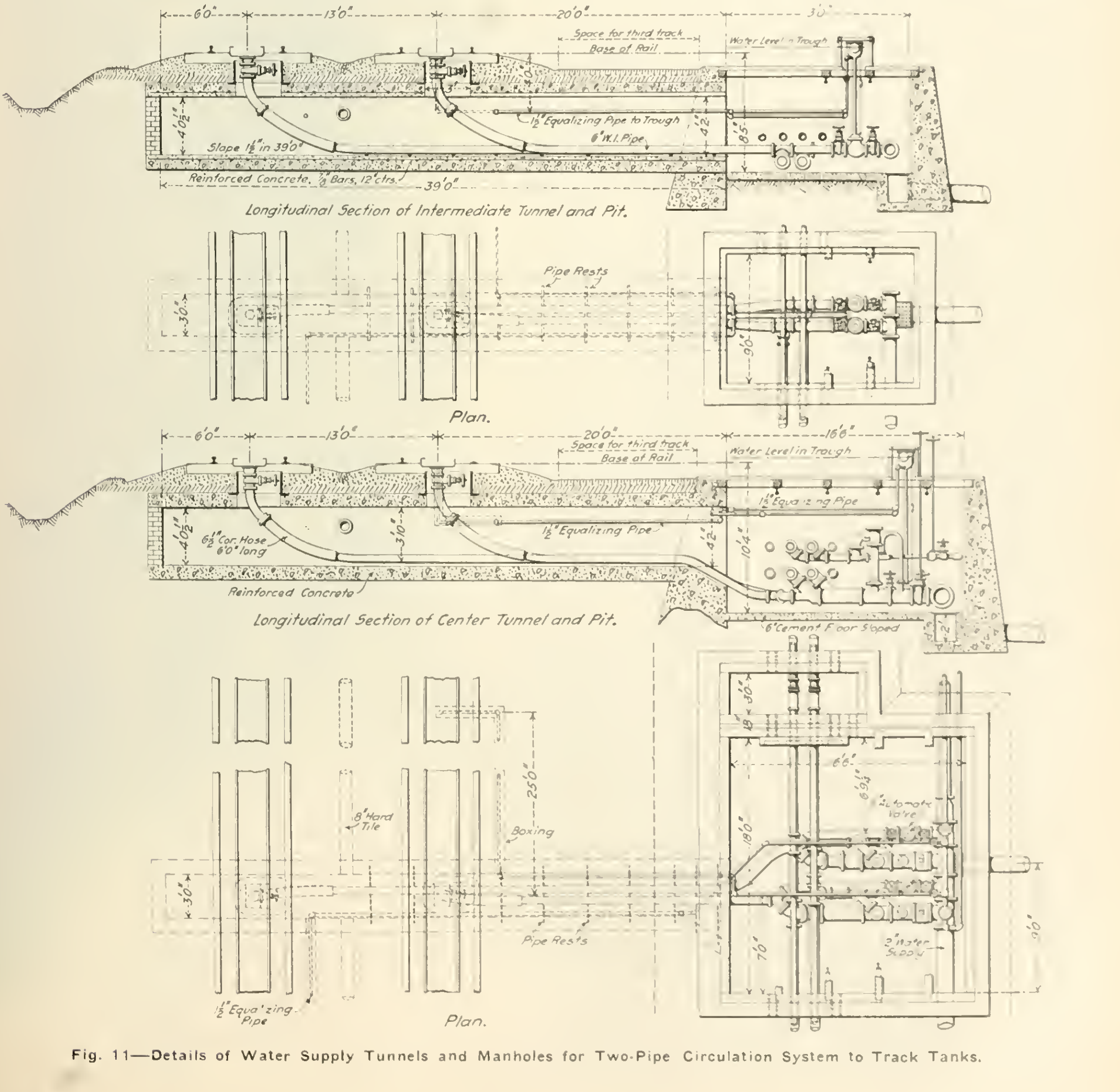


Fig. 11—Details of Water Supply Tunnels and Manholes for Two-Pipe Circulation System to Track Tanks.

the water pipes. The water supply and automatic valves are the same as on the two pipe system. The advantages of the proposed system over the double pipe system are: Less first cost and greater flexibility, as the circulation can be localized, heat radiated by the steam pipes is absorbed by water pipes, all pipes insulated and the heat loss minimized.

Earlier articles on one or more features of this subject are given in the following list:

Design of Kiesel balanced scoop, used by the Pennsylvania Railroad, *American Engineering and Railroad Journal*, November, 1896, p. 283; *Railroad Gazette*, Jan. 8, 1897.

Design of L. S. & M. S. scoop, *American Engineering and Railroad Journal*, November, 1900, p. 344; December, 1901, p. 376.

Design of N. Y. C. & H. R. R. R. scoop, *American Engineering and Railroad Journal*, May, 1901, p. 143.

Experiments with scoops, *American Engineering and Railroad Journal*, December, 1901, p. 392; July, 1900, p. 211; November, 1900, p. 344; December, 1901, pp. 376 and 392.

Modern Water Supplies for Locomotives, Proc. American Ry. Master Mechanics' Asso., 1902, p. 287; abstracted in *Railroad Gazette*, July 11, 1902.

Le Genie Civil, Sept. 16, 1899; June 8, 1901.

Railroad Gazette, Dec. 9, 1898.

Bulletin International Railway Congress, September, 1903.

The Sunnyside Yard of the Pennsylvania.

BY F. H. SHAKESPEARE.

The management of the Pennsylvania Railroad, having decided on building the New York extension with its two Hudson river tubes, four East river tubes, underground station at Thirty-third street and Seventh avenue, Manhattan, and the cross-town tunnels under Thirty-second and Thirty-third streets to the river tubes, was confronted with the question of how to provide suitable yard facilities for operating this terminal. The location of a large terminal yard in Manhattan was obviously out of the question, owing to the prohibitive cost of real estate, to say nothing of the improbability of getting a franchise permitting its construction in the heart of the city. Having provided for a yard of very limited capacity in connection with the track facilities at the Manhattan station, the choice of sites for the main yards lay between Long Island and New Jersey, inasmuch as the Manhattan station was to be about midway between the ends of the tunnel. After considering the proposed New York Connecting Railroad in conjunction with the Long Island Railroad (controlled by the Pennsylvania) and the probable first cost of yard construction, the location of the site was decided on in favor of Long Island.

Near the eastern end of the tunnel extension is the Long Island Railroad's passenger terminal station in Long Island City. Near it are the much congested North Shore freight yard and float bridges of the same company. From these terminals the Montauk and Main Line divisions of the Long Island run eastwardly on diverging lines which join again at Jamaica, some 10 miles away. About three miles out on the Main Line division is a junction point where a short line called the North Side division diverges to the northward; close to it is the line of the proposed New York Connecting Railroad which is to make an all-rail connection to the New England states. All three of the above mentioned divisions are at present operated by steam locomotives, but in a few years electrification is to be extended so as to include nearly all the lines within the limits of Greater New York.

The Atlantic avenue, Brooklyn, division of the Long Island is now operated with multiple unit electric trains, and it is intended to use this class of equipment for all suburban traffic both on Long Island and in New Jersey. At Harrison, N. J., and Jamaica, L. I., there are to be interchange yards, where the steam locomotives of through trains are replaced by electric locomotives for the run through the tunnel section. The Manhattan station will therefore handle trains of two classes, namely: Multiple unit suburban trains, and ordinary coach and Pullman trains drawn by electric locomotives. The Thirty-third street side of the station and the Thirty-third street tunnels have been designed for use principally by multiple unit trains.

Following its usual custom, the Pennsylvania management appointed a committee to take up this question of terminal yard facilities, decide on a definite location, and formulate a track plan from which detailed drawings could be made and preparations got under way for the work of construction. After various surveys and other investigations, this committee decided on a location in the "Sunnyside" district in Long Island City. The purchase of a strip of land was begun along the Main Line division, commencing about one mile from the East river, and extending eastwardly for two miles, the average width is about 1,500 ft. The plan (Fig. 1) prepared by this committee contained many interesting features. It included an interchange yard with space for motor storage, engine storage, coaling facilities, etc., it being the intention at that time to change the motive power at Sunnyside yard rather than at Jamaica. The yard proper was divided into six sections, and from

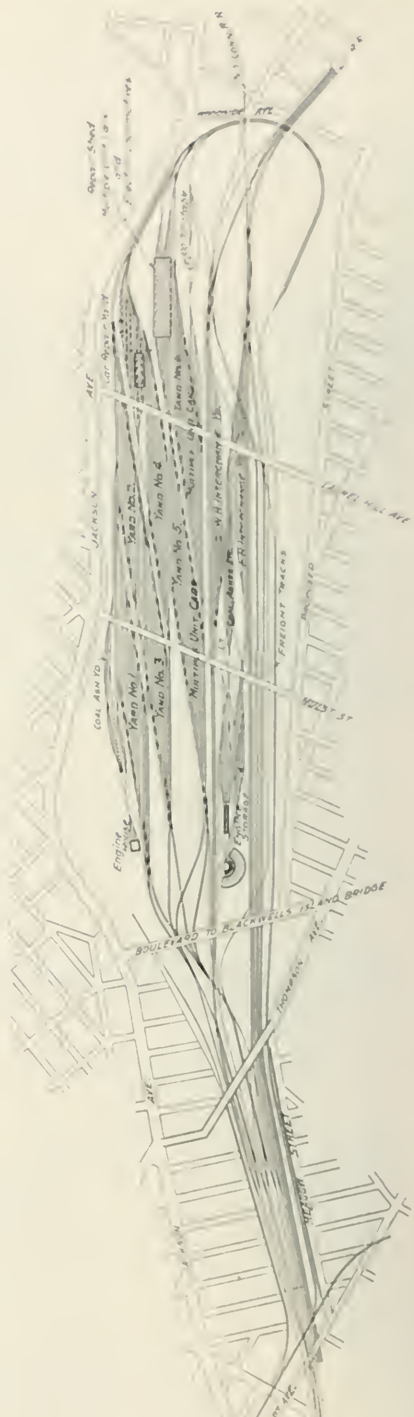


Fig. 1—Sunnyside Yard at Long Island City, As Originally Planned; Pennsylvania Railroad.

Fig. 2—Present Plan for Passenger Terminal Yard at Long Island City.

the head or westerly end of each a double-track line leads to the eastbound and westbound main tracks respectively, grade crossings being avoided by the use of track bridges. These sections were as follows: Two for Pullman cars, having a total capacity of 340 cars with an average of 17 to a track, two for coaches, having a capacity of 375 cars with 20 to a track and two for multiple unit cars having a capacity of 700 cars with 24 to a track. In the multiple unit sections all tracks and ladders were to be electrified, in each of the Pullman and coach sections, all running tracks and ladders, and two yard tracks were to be electrified, it being intended to use these two yard tracks for receiving drafts from the Manhattan station the cars to be thence shifted and distributed by steam switch engines. This plan provided also a single-track connection leading around a three-track loop to the easterly end of the yards, so as to turn complete trains around. The work included among other things 14 distinct track bridges and about a mile of waterproofed subways as approaches to the tunnels. The total first cost was estimated at about $10,000,000.

Negotiations with the city authorities were under way when the idea presented itself that the number of track bridges and the length of subways were rather excessive, also that the ground occupied (some 280 acres) was somewhat large for the storage of only 1,400 cars. After a decision by the late President Cassatt, a new plan was adopted, providing for a yard about 5,500 ft. long and 1,550 ft. wide at its widest point. This has been developed as shown in Fig. 2.

This new plan was made up in accordance with a basic change in the method of operation. The yard tracks were, so far as possible, made continuous, rather than stub end, that is, nearly all drafts will be taken around the loop, entering at the easterly end of the yards and leaving at the westerly end. This will keep all yard traffic moving in the same general direction, avoiding many conflicting movements and lessening the danger of collision. The interchange yard was eliminated, satisfactory evidence having been produced to show that a saving in time of operation could be made by locating it at Jamaica. The idea of using steam switch engines was abandoned and it was decided to operate the whole yard electrically. All crossings of tracks at grade were avoided by the use of track bridges. A freight classification yard, having a capacity of 400 cars, was provided for and has been located just north of and adjacent to the tunnel portals about half a mile from the East river. From here nearly all freight will be carried by means of a Y or switchback along the north side of the passenger yards to an elevated line crossing the passenger tracks and running southward for about half a mile to a junction with the Montauk division. The passage of freight through the Sunnyside yard is thus avoided.

An investigation of the present passenger yard facilities at both Jersey City and Long Island City produced the following working information: At Jersey City there are two yards: the Waldo avenue, which is situated about $1\frac{1}{2}$ miles from the station, and the Jersey City, which is adjacent to the station.

Waldo Avenue Yard.

No. of tracks		27
Capacity of yard		320 cars.
No. of cars per track, varies from	2 to	20 "
Max. No. of cars in yard at one time		250 "
" " Pullman cars in yard at one time		110 "
" " Penn. R. R. cars in yard at one time		140 "
Average No. Pullman cars per 24 hrs.		160 "
" " Penn. R. R. cars per 24 hrs.		160 "
Maximum No. Pullman cars per 24 hrs.		210 "
" " Penn. R.R. cars per 24 hrs.		175 "
No. of wheel tracks		2
Time at which maximum number of cars are in yard, 9 to 10 a m.		

This yard is used exclusively for through line and Pullman business, no attempt being made to separate the Pullman or dining cars from the coaches. The yard people think this is as it should be and also consider that a track holding 12 cars and one engine, or about 900 ft. long, is the most suitable length, even though the make-up sheet shows that few trains carry more than eight cars.

Jersey City Yard.

No. of tracks		13
Capacity of yard		158 cars.
No. cars per track, varies from	1 to	17
Maximum No. of cars in yard at one time		175 "
" " coaches in yard at one time		115 "
" " express cars in yard at one time		31
" " mail cars in yard at one time		30
Average No. of express cars per 24 hrs.		40
Average No. of mail cars per 24 hrs.		37 "
Time at which maximum number of cars are in yard		3 p. m.

This yard is used for local, mail and express service. It is very much congested and to properly handle the present business should have a capacity of 275 cars. The yardmaster recommends tracks having a capacity of 15 cars and a locomotive, or about 1,050 ft. long, his idea being to handle two trains on one track. It is probable that 65 per cent. of the suburban service to Jersey City will continue to be handled at that point either by the present ferry or by the Hudson & Manhattan tunnels.

At Long Island City there are three yards.

Yard No. 1.

No. of tracks	20
Total capacity of yard	285 cars.
Capacity of longest track	15 "
Capacity of shortest track	8 "
Maximum No. of cars in yard at one time	285 "
Time at which maximum No. of cars are in yard	11 a. m.

This yard handles the North Side division and through business.

Yard No. 2.

No. of tracks	[illegible]
Total capacity of yard	[illegible] cars.
Capacity of longest track	15 "
Capacity of shortest track	[illegible]
Maximum No. of cars in yard at one time	[illegible]
Time at which maximum No. of cars are in yard	11 a. m.

This yard handles all the local business excepting the North Side division.

Yard No. 3.

Total capacity of yard	[illegible] cars.

This yard is used to store race trains and is always filled except during racing hours.

During the maximum 24 hours, 576 cars run out of Long Island City. At 11 a. m. there are 450 cars in the yards, 45 of which must necessarily stand on the station tracks. The yard people here recommended tracks having a capacity of 12 cars each.

TRACK SPACING.

Both the Pullman and Pennsylvania yard people agreed that tracks in the through coach yard should be spaced with alternately wide and narrow platforms planking to extend to the rail and level with it, the narrow spacing leaving 6 ft. between cars and the wide spacing 15 ft. The wide platforms are covered by a shed with roof extending over the lower decks of the cars. These spacings mean that tracks are 16 ft. and 25 ft. apart, center to center respectively. In the local yard a space of 4 ft. between cars, i.e., 14 ft. center to center of track is considered ample.

WHEELING FACILITIES.

In the opinion of the yard men, each wheeling track should be long enough to let five cars be worked at once, tracks to be spaced 25 ft., center to center, and each track to have a pit under it. An overhead traveling crane should be provided, together with space for storing wheels and facilities for turning wheels and axles.

PIPING IN YARDS.

The coach and Pullman yards should be piped with separate lines for steam, gas and water, and also air for cleaning and for

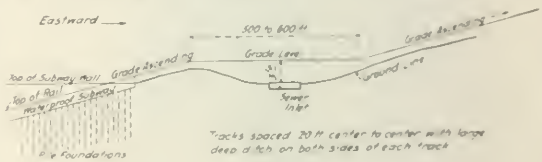


Fig. 3.

brake testing; there should be, also, outlets for charging electric storage batteries. Details are as follows:

Steam: Locate outlets at both ends and middle of all tracks.
Water: Pipe all tracks with 100 ft. between plugs.
Gas: Pipe all tracks with 100 ft. between plugs.
Air for cleaning: Pipe all tracks with 100 ft. between plugs.
Air for testing: Locate outlets at both ends and middle of all tracks.
Battery charging: Wire all tracks with 65 ft. between plugs.

BUILDINGS.

The carpet cleaning shed should have platforms 15 ft. by 75 ft., and about 4 ft. above the ground, the vacuum cleaning system is considered preferable to the blower system. The following table shows the present floor space at the Waldo avenue yard, where 700 men and 30 women are employed; also the floor space required to properly perform the work.

Pullman Store Room Space and Requirements.

	Present	Required
Heavy material storeroom	800 sq. ft.	1,100 sq. ft.
Miscellaneous storeroom	2,500 "	3,800 "
Clean linen storeroom	1,500 "	2,600 "
Soiled linen storeroom	2,000 "	4,000 "
Cleaners' equipment storeroom	360 "	900 "
Plumbers' storeroom	360 "	900 "
Carpenters' storeroom	600 "	1,200 "
Carpet storeroom	700 "	1,100 "
Record storeroom	600 "	1,200 "
Porters' storeroom	750 "	1,200 "
Commissary storeroom	3,600 "	7,200 "
Supt. and foreman's office	360 "	900 "

If the soiled linen is placed on the second floor, an elevator for raising and a chute for lowering the linen should be provided. Ample toilet facilities should be provided throughout the building, the porter's room having separate toilet and bath facilities. The refrigerating boxes in the commissary should be cooled by refrigerator plant rather than by icing.

Pennsylvania Railroad Buildings.

	At present	Required
Battery house	1,850 sq. ft.	5,500 sq. ft.
Maintenance-of-way storeroom	8,500 "	14,400 "
Carpenter shop	1,000 "	1,400 "
Carpet room	720 "	720 "
Steamfitters' room	750 "	1,500 "
Air brake room	240 "	240 "
Tinsmiths' room	375 "	500 "
Officers	600 "	1,200 "
Yardmasters' office	450 "	900 "

The following amounts of waste, cleaning and lubricating oils are used per month, and a suitable building should be provided for the storage of the same together with about 300 sq. ft. each for Pennsylvania Railroad and Pullman paints:

	Used.	Storage-room required for:
Pullman cleanzine	40 bbls.	80 bbls.
" kerosene	30 "	60 "
" cotton waste	16 bales.	30 bales.
Penn. R.R., cotton waste	5 "	10 "
" " woolen waste	1¼"	3 "
" " Galena winter oil	40 bbls.	60 bbls.
" " Galena summer oil	40 bbls.	60 bbls.

The general sentiment of all the yard people is opposed to narrow gage tracks for trucking purposes between the standard gage tracks. It is also agreed that a single post inverted umbrella shed is preferable to any other type.

ELECTRIFIED SERVICE.

There are at present about 150 motor cars and trailers in the Long Island Railroad electric service. The officials in charge of this equipment recommend a spacing of 11 ft., center to center, of track for the multiple unit storage yard, thus giving $5\frac{1}{2}$ ft. between cars.

INSPECTION PITS.

The motor cars are inspected on a mileage basis, cars going over the pits after having run 750 to 800 miles on the road. With the present service, this averages once in four days. The pits now in use have a capacity of four cars each, all light repairs being made while the cars are over the pits. Owing to the excessive weight of the motor cars and trucks, heavy work, such as wheeling, or repairing motors, is done at the repair shops. Pits having standing room for seven cars are recommended so that an entire train can be inspected over one pit. The pits now used are of concrete, $42\frac{1}{2}$ in. deep from top of rail to bottom of pit, bottom being slightly

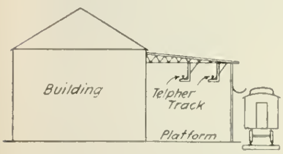


Fig. 4.

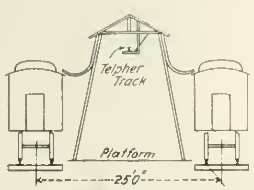


Fig. 5.

concaved. The pits are lighted, piped with air which is used for blowing motors, and are steam heated. There is no third rail along the pits, current being delivered through an overhead trolley. Tracks on the inspection pits are spaced 14 ft., center to center.

From the above mentioned investigation, it will be seen that, in order to handle business of an amount equal to that carried at present, yards must be provided having a capacity of at least 840 cars, about 500 of which are used on through service. In the course of a very few years, all the local or suburban trains will be made up of multiple unit equipment and consequently have been considered as such in the design.

In developing the plans for the Sunnyside yard and contemporary improvements, the following general ideas were kept in mind and the design made to conform thereto: Separation of multiple unit equipment from ordinary coach and Pullman equipment, main tracks separated from the yard proper and the running tracks leading thereto, by being placed on a different level; no crossing of running tracks at grade; all switches to be designed so as to allow as many parallel movements as possible without unduly complicating the track situation or greatly increasing the cost; running tracks and connections between the main tracks and yards arranged so as to allow an alternative route for each movement, these alternative routes being widely separated so as to prevent the yards being tied up and blocked by a serious derailment or wreck occurring at any particular point. In the design of the Sunnyside yard and the Manhattan station provision has been made for two additional tunnels under the East river, which, when built, are to run under Thirty-first street, Manhattan. The city of New York has required the construction of two viaducts carrying streets over the yard approaches, one over the freight yard, and three over the Sunnyside yards proper; also three bridges carrying the main tracks over streets east of the yards, as well as the elimination of several grade crossings on the Long Island City passenger line.

Approaching the Sunnyside yards from the west there will be 10 main tracks, four from the Long Island City station and six from Manhattan by way of the river tunnels. At the easterly end of the yards there will be eight tracks, four leading to the Main Line division, two to the North Side division, and two to the New York Connecting Railroad. These main tracks meet and are joined by a system of interlocked switches, so arranged as to allow three trains to pass in each direction at the same time. In connection with these switches, connections will be provided whereby an occasional interchange of steam and electric locomotives may be effected. Throughout the limits of the Sunnyside yard, all westbound main tracks lie together and all eastbound tracks together. This track arrangement was made possible by a crossing of the tunnels between the portals and the river on the west, and an arrangement of two-track bridges on the east. From the portals eastward all tunnel tracks are in waterproofed subways to a point where the top of rail is 8 ft. above the mean high tide level. Just beyond the ends of these subways the tracks have been so graded as to prevent surface water from draining towards the subways and tunnels. This was accomplished as shown in Fig. 3. Beyond these points, which are in the vicinity of the Thomson avenue viaduct, all main tracks are carried eastward on a rising grade, thus passing through the yards on a level some 20 ft. higher than the yard tracks. A station is contemplated just east of Thomson avenue, whereby passengers may transfer to the trolley cars or other transit facilities which will be in operation over the Blackwell's Island bridge. The general principles followed in making plans for main tracks are as follows: Standard spacing of 13 ft., center to center wherever possible; no masonry walls or abutments placed closer than 8 ft. from center of track to face of masonry; all grade tangents connected by vertical curves having a radius of 30,000 ft. or more, horizontal curves kept as low in degree as possible and easements provided in case of a curve sharper than 2 deg. 30 min.; No. 15 frogs used for all connections in the main tracks.

Near the subway-ends are connections from the main tracks to running tracks which lead to and from the yards. The eastbound running tracks pass along the southerly side of, and on a lower level than the main tracks, leading thence around the loop to the easterly end of the yards. Provision has been made for the ultimate construction of four loop tracks, one from each of the New York lines and one from Long Island City. In addition to the loop tracks there will be, ultimately, a double-track connection to the yards passing under track bridge No. 6 as shown in Fig. 2. Previous to the construction of No. 6 bridge, a single-track emergency connection will lead from the westbound main tracks at the interlocking plant down along the embankment so as to connect with the yard tracks adjacent to the motor storage space. On the plan in Fig. 2 the following points of interest should be noted. Running track heading to loop from line B (Thirty-third street, eastbound) is crossed over other loop tracks, thus affording a route for multiple unit traffic to the yard, independent from the routes used by coach and Pullman or combination traffic; an emergency connection from main eastbound tracks to this multiple unit running track near bridge No. 3; an emergency connection located west of Line A portal between Line C (Thirty-second street, westbound) and running track to Long Island City. On the loop is a system of switch work whereby drafts may be passed to either the multiple unit section or the coach and Pullman section of the yards.

From the loop switching plant, multiple unit equipment may be sent direct to the storage yards or may be diverted to the inspection pits, whence it may pass on to the storage yards or, again, be diverted to the repair shops. The multiple unit storage yard will, ultimately, have 42 tracks, each with 800 to 900 ft. of clear standing room, thus giving a total capacity of 550 cars. These tracks are divided into seven groups of six tracks each, the tracks in each group being spaced 15 ft., center to center, with spaces 25 ft. wide between groups. The westerly or leaving ends of these tracks are connected to a double-track ladder, and the easterly or entering ends to a three-track ladder. The reason for three tracks on the easterly end is to provide for some switching movements and also to allow drafts to leave the yard by these easterly ladder connections, as would be necessary in case of a movement to line E (Thirty-first street, westbound). The spacing of 25 ft. between groups of tracks was necessary to allow the introduction of slip crossings in the near ladder without fouling the adjacent track in the next group.

The coach and Pullman storage yard consists of 11 tracks, spaced alternately 25 ft. and 16 ft., center to center, and 35 tracks divided into groups of six tracks each with a spacing of 14 ft., center to center, between the tracks of each group and 19 ft. between groups; these tracks vary in length from 950 to 1,100 ft. of clear standing room and have a total capacity of 600 cars. The southerly or leaving ends of these tracks are connected to a three-track ladder, the far track of which serves to connect with a small storage space for electric locomotives or motors. The northerly or entering ends of these tracks are connected with a ladder increasing from one to five tracks as the number of storage tracks connected thereto increases. While the general design of the Sunnyside yards is such that much switching of cars will be avoided, yet it has been thought best to provide the above-mentioned five ladder tracks with connections which will let a considerable number of switching movements be made without interfering with the movement of drafts entering the yard. It is the intention to equip at least one track in each group with inspection pits. With a track spacing of 14 ft., center to center (1.5 ft. where column foundations for viaducts are introduced) it will be noted that by removing each third track and lining over each second one of the remaining two, a spacing of 26 ft. and 16 ft. may be obtained, thus affording a ready means of increasing the number of wide spaced tracks should traffic conditions require it. A yard for private cars, with a time-table, has been provided as shown on the plan.

A portion of the space within the loop has been utilized in the design for an additional storage yard, having stub end tracks with a total capacity of 350 cars. The construction of this yard is not contemplated for some years as yet. Throughout the yards, all ladders and running tracks have been spaced 13 ft., center to center, and all connections have been designed for No. 8 frogs except at the loop switching plant, where a few No. 10's and No. 12's were found necessary.

The various yard buildings will be in the space lying between the multiple unit section and coach and Pullman section of the yards. There will be stairways for the use of yard employees leading from these spaces to two of the street viaducts crossing the yard; also an incline driveway leading to the Honeywell street viaduct. Among the various buildings contemplated are the following: Pullman store building, motive power store building, Pennsylvania Railroad service building, storage battery house, bunk house for yard men, carpet cleaning sheds, wheel crane shed and crane, multiple unit inspection sheds, multiple unit repair shops, car inspector's building, oil house, air compressor plant, heating plant, pump house, yardmaster's office.

In excavating near the space set apart for multiple unit repair shop, a very good supply of water has been found. It has been decided, therefore, to build a reservoir located south of the main tracks and within the loop, thus placing it high enough to supply by gravity flow the whole yard and also the Long Island City power house. A pump house and wells are to be located near the Honeywell street viaduct and within the space for buildings.

In a yard so large as that to be built at Sunnyside, the problem of handling supplies, etc., is quite serious. In this case, a system of telpher tracks has been designed whereby the overhead single rail trolley, or telpher can be used to meet this need without in any way interfering with the train movements or other operations of the yards. These telpher cars are to carry linen, storage batteries, commissary and other supplies, and even employees, back and forth between the yard buildings and the various tracks. The layout of telpher tracks is shown in Fig. 2, and the methods of supporting them are as in Figs. 4 and 5.

Construction of the Sunnyside yards and approaches was commenced about January 1, 1907, and the yards will probably be put in operation some time during the year 1910. The construction requires the moving of 1,000,000 cu. yds. of earth, the driving of 300,000 lineal feet of piling, the erection of 200,000 cu. yds. of concrete masonry and the laying of some 75 miles of track. The estimated cost is about $7,000,000.

Coaling Stations on the Belen Cut-off.

Illustrations are shown herewith of the locomotive coaling stations on the Eastern Railway of New Mexico, better known as the Belen cut-off of the Atchison, Topeka & Santa Fe, which was recently completed between Belen, N. Mex., and Texico, on the Texas-New Mexico boundary.

The terminals for the eastern end are located at Clovis, N. Mex., 10 miles west of Texico, where the conditions were particularly favorable for a model arrangement. The coaling plant, which is shown on page 347, is built of reinforced concrete and steel. The bin has a storage capacity of 750 tons and four tracks are served, two outside and two underneath. The bin is filled by a belt conveyor. The receiving track is 250 ft. away, has room for 10 cars and is sloped 1 per cent. for ease in moving the cars across the hopper. The elevating capacity of the belt is 120 tons an hour. The incline for the belt conveyor is of steel frame construction and the roof trusses over the bin are steel. All siding and roofing on the plant is "asbestos protected metal."

Coal is weighed in steel hoppers suspended on a special "Buffalo" pipe-level scales, having plus and minus beams and a type registering device to record on the coal ticket the exact weight of coal taken on a locomotive.

Coaling and Cinder Plant at Belen, N. Mex., Under Construction; Atchison, Topeka & Santa Fe.

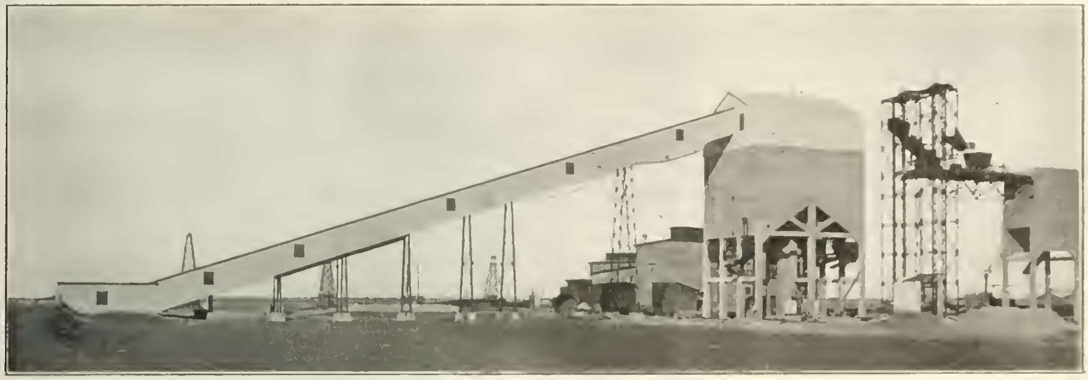
In addition to the coaling plant is a novel cinder handling plant, seen at the right in the photograph. Underneath the two tracks passing under the coal pocket are cinder pits lined with fire brick. Between these two pits is a hoisting tower of steel construction in which travels a pair of large Holmen buckets. These buckets automatically operate gates which deliver the cinders to the buckets. At the top of the tower the buckets automatically deliver their load to steel-lined cars working in time with the elevator and operated by it, a system recently patented. These cars, which dump and close automatically, deliver the cinders to a concrete storage bin a short distance from the elevator, arranged to deliver to railroad cars underneath. Both the cinder plant and coaling plant are worked by electric motors.

In connection with the coaling plant is a reinforced concrete sand storage bin. The sand is elevated by the belt conveyor and discharged into a bin under the coal pocket. A stove dryer and screens are so arranged that the sand is dried and screened without hand labor. The dry sand is raised by compressed air.

At Taiban, 45 miles west of Clovis, is the coaling plant shown herewith. This is a wooden frame plant of 250 tons storage capacity. The coal is elevated by means of large Holmen buckets in the usual manner. Another plant is located at Yesso, 42 miles west of Taiban, and is a duplicate of the Taiban plant in all respects.

The next plant is at Vaughn, 13 miles west of Yesso. There is a novel feature connected with this plant, which is also shown. The coal is received on a track about 48 ft. from the storage pocket. A Holmen elevator and Barrett automatic tram car system is used to convey the coal to the storage pocket as described for the cinder plant at Clovis.

A sand plant is also a part of the equipment at this place. The sand is elevated in the Holmen buckets and discharged into a reinforced concrete bin between the elevator tower and the coal bin. The sand gravitates through a stove dryer, over screens and into a steel drum from which it is blown to the dry sand bin by compressed air.



Coaling and Cinder Plant at Clovis, N. Mex., on Belen Cut-Off of the Atchison, Topeka & Santa Fe.

A coaling plant at Willard, 55 miles west of Vaughn, is a duplicate of the ones at Taiban and Yesso. Another at Becker, 39 miles west of Willard, is also a duplicate of these in general design, but of 350 tons capacity.

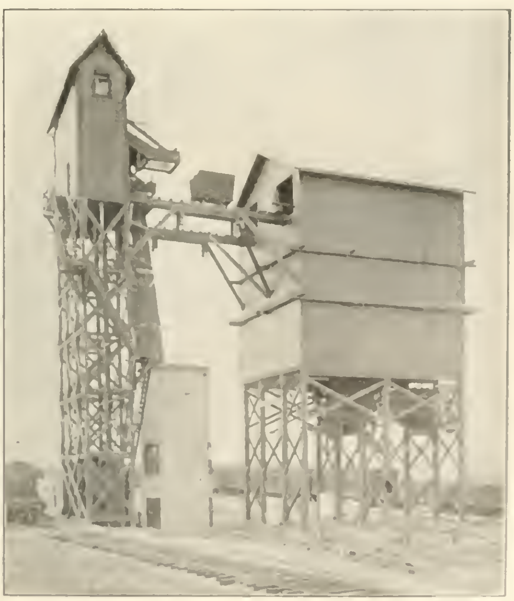
The plant at Belen, the western terminus (page 346) is like the one at Clovis, except in the method of elevating coal. This is done in Holmen buckets, and by means of the Barrett automatic tram car system it is delivered to the coal bin, 135 ft. from the receiving track. Two kinds of coal are handled here and to prevent their getting mixed, the receiving hopper is divided into two parts. One Holmen bucket handles the coal from each hopper and the tram cars deliver the coal independently to their respective bins. A Holmen-Barrett cinder plant here is a duplicate of the Clovis plant.

With the exception of the Clovis plant all the plants are equipped with the weighing hoppers mentioned with the Clovis plant, and all but this plant are driven by "Ohio" gasolene engines.

The plants were all designed and built by Roberts & Schaefer Co., Chicago.

A molder employed in the Baden State Railroad shops at Karlsruhe was elected on the Social Democratic ticket a member of the city common council. The railroad authorities informed him that if he accepted this office he would be discharged from the State Railroad service. In the Baden Parliament Social Democratic members declared this notice to be in contravention of a citizen's rights. The Prime Minister answered that the action of the government was due to the fact that the Social Democratic party regards as one of the most important means of obtaining its ends strikes by workmen, and especially by railroad men. The State Railroad management is responsible for the regular and uninterrupted operation of the railroads in the interest of the public at large, and cannot keep in its service any man who openly declares that it may become his purpose to prevent such regular and uninterrupted operation.

Coaling Plant at Taiban, N. Mex.; Belen Cut-Off.



Coaling Plant at Vaughn, N. Mex.; Belen Cut-Off.

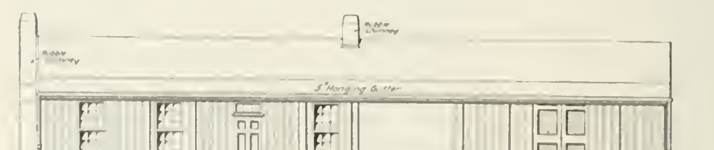
Station Standards; Virginian Railway.

In the previous articles (see *Railroad Gazette* of March 15 and August 23, 1907, under caption "The Tidewater and the Deepwater Railways") the general features of the road and the methods of track and bridge construction were considered. The same system of standardization that has already been outlined has been carried on to other departments of the work.

It is not often, however, that railroad standardization is carried to such an extent as to include the station buildings and section men's houses, so that they can be built and located where desired, without further attention from the engineering department. This has been done in this instance, and is working successfully. The plans, as prepared, could only be made applicable to places where the conditions to be met are practically uniform; but as there are no large towns along this line, the plans are applicable to nearly every place upon it. The original plans were of three main types; one for towns of considerable size; one for small places in Virginia, and one for small places in West Virginia. Later it was found that a modification of these would be required in certain localities. For example, new stations were designed for use in the tobacco section of Virginia for both large and small towns; and, in West Virginia there has been a revision of the plans for small towns. The reason for the distinction made between the two states is that the laws of Virginia require separate waiting room accommodations for white and colored people, while those of West Virginia do not. The first design of station for large towns is 80 ft. long by 22 ft. wide. The second is 70 ft. long by 26 ft. wide, and both are combination freight and passenger stations. The original station for small Virginian towns contains waiting rooms for white and colored passengers and a ticket office and a freight house and measures 60 ft. by 22 ft. That for West Virginia has but one waiting room, the ticket office and freight house, and measures 40 ft. by 16 ft.

Of the smaller sized stations of the original design that at Mullens, W. Va., is typical. It is a frame building and the specifications permit that the rough framing shall be of either white, Norway or southern pine, spruce, Pennsylvania white hemlock or fir, provided only that it is sound and free from defects. The interior finish is in natural wood, kiln dried and varnished on the exposed surfaces. The flooring of the offices and waiting rooms is of quarter sawn Carolina pine or maple of 2½ in. face and ⅞ in. thick and matched for the whole length. The baggage and freight house flooring of all stations is of 2-in. southern pine 6 in. wide, quarter sawn and smooth. The exterior is given three coats of standard paint, one priming coat and two finishing coats, the body color to be a standard light yellow with white trim. Six settees are provided along the walls of the waiting rooms, and these are made of ⅞-in. oak or ash slats with V joints screwed to cast iron brackets or supports of the form shown. These specifications as to finish also apply to the larger sized stations.

Station at Mullens, W. Va.; Virginian Railway.



Side Elevation of Rustic Combination Station.

In the Mullens and similar stations the waiting room has an inside measurement of 10 ft. by 14 ft. 10 in., or the full inside width of the building; the ticket office has a width of 6 ft. 6 in. and the freight house 21 ft. 4 in. The latter has sliding doors at the front and back and, on the track side, has a gangway of 4-in. planks for an approach. In the second design of "rustic stations," as they are called, the total plan of the building covers an area of 62 ft. by 16 ft. with an operator's window at the ticket office end projecting 5 ft. 6 in. on the track side. This projection is merely the extension of the ticket office out to the edge of the overhang roof of the platform. This roof is carried at its outer edge by eight round wooden columns. The ticket office at one end has a width over the partition walls of 11 ft. and extends the whole width of the building. The total length of the ticket office and waiting room section of the building is 34 ft., of which the waiting room occupies 23 ft. Beyond this is an open driveway 11 ft. wide and then a freight room occupies the remaining 23 ft. of the plan. The floors of these freight rooms are either on the ground or raised 2 ft. 11 in. above the level of the waiting room floor. The intention is to use the rustic station with an elevated freight floor in the tobacco country of Virginia, while that with a low floor will be used in West Virginia. The interior finish of these stations is essentially the same as that of the design already described. Externally they have a rubble chimney for both the ticket office and waiting room, which gives them the characteristic feature of the other buildings of the country, and it is the intention to plant climbing vines about the one at the end of the building. This will be an innovation and add to the attractiveness of the structure.

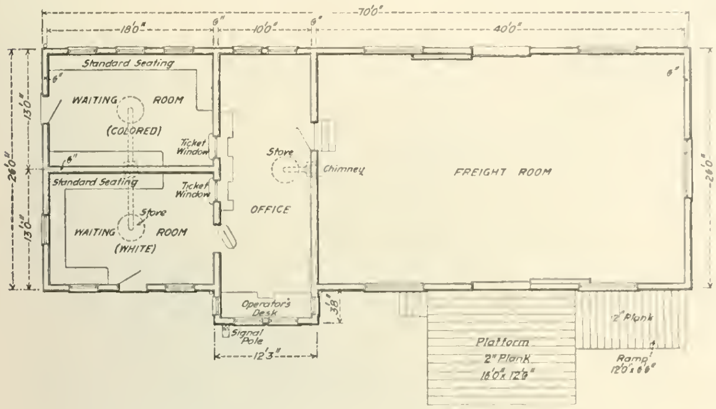
The floor plan of the 60-ft. by 22-ft. station for small towns in Virginia is the same as that of the larger 80-ft. by 22-ft. station, except in dimensions, and the inside and outside finish is like that of the smaller West Virginia stations.

The 80-ft. by 22-ft. station, of which that at Brokneal, Va., is a sample, has a freight room at one end 34 ft. 6 in. long and two waiting rooms for white and colored people respectively, each with a width of 21 ft. 9 in. at the back and 16 ft. at the front, where the ticket office is located. In modifying this design, the building has been widened to 25 ft. and the waiting rooms placed one back of the other at one end of the building with the ticket office between them and the freight room. These stations are also frame buildings erected to the same general specifications as the smaller stations and with the same interior and exterior finish.

In addition to these regular stations that are to be built in towns and villages, a smaller building known as an operator's house has been designed for use at points where it will be necessary to make station or water stops and where no freight will be received. Such a place, for example, as Elmore on the Deepwater section, where there will be an assembling yard and water tank. Here it will be necessary to have an operator and accommodations have accordingly been provided for such passenger traffic as may offer. The outside dimensions of the building are 12 ft. by 30 ft., and it is divided in the plan into two rooms; one a waiting room and one for the operator. The interior and exterior finish is the same as that of the standard stations, and it has the same large opening between the two rooms filled with a wire mesh that obtains in the case of the other buildings.

This standardization of station buildings is possible, of course, only for small towns. For large places special designs would have to be prepared, and this has been done in the case of the road's large places, Norfolk and Roanoke. Here there will be a yard and a freight house of dimensions suited to the requirements of the cities. The passenger stations have not yet been designed.

The layout of the tracks and building is given on the plan. These are located at the south side of the city at the crossing of the Roanoke & Southern or the Winston-Salem division of the Norfolk & Western. The passenger station will be 40 ft. wide by 150 ft. long and will be approached by a screening driveway from Jefferson avenue along which there is a line of street cars. This street will be raised about 5 ft. to meet the grade of the road. The road is single track and will have a connection with the Norfolk & Western over a 13-deg. curve, and there will be a long passing siding in front of the depot, with a track leading off to a double-track siding in front of the freight depot with space left for additional tracks when the traffic offered may require it. Beyond the freight house there will be a number of team tracks as shown. In all of this layout the plans have been prepared for present construction and future extension.



Plan of Standard Combination Passenger and Freight Station.

The freight depot, as designed, will have a width of 40 ft. and a length of 231 ft., of which but 134 ft. 11 in. will be built at present, and the remainder added when the requirements of the traffic shall demand it. The part to be built first will be the east end and will include the offices. The building is to be of brick set on concrete foundations of 1-4-7½ mixture except around the basement beneath the offices, where a 1-3-6 mixture is to be used. Provision is made in these foundations for expansion and contraction due to variations of temperature by the use of vertical tarred paper joints. The piers for the posts supporting the freight house floor are also of concrete of the 1-4-7½ mixture, and these are spaced on 9 ft. 6 in. centers longitudinally and 9 ft. 5 in. centers transversely. Everything is carried down to at least a foot below the natural surface of the ground, or as much lower as may be required in order to get a good footing. The floor of the freight house is carried on 12 in. x 12 in. posts capped by 12 in. by 14 in. girders, upon which 2 in. by 12 in. joists are laid on 12-in. centers, over which the 2-in. flooring is laid. The top of this floor will be 4 ft. 6 in. above the base of the rail and will have a drop of 2 in. in the slope of the outside platform, so that the latter will be 4 ft. 4 in. above the base of the rail. This platform, which will be on the track side only, will have a width of 8 ft. 2 in. The sliding doors opening upon the platform will be spaced on 38-ft. centers so that a string of five cars can be spotted in front of the house, each with its door opposite one in the house. Scales will be placed near the center of the floor of the first section to be built, and this will be completed with a brick end wall, which will afterwards form a brick firewall extending up through the roof.

A basement with a headroom of 8 ft. will be located beneath the offices and will be used as a heater room. The floor of this space will be of waterproofed, reinforced concrete on a screening foundation, the whole having a thickness of 21 in.

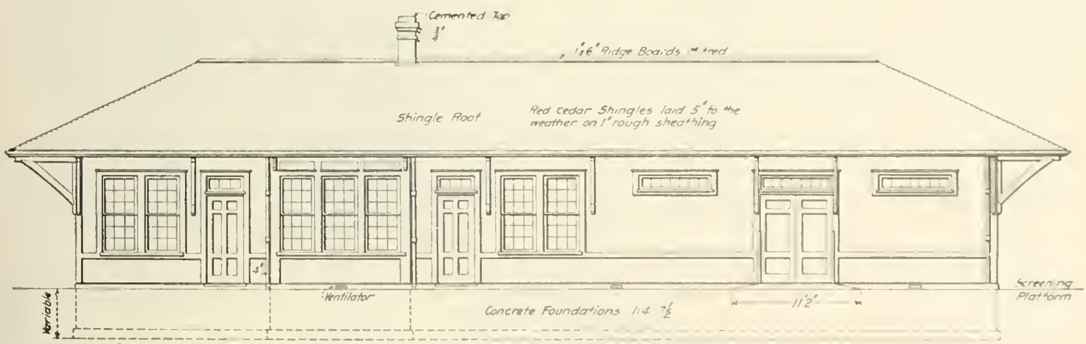
The roof is carried by a simple wooden truss and the whole floor space will be clear and unimpeded by columns. These trusses are spaced on 19-ft. centers. Skylights are put in each slope on 38-ft. centers so that there is ample light admitted from above. The curbing around these skylights is to be of white pine with wooden bars glazed with ⅜-in. ribbed plate, shingled and set in putty with clips. The roof covering will be of No. 1 American Bangor slate laid with a 3-in. lap.

The drainage of the roof water is provided for by five down-spouts on each side. Those on the track side deliver into a 6-in. vitrified sewer pipe that leads down the side of the building to the ends where it empties into 8-in. pipes that run across the ends of the building into a sewer opposite the center of the building and set some distance out from it. At the back corners where the 8-in. pipes turn from the ends, lamp or cleaning holes will be placed, and at the sewer opening there will be the usual manhole and cover. In this way the water from the roof is led away from the foundations at once and the seepage of dampness beneath the building will be avoided, as the pipes are run at a minimum distance of 4 ft. from the walls.

The offices are to be finished in natural wood, with rubbed down shellac, followed by two coats of hard oil rubbed down to an egg-shell gloss.

This is the only large freight house that has, thus far, been designed, as there is no need of so extensive a provision at other points along the line. Work is also in progress on the yard that will be located at Roanoke.

Roanoke Yard.—This yard is the only one of any magnitude that has, thus far, been designed, and even this is small in comparison with other distributing and classification yards that have been built in recent years. The reason for this, at so important a point as Roanoke, is that the traffic that is expected will consist almost exclusively of coal bound for tidewater and originating on the Deepwater section. This traffic will be made up and classified in the Princeton yard, which will be the main point of assembly for the road as well as that from which the empties will be distributed among the mines. Hence both east and westbound trains will for the most part pass through Roanoke without breaking bulk.



Combination Passenger and Freight Station at Brookneal, Va.

The total length of the Roanoke yard is about 7,800 ft. and it is located almost entirely west of the passenger station at Jefferson avenue. The layout is somewhat peculiar and is based upon the exigencies of the case and the topographical limitations imposed. In general the yard follows the bend of the Roanoke river, whose banks it reaches a short distance west of the roundhouse. On entering from the east there is a lead from the main line to the left which runs parallel to the same for the whole length of the yard and forms a passing track. Before reaching the passenger station there is another lead to the left which branches into the double track in front of the freight house already referred to with two extra tracks that may be used for storage. The total capacity of these four tracks from a point east of the freight house to the switches giving access to the team tracks is 111 cars. This team track yard is placed between the freight house and the storage yard and is arranged with double blind-end tracks with a screening driveway approach to one side of each track. These have a total capacity of 126 cars, and beyond, between the team tracks and the

Plan of Freight Yard and Station at Roanoke, Va.; Virginian Railway.

roundhouse, is a storage yard composed of 18 blind tracks served by a single ladder track and having a capacity of 300 cars. As will be seen from the engraving, the switching lead for all of these tracks is one running parallel to the main line and extending down into the eastbound yard, where it is to be used as far as the necessities of the string of cars being handled will require.

The roundhouse is to be in the angle formed by the line of Jefferson street and Prospect avenue. At present a house of 10 stalls will be erected but provision will be made for extending it by 20 stalls, making it 30 in all, as soon as it may be needed. The coal trestle, water column and sand pockets are placed between the incoming and outgoing tracks, with ash pits set in the incoming tracks, and these are doubled at that point. The coal pockets have a length of 200 ft. and stand 30 ft. above the tracks, being reached over a trestle on a 5 per cent. grade.

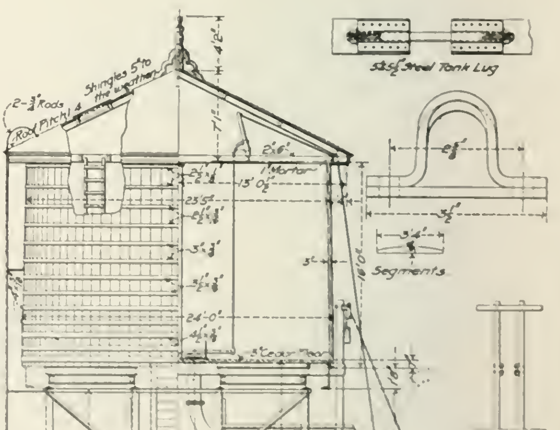
The repair tracks are south of the approach tracks to the roundhouse and are served by a single ladder track that is extended by a switching lead running along the southern side of the main yard and connected with it in such a way that cripples can be taken to the yard and the repaired cars removed and placed in either the east or westbound yards without interfering in any way with the engine movements to or from the roundhouse.

Next to the repair tracks come those for cabooses and the wrecking train. This arrangement of caboose tracks necessitates special switching for the caboose both on incoming and outgoing trains in each direction.

The neck of the yard is formed below the Franklin Road bridge, which is about 3,000 ft. west of the eastern end of the yard or near the middle of the same when it is considered as a whole. At this point there are five tracks, that on the north is the main line, then comes the passing track, then two cross-overs and engine tracks, and last the switching lead for the repair tracks.

The east and westbound yards lie side by side and, except for the arbitrary assignment of tracks to the two, are essentially a single yard consisting of 14 tracks exclusive of the running track at the south side and the passing track at the north, and having a common ladder at each end, that at the west end being run into the passing track and then used as a switching lead. The total capacity of the yard is 1,128 cars, of which 1,385 are assigned to eastbound and 743 to westbound traffic.

The movement of the cars through the yard will be very simple in that, as already explained, there will be very little breaking up of the trains. On entering from the west the trains come in over the passing track and switching lead and in upon the eastbound tracks. The engine is cut off from the train and passes on directly to the roundhouse. The caboose is cut off and hauled back and thence around the running track to the south to the caboose tracks, and whatever classification may be needed will be done over the latter at the east and the running track extending down past the freight station, the cripples being taken out and dropped in on the

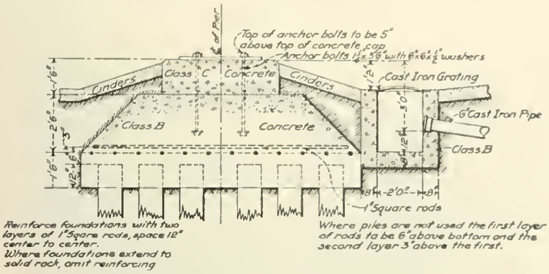


Standard Water Tank; Virginian Railway.

repair tracks to which a direct lead is provided by way of the ladder from every track in the yard.

Entrance to the westbound yard is effected in a similar manner. The train leaves the main line at the first switch and runs over the passing or running track by way of the cross-overs beneath the Franklin road bridge to the yard ladder and thence in upon the westbound tracks. The engine returns to the roundhouse over the running track to the south of the yard and the caboose is cut off and hauled directly back upon the waiting tracks. Classification and the cutting out of cripples is accomplished in the same manner as in the case of the eastbound traffic.

From east to west the yard grade is level as far as the station



Standard Masonry for 80-ft. Turntable.

when it begins to rise and continues to do so to the western extremity at a rate varying from 0.20 to 0.358 per cent.

The yard is in no sense a classification yard although some work of that character will necessarily be done there, but it is more of a halting place where engines can be changed and cars inspected and repaired prior to their onward movement to tidewater or the mines. For this reason a complication of operation is not provided for as it will be in the case of the great assembling yard at Princeton, which will be dealt with at length in a future issue.

Miscellaneous Standards.—In connection with the station and yard work certain other standards have been adopted that are based upon good American practice and which will serve to simplify the work of the engineering department as already intimated. Among these are standards for water tanks, signals, turntable foundations, crossing signs, methods of running wires, fencing, towers, etc.

One example of these standards is given in the 16-ft. by 24-ft. water tank having a capacity of a little less than 52,000 gallons. As in all other foundation work concrete is used for these tanks, in this case the proportions being 1-3-6. Ordinarily the footings are 4½ ft. sq. but these are increased where the soil is soft. All of these columns are formed of 6 in. by 6 in. by ½ in. angles rising to a height of 17 ft. 9 in. above the rail and there carrying the floor beams, which are made up of 12 in. I's with 8 in. I beam braces. The floor of the tank is made of 3-in. cedar plank, and its upper surface is 7 in. above the tops of the columns, so that it is 20 ft. above the top of the rail. In the general features of the construction the tank does not differ essentially from others of a similar character and is illustrated as an example of good current practice.

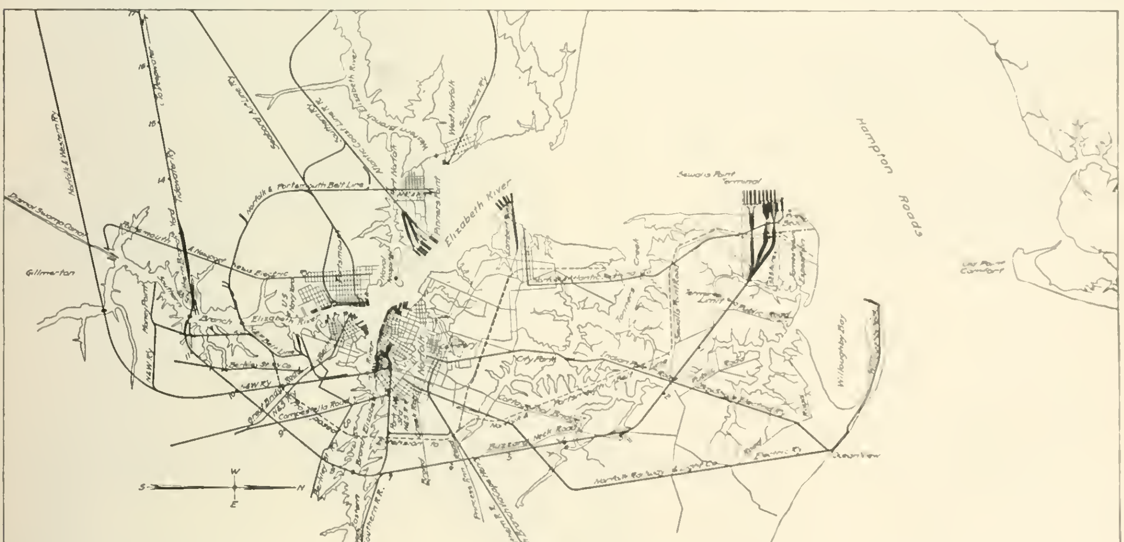
With the design adopted the only flexibility required is in the adjustment of the foundations to the soil upon which they stand, and the same holds true of those for turntables. In that for the 80-ft. table, which is the size adopted, the engraving shows the center arranged to be carried on piles, and these are ordinarily calculated to carry 15 tons. The concrete is of the 1-3-6 proportion as in the case of the water tank piers, and is reinforced with 1-in. square rods spaced on 12-in. centers and in two rows which are 3 in. apart horizontally; the lower rows being 6 in. above the tops of the piles when these are used and projected 12 in. into the concrete.

When piles are not used the lower row of reinforcing is placed 6 in. above the bottom of the concrete, and when the concrete is carried down to a rock foundation the reinforcement is omitted. The foundation is finished with a cap of richer concrete of the C class or 1-2-2 mixture 18 in. thick, upon which the base of the center is to rest.

In the matter of signals the final decision has not yet been reached as to what will be done all along the line, except that it is probable that some system will be adopted whereby a space interval can be maintained between trains. Meantime the details of the signal posts and semaphores have been worked out in accordance with standard practice, being identical with that adopted on the New York Central lines.

In working out these standards allowance had to be made in some cases for the variations in the laws of the two states through which the road runs. These usually make themselves felt in minor details but are of sufficient importance from a legal standpoint to make themselves felt. For example in the case of crossing signs. In Virginia the simple wording "Railroad Crossing" suffices, but in West Virginia there must be added to this the words "Look Out for the Locomotive."

From what has been said in this and previous articles it will be seen that thoroughness in all of the details that go to make up the sum of the construction of the road from the preliminary surveys to the construction of the buildings and tracks has been the watchword of the management throughout.



Map of Norfolk, Va., Showing Railroad Connections and Terminals.

It now remains to say a few words regarding the terminal facilities at the coast. It will be remembered that this road is built with the intention of building up a traffic that does not yet exist and of developing coal properties that have not yet been fully opened.

Further, as there is no market for this coal along the line of the road and the outlet to the west is restricted, it is evident that the seaboard must be the destination of practically all of the traffic that will originate along the line, and that provision must be made to handle it in a coastwise traffic. For this reason no attempt has been made to enter Norfolk over its own lines, but on the other hand, a wide detour carries the line well beyond the limits of the city and around to the north of the same to the terminal at Sewall's Point. Before reaching the Elizabeth river it runs parallel to the Norfolk & Western, but about two miles to the north, thus skirting the Dismal swamp. A yard will be located on the west bank of this southern branch of the Elizabeth river at the point of crossing of the Portsmouth & Newport News Electric Railway, beyond which it crosses all of the roads centering in Norfolk and then runs down on the sand spit that forms Cape Henry and so reaches Sewall's Point. This point is opposite Old Point Comfort and borders the deepwater of Hampton Roads, but is still sufficiently sheltered to make it possible for vessels to lie securely at the wharves that will be built, without experiencing any inconvenience from the seas that may roll in from the capes outside.

The terminal property as acquired by the railroad was a barren stretch of sand, and on this the heavy wharves and coal handling apparatus will be built. Soundings have been made to determine the qualities of the underlying ground and it is probable that the methods of transferring the lading from the cars to the steamships will be similar to that used upon the lakes, where the cars are lifted and dumped into the hold or weighing hoppers direct without the use of the conveyors or hoists that usually accompany coal-handling plants. It is thought that these car dumps can be made of greater capacity and can handle a large tonnage more expeditiously and economically than a trestle and incline, and for that reason it is probable that they will be adopted. The road will thus be a further exemplification of the predominance of the progressive ideas which it has been shown have controlled every step in its construction from its first inception to the completion of those facilities that will play so important a part in the delivery of its traffic to the markets of the country.

Symmetrical Masonry Arches.

UNIT LOADS AND COEFFICIENTS.

BY MALVERD A. HOWE.

The application of formulas based upon the elastic theory leads, necessarily, to approximate results unless the moments of inertia at all sections of the ring and the curve of the axis are such that the expressions for the horizontal thrust, bending moments at the supports, etc., can be integrated.

In the case of masonry arches it is seldom that the integration can be performed. Summation formulas, however, can be used. These simply mean that the moment of inertia is assumed constant for a finite length of the arch axis and that for this length the axis is a straight line. It is evident then that the shorter the length assumed as straight the more nearly will the results approach the true values.

In applying the summation formulas the method of procedure is as follows. (See Fig. 1.) The span is divided into equal parts ($n = 20$ will be sufficiently close for most cases) and each part is bisected. At these points the values of the co-ordinates x and y of the arch axis are either computed or scaled from a carefully made drawing. The moments of inertia I of the sections of the arch ring at the points for which x and y have been determined, are next computed, and then the lengths δs of the arch axis for each equal division of the span determined.

Let $\Delta = \delta s \div I$, then if H_1 represents the horizontal thrust at the supports, for vertical loads

$$2 H_1 = \frac{\Sigma m_x \Delta \left(y - \frac{\Sigma y \Delta}{\Sigma \Delta}\right)}{\Sigma y \Delta \left(y - \frac{\Sigma y \Delta}{\Sigma \Delta}\right)} = \frac{\Sigma m_x B}{D} \quad \ldots\ldots\ldots (A)$$

in which m_x is the common moment for the given loading plus an equal and symmetrically placed load on a beam supported at the ends.

In a previous* article it was shown for two arch rings having spans of L and 40 and rises of f and 1 respectively, that when the ordinates $y_1 : y_1' = y_2 : y_2' = y_n : y_n' = f$ (f' = unity) and $\Delta_1 : \Delta_1' = \Delta_2 : \Delta_2' = \Delta_0 : \Delta_0'$ (Δ_0' = unity)

$$H_1 : H_1' = \frac{L}{40 f} : 1 \text{ or } H_1 = \frac{L}{40 f} H_1'$$

Now if $n = 20$ and $\delta x = L \div 20$, then $\frac{L}{40} = \frac{\delta x}{2}$ and $H_1 = \frac{\delta x}{2 f} H_1'$ also $H_1' = \frac{2 f}{\delta x} H_1$.

Supposing that formula (A) has been solved for a unit load at each point of division respectively, then the values of H' for each load are readily found by simple multiplication. In a like manner the expressions for the moments at the supports become $M_1 = \frac{\delta x}{2} M_1'$ and $M_2' = \frac{\delta x}{2} M_2$. The vertical reactions remain the same regardless of changes in L and f.

Table A contains a complete set of coefficients which were based upon an arch having a span of 100 ft. and a rise of 16.67 ft. The depth of the ring at the crown and the springing being in the ratio of about 1 to 2.

Columns 1 and 2 of Table A contain the coefficients which must be satisfied by each arch ring to which the coefficients in the remaining columns apply. That is, each y for the axis must bear the ratio to the rise f of the axis as the coefficient in column 1 bears to unity, and each value of $\Delta = \delta s \div I$ must bear the relation to Δ_{10} that the coefficient in column 2 bears to unity. The use of the coefficients in Table A will become evident in the solution of a problem.

Assume that for some reason that the rise must be changed from 16.67 ft. to 12.5 ft. while the span remains unchanged or 100 ft.

In Table B, column 1 gives the new values of $y = 12.5\ y'$. In Fig. 1 divide the span into 20 equal parts and, at the centers of these divisions, lay off the ordinates y and draw a curve through

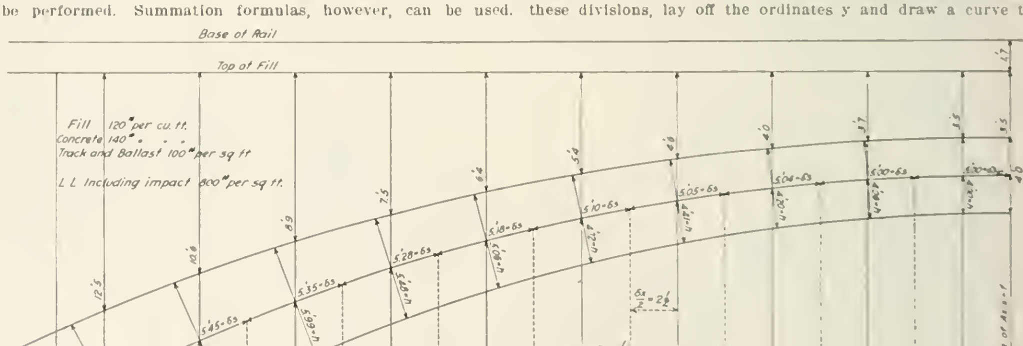


Fig 1.

the extremities. This will be the new arch axis. Then scale the values of δs and place the results in column 2 of Table B.

The next step will be the assumption of the depth of the arch ring at the crown, or for all practical purposes at the section numbered 10. This depth will depend upon the loading and the material composing the ring as well as the radius of curvature at the crown. Let it be assumed that the ring is to be composed of concrete and that the fill will be composed of gravel and about 3 ft. deep over the crown. The moving load will be assumed at 5,000 lbs. per foot of span with 100 per cent. impact. In other words, a single-track railroad bridge is the structure to be designed. The depth at the crown by various empirical formulas will be somewhere in the vicinity of 4 ft., and, as a little error now can be easily corrected later, the depth will be assumed as 4 ft. at the section numbered 10. A longitudinal slice of the bridge 1 ft. thick is assumed. Then $I_{10} =$

*Railroad Gazette, Aug. 20, 1907.

5.333 and $\Delta_{10} = \delta s_{10} \div I_{10} = 5.00 \div 5.33 = 0.938$, and hence $\Delta_n = 0.938\,\Delta_n'$. These values are given in column 3 of Table B.

Since $\Delta = \frac{\delta s}{I}$, $I = \frac{\delta s}{\Delta} = \frac{h^3}{12}$ $\therefore$ $h = \sqrt[3]{\frac{12\delta s}{\Delta}}$ for each point.

The values of h are given in column 4 of Table B.

Assuming that the fill weighs 120 lbs. per cubic foot, the rails, ties and ballast to be equivalent to 100 lbs. per square foot, and that the concrete in the ring weighs 140 lbs. per cubic foot, the dead load concentrated at each point becomes as shown in column 5 of Table B. The dimensions employed are shown in Fig. 1. In column 6 of Table B are given the values of H_1 for unit loads at points 1, 2, 3, etc., respectively. These coefficients multiplied by the actual loads at these points will give the values of H_1 as shown in column 7

The equilibrium polygon is now located since $\frac{M_1}{H_1} = y_1 = -0.55$ ft., or the polygon starts 0.55 ft. below the axis at the support. For convenience in drawing the equilibrium polygon, the moment at crown should be computed by the formula,

$$M_x = M_1 + V_1x - H_1y - \Sigma^x P(x - a)$$
$$\text{or } M_c = M_1 + \tfrac{1}{2}LV_1 - H_1f - \Sigma^{\frac{1}{2}L}P(\tfrac{1}{2}L - a)$$

In this case $M_c = -13{,}900$ and $y_c = \frac{-13{,}900}{124{,}500} = -0.11$ ft., or the polygon passes the crown 0.11 ft. below the axis. This polygon is shown on Fig. 2, one-half only being drawn as it is symmetrical. For convenience and accuracy in drawing the polygon, start at the support and at the crown and close at the quarter point.

Inspection shows that this polygon lies well within the middle

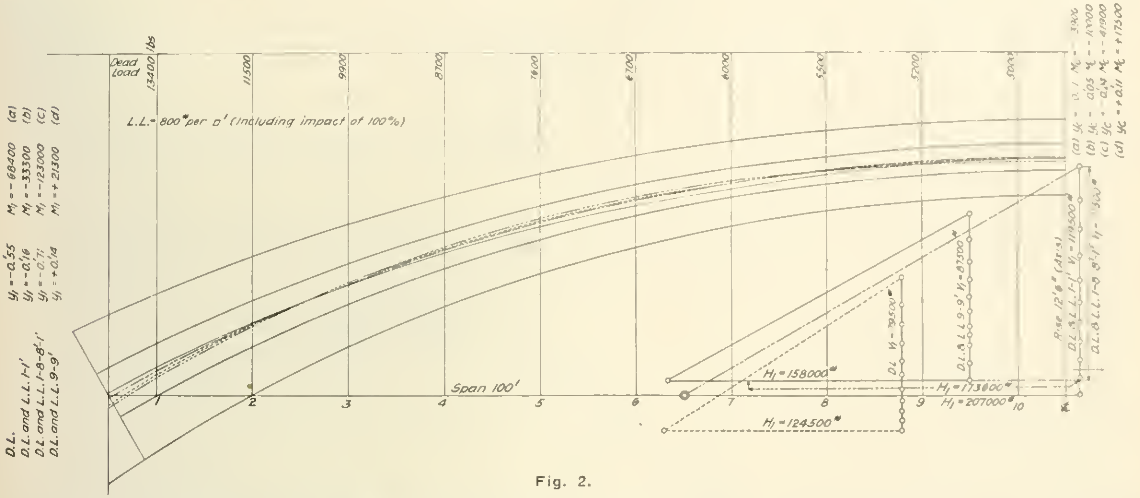


Fig. 2.

of Table B. The values of H_1 for the loads 1 to 10 is 62,230 lbs. and for the entire dead load this becomes $2 \times 62{,}230 = 124{,}500$ lbs. The vertical reactions V_1 and V_2 each equal one-half the entire dead load, or 79,500 lbs.

The computation of M_1 now follows: Since the coefficients M_1' are each multiplied by $\frac{\delta x}{2} = 2.5$ to obtain the values of M_1 for unit loads, this may be considered as a constant factor and introduced at the end of the calculation. In column 8 of Table B are given the sums of each pair of symmetrical values of H_1' as given in columns 5 and 6 of Table A. These multiplied by the dead load (column 9, Table B), and the sum multiplied by $\frac{\delta x}{2} = 2.5$ gives the value of M_1 and M_2 for the total dead load, or $M_1 = M_2 = -27{,}359 \times 2.5 = -68{,}400$ lbs. feet.

third of the ring and that the maximum compression is very much below the safe strength of the concrete.

The live load will now be considered. Let this be 800 lbs. per square foot or $5 \times 800 = 4{,}000$ lbs. per division.

Table A, column 11, shows the fields of loading which produce maximum moments. (Approx.)

Live Load 1 to 8.

$H_1 = \frac{L}{40f}H_1' = 0.2\ H_1'$ or $H_1 = 0.2 \times 30.668 \times 4{,}000 = 24{,}500$ lbs.

$M_1 = \frac{\delta x}{2}\ M_1' = 2.5\ M_1'$ or $M_1 = -18.819 \times 2.5 \times 4{,}000 = -188{,}200$ lbs.-ft.

$V_1 = 7.203 \times 4{,}000 = 28{,}800$ lbs.

$V_2 = 32{,}000 - 28{,}800 = 3{,}200$ lbs.

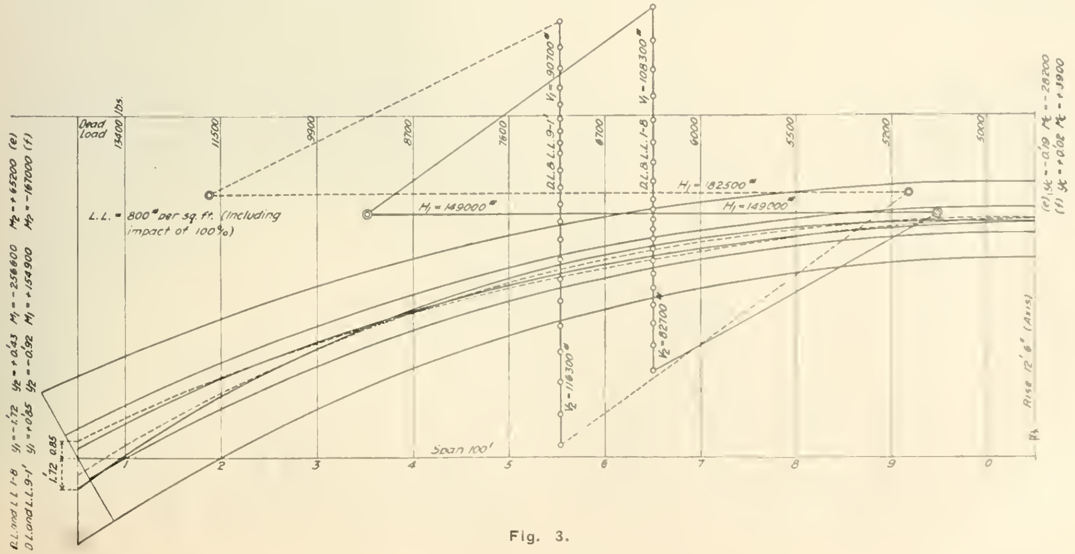


Fig. 3.

$M_c = +13.360 \times 2.5 \times 1{,}000 = +133{,}600$ lbs.-ft.
$M_2 = -14{,}200$ lbs.-ft.

Combining these values with those obtained for the dead load the following results obtain

Dead Load and Live Load 1 to 8.

M_1	D. L.	= 68,100 lbs.-ft.	M_c	D. L.	= −68,100 lbs.-ft.
	L. L.	= 188,200 "		L. L.	= +133,600 "
	D. L. + L. L.	= 256,600 lbs.-ft.		D. L. + L. L.	= +65,200 lbs.-ft.
H_1	D. L.	= 124,500 lbs.-ft.	M_2	D. L.	= −13,900 lbs.-ft.
	L. L.	= 24,500 "		L. L.	= −14,200 "
	D. L. + L. L.	= 149,000 lbs.-ft.		D. L. + L. L.	= −28,200 lbs.-ft.
V_1	D. L.	= 79,500 lbs.-ft.	V_2	D. L.	= 79,500 lbs.-ft.
	L. L.	= 28,800 "		L. L.	= 3,200 "
	D. L. + L. L.	= 108,300 lbs.-ft.		D. L. + L. L.	= 82,700 lbs.-ft.

$$y_1 = \frac{256{,}600}{149{,}000} = 1.72 \text{ ft.} \qquad y_c = \frac{-28{,}200}{149{,}000} = -0.19 \text{ ft.}$$

$$y_2 = \frac{+65{,}000}{149{,}000} = 0.43 \text{ ft.}$$

In like manner each set of loadings is considered. Any other field can be taken by simply adding the values of H_1, M_1', V_1, etc., in Table A corresponding to the loading used.

The moment at the support is

$$M_1 = H_a \frac{\Sigma y \Delta}{\Sigma \Delta} = H_a Y' f = 0.817 (12.5) H_a = (10.21) H_a \text{ (see Table A).}$$

By a brief calculation it becomes evident that the concrete will be subjected to tensile stresses greater than its safe strength when the axial thrust is considered without taking into account the effect of a drop in temperature, hence it becomes necessary to either reinforce the rib with steel or increase its depth. Assuming that the latter is not feasible the rib will be reinforced with steel.

Let $E_c = 1{,}500{,}000$ lbs. per square inch and $E_s = 30{,}000{,}000$ lbs. per square inch, then $\frac{E_s}{E_c} = 20$ and each square inch of steel is equivalent to 20 square inches of concrete.

Let 1 per cent. of the area at the crown be assumed as steel, or 0.8 of a square foot of equivalent concrete, and place the center of the steel 0.25 ft. from the outside of the concrete. The effective area is now $4.0 + 0.8 = 4.8$ sq. ft. $= F$ at the crown, and practically at section number 10.

I = the moment of inertia = 7.78 and the section modulus $S = 3.89$.

Since the values of Δ must always remain in the relative magnitudes shown in column 2 of Table A, if the moment of inertia is

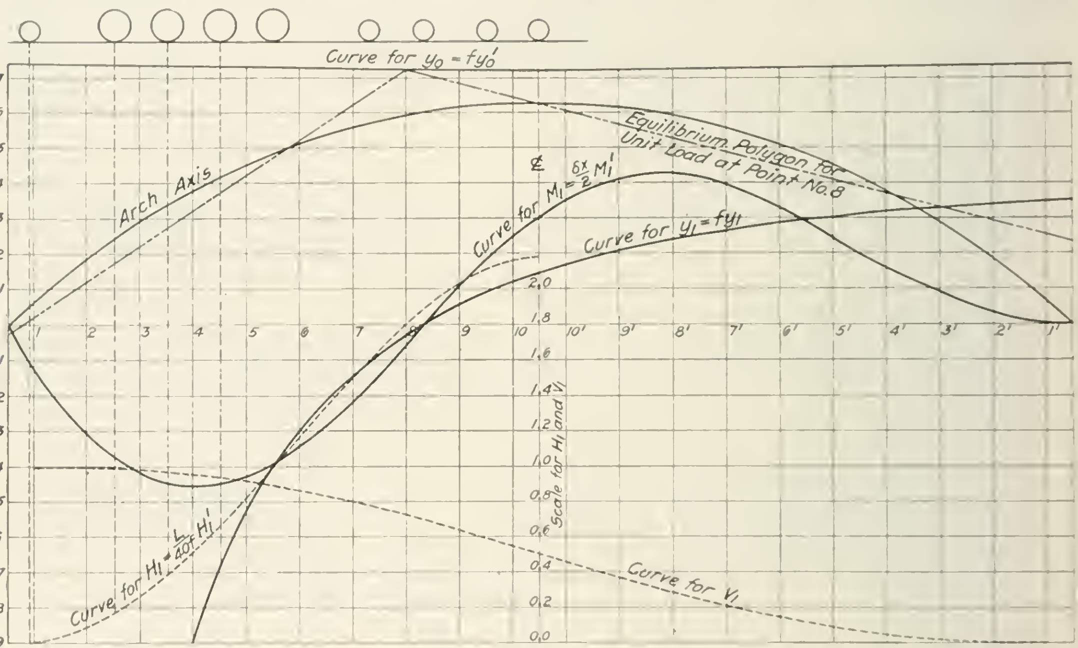


Fig. 4.

increased at any section, the moment of inertia at each other section must be increased in like proportion.

At the crown the original I was 5.33 and $7.78 \div 5.33 = 1.46$, or each section must have its I increased 46 per cent.

For example take section number 1. The original I was 32.68, and adding 46 per cent. to this I becomes 47.72, then

$$\frac{h^3}{12} + 0.8\left(\frac{h}{2} - 0.5\right)^2 = 47.72 \text{ or } h = 7.65 \text{ ft. (nearly).}$$

The effective area is $7.65 + 0.80 = 8.45$ and the section modulus is 12.42.

In like manner the proper depths of the arch ring at other sections can be determined.

It is not feasible or necessary in this article to compute the fiber stresses for all loads at all points. The method is identical in each case so one example only will be given. Point number 1 will be selected and the fiber stress for the dead load, dead load axial thrust and a change of temperature of − 20 deg. be determined.

In Table C are given the values of H_1, M_1, etc., for the various loadings considered. Since the first four sets are symmetrical, only one-half of each equilibrium polygon is drawn, as shown in Fig. 1. In the last two sets the loading is not symmetrical and hence the polygons must be constructed for the entire span. Proceed as follows: Lay off y_1 and y_2 at the left support and y_c at the crown and construct both halves of the polygon on the left of the crown as shown in Fig. 3.

All of the above results are obtained with comparatively little labor and in a short time. As usually considered the arch rib, as shown in Fig. 1, would be passed as quite safe for the given loadings. But the effect of the axial thrust and temperature changes remain to be considered.

The effect of the axial thrust will be first taken up. The horizontal thrust is

$$H_a = H_1 \left\{ 1 - \frac{D}{D + \Sigma \frac{(\delta x)^2}{\delta s F}} \right\}$$

where

$D = D' f^2 \Delta_{10} = 0.589 f^2 \Delta_{10}$ or $D = 86.32$ (see Table A)

$\delta x = 5.0$ ft.

F = area of rib at section considered.

$\Sigma \frac{(\delta x)^2}{F \delta s} = 19.43$ ∴ $H_a = .18 H_1$ (nearly)

Point Number 1.

$F = 8.45$ sq. ft.	$S = 12.42$.	$\sin \Phi = 0.454$.
$\cos \Phi = 0.885$.	$y = 1.36$ ft.	$x = 2.5$ ft.

Dead Load.

The axial thrust $= N_x = H_1 \cos \Phi + V_1 \sin \Phi = 146{,}300$ lbs.
The moment $M_x = M_1 + V_1 x - H_1 y = -39{,}200$ lbs.-ft.

The fiber stress $p = \frac{N_x}{F} \pm \frac{M_x}{S} = \frac{146,300}{8.45} \pm \frac{-39,200}{12.42}$

Or the stress in the upper fiber = + 14,100 lbs., and the stress in the lower fiber = + 20,500 lbs.

Dead Load Axial Thrust.

Assume H_a = 1,000 lbs. and determine the fiber stresses. N_x = 1,000 (0.885) = 885 lbs. M_x = 1,000 (10.21 — 1.36) = 8,860 lbs.-ft.

$$p = \frac{-885}{8.45} \mp \frac{8860}{12.42}$$

Or, the stress in the upper fiber = — 818 lbs., and the stress in the lower fiber = + 609 lbs.

Then for H_a = 1 lb., these quantities become — 0.818 lbs. and + 0.609 lbs. respectively.

For the dead load H_a = 18 per cent. H_1 = 18 per cent. 124,500 = 22,400 lbs.

Therefore, the stress in the upper fiber = 22,400 × 0.818 = — 18,300 lbs., and the stress in the lower fiber = 22,400 × 0.609 = + 13,600 lbs.

Temperature change of ± 20°:

$$H_t = \frac{e\,t^\circ E\,L}{0.589\,f^2\,\Delta_{10}} = \frac{e\,t^\circ E\,L}{86.32} \qquad \begin{array}{l} e = 0.000006. \\ E = 1,500,000 \times 144 \text{ per sq. ft.} \\ L = 100 \text{ ft.} \\ t^\circ = 20^\circ. \end{array}$$

and H_t = 30,000 lbs.

Reducing this for the effect of the axial thrust
H = 82 per cent. 30,000 = 24,600 lbs.

The stress in the upper fiber = 24,600 × 0.818 = ± 20,100 lbs., and in the lower fiber 24,600 × 0.609 = ∓ 15,000 lbs.

In precisely the same manner any other loading can be considered or any other section of the arch ring examined.

Table D contains the fiber stresses for section number 1 and at the crown for various loadings. Exclusive of the temperature effect the maximum tension in the concrete is 12,700 lbs. per square foot, or a little less than 100 lbs. per square inch. The maximum compression is at point 1 and equals 52,800 lbs. per square foot, or about 370 lbs. per square inch. The stress in the steel is less than 20 × 370 = 7,400 lbs. per square inch.

If the temperature effect is considered, the maximum tension in the concrete is 38,500 lbs. per square foot, or about 270 lbs. per square inch, and in the steel less than 20 × 270 = 5,400 lbs. per square inch. The maximum compression, including the effect of temperature, is 67,800 lbs. per square foot, or about 470 lbs. per square inch, and in the steel, less than 20 × 470 = 9,400 lbs. per square inch.

In case the tension values are considered too large the arch ring can be made a little deeper.

The dead load was based upon a plain concrete ring which now has been increased in depth a maximum amount at the supports and not at all at the crown. At section number 1 the additional concrete increases the dead load about 150 lbs., which is of no practical importance when it is considered that the dead load assumed for this section was 13,400 lbs. Increasing the depth of the ring actually decreases the effect of the axial thrust and hence the values given in Table D are a little large. Since the stresses due to temperature changes include the axial thrust effect, the values given in Table D are a little small.

The above solution shows that the use of unit loads in determining the values of H_1, M_1, V_1, etc., for an arch ring, enables the designer to change at will the loads, the span and the rise of the arch as well as the depth of the ring with very little labor.

Although the loads have been assumed as concentrated at the points of division as being most convenient for determining H_1, M_1, V_1, etc., for unit loads, it is not at all necessary that the actual loading should be so arranged. The actual loading may be placed anywhere and the unit values of H_1, M_1, V_1, etc., are determined from a curve drawn with the computed values of these quantities based on unit loads placed at the points of division. (See Fig. 4.)

That the summation method is approximate must be conceded by all, but it can be made a very close approximation. The largest errors in the values of H_1 lie near the supports where the actual values are small. For a parabolic arch computed by the integration method and the summation method the difference in the values of H_1 was 0.16 per cent. By the integration method the values of M_1 were — 63.004 and + 62.936, and by the summation method — 62.510 and 61.940.

TABLE B.

Point No.	1. $y = f\,y'$ or $12.5\,y'$	2. ds Scaled from Fig. 1.	3. $\Delta = \Delta'\Delta_{10}$ or $0.938\,\Delta'$	4. $h = \frac{12\,ds}{\Delta}$	5. D. L. Dead Load W.	6. H_1 or $\frac{L}{40f}H'$ or $0.2\,H'$	7. $W H_1$	8. Symmetrical values of M_1 combined M	9. W M
	ft.	ft.		ft.	lbs.	unit lds.			
1.	1.36	5.65	0.173	7.32	13,400	0.0000	0,000	1.000	—13,400
2.	3.77	5.45	0.225	6.62	11,500	0.0886	1,019	2.214	—25,461
3.	5.82	5.35	0.298	5.99	9,900	0.2610	2,584	2.660	—26,334
4.	7.56	5.28	0.384	5.48	8,700	0.5094	4,432	2.378	—20,689
5.	9.03	5.18	0.480	5.06	7,600	0.8170	6,209	1.473	—11,195
6.	10.20	5.10	0.588	4.72	6,700	1.1574	7,755	0.127	—851
7.	11.13	5.05	0.709	4.41	6,000	1.4982	8,989	1.436	8,616
8.	11.81	5.04	0.819	4.20	5,500	1.8020	9,911	2.956	16,258
9.	12.26	5.00	0.899	4.06	5,200	2.0304	10,558	4.158	21,622
10.	12.47	5.00	0.938	4.00	5,000	2.1526	10,763	4.815	24,075
							62.230		—97,930
									+ 70,571
									—27,359

TABLE C.

1.	(a)	(b)	(c)	(d)	(e)	(f)
1. Loading.	D. L.	D.L. and L.L., 1-1'.	D.L. and L.L. 1-8 & 8'-1'	D.L. and L. L. 9-9'	D.L. and L. L. 1-8	D.L. and L. L. 9-1
2. M_1	— 68,400	— 33,300	—122,990	+ 21,300	—256,600	151,900
3. M_2	— 68,400	— 33,300	—122,990	+ 21,300	+ 65,200	—167,000
4. H_1	124,500	207,000	173,600	158,000	149,000	182,500
5. V_1	79,500	119,500	111,500	87,500	108,300	90,700
6. V_2	79,500	119,500	111,500	87,500	82,700	116,300
7. M_c	— 13,900	— 10,000	— 41,900	+ 17,500	+ 28,200	+ 3,900
8. y_1	—0.55	—0.16	—0.71	+ 0.14	—1.72	+ 0.85
9. y_c	—0.11	—0.05	—0.24	+ 0.11	—0.19	+ 0.02
10. y_2	—0.55	—0.16	—0.71	+ 0.14	+ 0.43	—0.92

TABLE D.

1. Loading.	2. Point No. 1 Top fiber.	3. Point No. 1 Bottom fiber	4. Loading.	5. Crown Top fiber.	6. Crown Bottom fiber
D. L.	— 14,100	+ 29,400	D. L.	+ 22,400	+ 29,600
D. L. axial ...	—18,300	+ 22,700	Axial	+ 8,400	—17,800
Sum	— 4,200	+ 31,100	Sum	+ 30,800	+ 11,800
Temp. ± 20°..	± 20,100	∓ 15,000	Temp. ± 20°..	∓ 9,300	± 19,600
Total	—24,300	+ 49,100	Total	+ 40,100	— 7,800
D.L. & L.L. 1-8.	+ 6,200	36,600	D.L. & 1-8 & 8-1'	+ 25,300	+ 47,100
Do., axial	—21,900	+ 16,200	Axial	+ 11,800	—24,800
Sum	15,700	+ 52,800	Sum	+ 37,100	+ 22,300
Temp. ± 20°..	± 20,100	∓ 15,000	Temp. ± 20°..	∓ 9,300	± 19,600
Total	—38,500	+ 67,800	Total	+ 46,400	+ 41,900
D.L. & 1-1'...	+ 26,800	+ 29,400	D. L. & 9-9'...	+ 37,500	+ 28,500
Axial	—20,500	+ 22,700	Axial	+ 10,700	—22,600
Sum.	— 3,700	+ 52,100	Sum	+ 48,200	+ 5,900
Temp. ± 20°..	± 20,100	∓ 15,000	Temp. ± 20°..	∓ 9,300	± 19,600
Total	—23,800	+ 67,100	Total	+ 57,500	13,700

NOTE.—All stresses are expressed in pounds per square foot. The + sign signifies compression.

TABLE A.

Point No.	1. $y = f\,y'$	2. $\Delta = \Delta_{10}\,\Delta'$	3. $H_1 = \frac{L}{40f}H_1'$	4. $M_1 = \frac{dx}{2}M_1'$	5. $M_2 = \frac{dx}{2}M_2'$	6. $V_1 = V_1'$	7. $V_2 = V_2'$	8. $y_1 = f\,y_1'$	9. $y_2 = f\,y_2'$	10. $y_0 = f\,y_0'$	11. Points loaded (inclusive).	12. $H_1 = \frac{L}{40f}H_1'$	13. $M_1 = \frac{dx}{2}M_1'$	14. $M_2 = \frac{dx}{2}M_2'$	15. $V_1 = V_1'$
	y'	Δ'	H'	M_1'	M_2'	V_1	V_2	y_1'	y_2'	y_0'		H_1'	M_1'	M_2'	V_1
1.	0.1086	0.1840	0.000	—1.000	0.000	1.000	0.000	.....	.....	.....	....	......	......	......	......
2.	0.3012	0.2395	0.443	—2.455	0.241	0.992	0.008	—5.967	0.538	1.186	1-8	30.668	—18.819	+ 13.360	7.2[illegible]
3.	0.4656	0.3180	1.305	—3.347	0.687	0.976	0.024	—2.719	0.522	1.178	9-1	72.498	+ 22.3[illegible]3	— 9.846	2.797
4.	0.6048	0.4087	2.547	—3.667	1.289	0.949	0.051	—1.530	0.502	1.168	1-8 and 8'-1'	61.336	— 5.459	— 5.459	8.[illegible]
5.	0.7224	0.5115	4.085	—3.443	1.970	0.910	0.090	—0.902	0.479	1.161	9-9'	41.830	+ 8.973	8.973	2.000
6.	0.8160	0.6266	5.787	—2.752	2.625	0.859	0.141	—0.513	0.451	1.157	1-1'	103.166	+ 3.514	+ 3.514	10.[illegible]
7.	0.8892	0.7564	7.491	—1.706	3.142	0.796	0.204	—0.251	0.418	1.151	1-10	51.583	—16.002	+ 19.516	8.386
8.	0.9444	0.8728	9.010	—0.450	3.406	0.721	0.279	—0.066	0.376	1.147	....	......	......	......	..
9.	0.9804	0.9580	10.152	0.838	3.320	0.637	0.363	0.072	0.324	1.146	....	......	......	......	..
10.	0.9972	1.0000	10.763	1.979	2.836	0.546	0.454	0.177	0.259	1.144	....	......	......	......	..
	......	......	51.583	.....	.....	.....	.....	.....	.....	.....	Each point with load, P = 1.				

D' = 0.5890. Y' = 0.817.

Rebuilding the Northern Pacific in Minnesota.

BY H. COLE ESTEP.

From Staples, Minn., to Fargo, N. Dak., a distance of 109 miles, the Northern Pacific is now engaged in one of the most important and interesting pieces of reconstruction work on the entire main line between St Paul and Portland This Minnesota work is distinguished both for its quantity and quality. It is the largest single continuous betterment now under way on the Northern Pacific system, and is at the same time the most thorough and complete. While the engineering problems encountered lack some of the spectacular features of mountain work, they are much more difficult and interesting by virtue of their very subtlety.

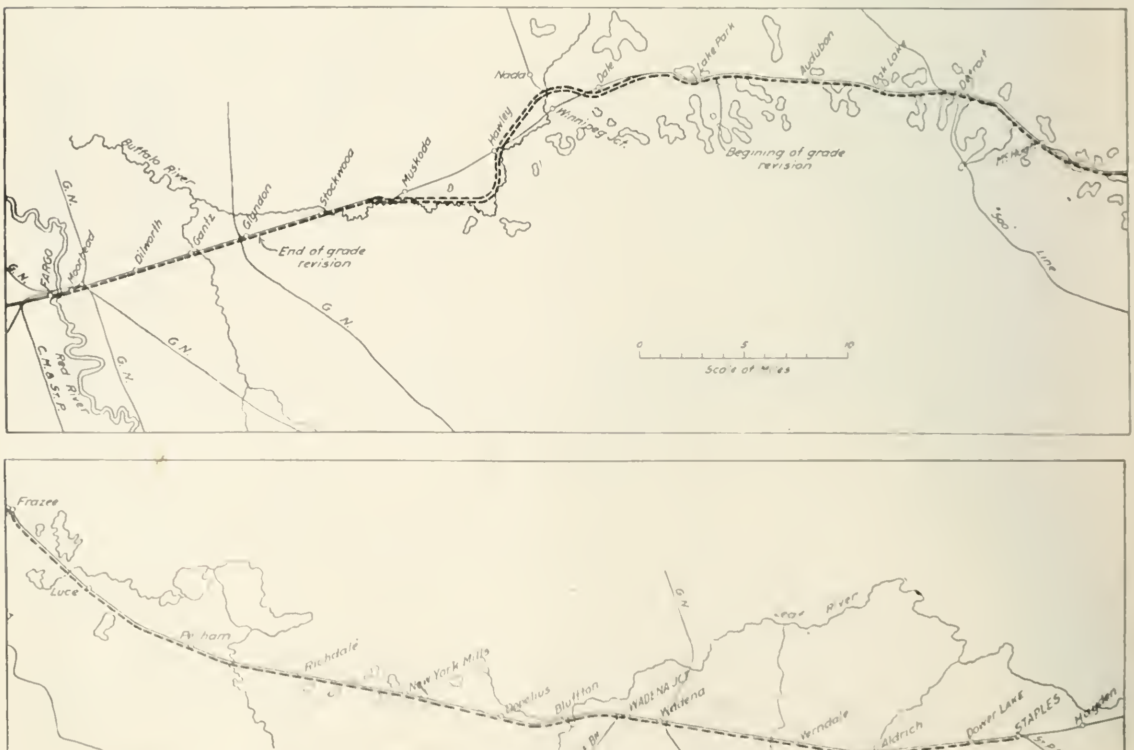
The improvements include double tracking, reballasting, reduction of grades and modifications of alinement throughout the whole of the 109 miles from Staples to Fargo. Some of the simple double-tracking and reballasting was done in 1903 and 1904. The heavier reconstruction work between Wadena and Glyndon was commenced during the spring of 1906. All of that between Wadena and Lake Park, 54.1 miles, is now practically completed; about one-fifth of the work on the 25 miles from Lake Park, Minn., west to Glyndon, remains to be finished this spring.

At Staples the main line from Duluth joins the line from St. Paul and Minneapolis. As a result this division between Staples and Fargo bears the densest traffic of any similar stretch on the Northern Pacific system. It not only carries the normally heavy main line freight and passenger travel, but in addition, every autumn must take care of all the eastbound grain and live stock coming from Montana and North Dakota, as well as the westbound coal and supplies going into the same district. Between Lake Park and Hawley on the old line there was a heavy pusher grade against both east and westbound traffic. It was to relieve the pressure on the single track due to the unusually dense traffic over this division and to eliminate the expensive, time-wasting pusher service between Lake Park and Hawley that the present improvements were undertaken.

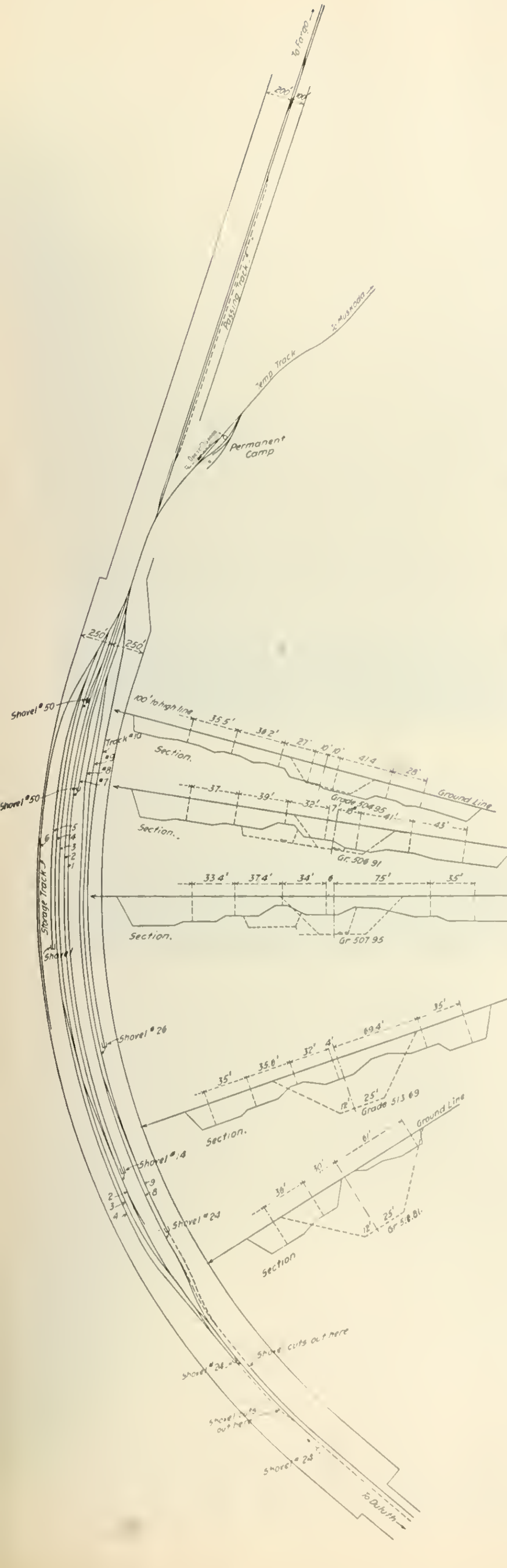
The work falls naturally into five sections, as follows: From Staples west to Dower Lake 2.8 miles, from Dower Lake to Wadena, 14.5 miles, from Wadena to Lake Park, 54.1 miles, from Lake Park to Glyndon, 27.6 miles, and from Glyndon to Fargo, 9.9 miles.

View Showing Fill, Temporary Trestle, and Old Main Line.

In 1903 the first section, 2.8 miles between Staples and Dower Lake, was double-tracked and reballasted without change of grade or alinement. Similar improvements were made on the second section, 14.5 miles between Dower Lake and Wadena, in 1904.



General Location; Northern Pacific Grade Revision and Second Track Work.



Steam Shovel Operations in Big Cut; Northern Pacific.

The third section, 54.1 miles between Wadena and Lake Park, contains aside from the usual double-tracking and reballasting, grade revisions of importance and one notable line change. Before the improvements on this section were made there was a 0.4 per cent. virtual grade east and westbound. This has been lowered to 0.3 per cent. actual east and westbound; the total rise and fall has been reduced 176 ft., while the total curvature has been cut down 130 deg.; 1,800,000 cu. yds. of material were required for the improvements. The work was commenced in April, 1906, was suspended during the winter of 1906-07, resumed in the spring of 1907, and is now practically finished.

The one line change occurs near McHugh, Minn. 40 miles west of Wadena. It is one mile in length. As is seen from the accompanying map, the old line was carried northward following the arc of a circle around the contour of the hills, and thus avoiding the heavy cut and fill necessary on the new location, which goes directly across the hills. The new line contains a 2,000-ft. fill averaging 50 ft. in height, and a cut 2,500 ft. long, approximately 30 ft. deep. By virtue of this line change a heavy grade is reduced, the main line is shortened and the soft, uncertain foundation upon which the old grade was built is replaced by firm, unyielding construction.

The fact that in a thorough revision of the 54.1 miles comprising this section of the work only one line change was required to bring the new double-track road fully up to the requirements of today is highly complimentary to the ability and foresight of the engineers who originally located this division. It is not often that we find an old road so located as to combine the low first cost which was necessary in the first instance, with the possibility of economical revision to meet the requirements of later and more prosperous days. The task confronting the original locating engineers can be better appreciated when we consider the topography of the region through which the road is built. This territory—known as the lake park region of Minnesota—is strewn with innumerable sheets of water varying in size from mere ponds to lakes 15 or 20 miles in length. Separating these bodies of water are rolling hills from 20 to 100 ft. in height, while various chains of ponds and lakes are connected by creeks and small rivers.

We have here the old problem of choosing the best of the several possible routes which lie in a lightly rolling country, complicated by the presence of the lakes. The large ones must be skirted, while the small ponds are often too soft to fill economically. This results in a strong tendency to locate a very crooked line in order to avoid heavy and expensive cuts and fills. The original engineers, however, seeing into the future, located a comparatively straight line in spite of the lakes, and attained the requisite economy of construction by introducing rather heavy grades.

The problem of revising and modernizing this line was comparatively simple. All that was necessary was to cut down the humps and with the material so obtained fill in the sags. The economy of this is patent. Where a radical revision is necessary, interest must be paid on the cost of an entirely new road, including new right-of-way, and also on the cost of the old road and right-of-way which is abandoned. In this case the company had only to finance the cost of the second main track and of the work required to bring the old construction into line with present day requirements.

The fourth section of the work comprises 27.6 miles between Lake Park and Glyndon, Minn. Here we find the heaviest construction and most daring engineering of any piece of railroad in the state of Minnesota. For a prairie country, the new work on this 27.6 miles is in every sense spectacular.

At Winnipeg Junction, seven miles west of Lake Park, is the Buffalo river, which is the controlling feature of the situation. The old line, in order to cross this valley, contained grades of 0.9 per cent. against eastbound, and 0.75 per cent. against westbound traffic. Expensive pusher service had to be maintained between Stockwood and Hawley, 11 miles, in order to assist heavy freight trains over these hills. The exigencies of the situation demanded a complete relocation of this section, which resulted briefly as follows: Increase in distance, 2.3 miles; increase in total curvature, 120 degs.; reduction of east and westbound grades respectively to 0.3 and 0.01 per cent. The resultant reduction in operating expenses will fully justify the heavy expense incurred by this relocation.

To complete the improvement 5,850,000 cu. yds. of material, mostly earth, must be removed. Of this total, 4,750,000 yds. have been moved to date, leaving 1,100,000 yds. to future operations. The work was commenced in May, 1906, was suspended during the winter of 1906-07, resumed in March, 1907, and is again suspended on account of winter weather. West of Hawley, both the engineering and the construction work is being done by the railroad company.

The new line is a succession of heavy cuts and fills. Cuts from 1,800 to 2,500 ft. long, 35 to 40 ft. deep, and containing 150,000 to 280,000 cu. yds. alternate with fills of equal length, height and bulk. The channel of the Buffalo river has been changed and the river is now crossed on a pile trestle 45 ft. high. At several points the new line crosses over the old, which was kept open by timber bulkheads, a temporary pile bridge spanning the gap in the new embankment.

The largest cut on the work is located near mile post 238, between Muskoda and Hawley. It is 7,000 ft. long with an average depth of 45 ft. This cut is followed by a stupendous fill 50 ft. high at its maximum and 31,000 ft. long. The cut, which also served as a borrow pit, was excavated by steam shovels in standard American fashion. The accompanying plan and sections of this cut show the general scheme employed in operating the shovels. The extra wide section to which the cut was excavated was adopted so that there would be no snow blockades at this point, even in the worst Minnesota blizzards.

In making the big fill a pile trestle 25,000 ft. long, consisting of four pile bents spaced 15 ft. apart, was built. The material from the steam shovels in the cut was loaded on trains of flat cars, which were pushed out on the trestle and unloaded with a ballast plow. In this way very low unit costs were obtained. The culverts under the big fill are all of permanent construction, the larger ones being monolithic reinforced concrete arches.

From Glyndon to Fargo, the last section of the work under consideration, the improvements consisted simply in reballasting and laying the second track without change of grade or alinement. The work between Glyndon and Moorhead was finished in 1906, that between Moorhead and Fargo the year previous. The bridge across the Red river at this point is a single-track structure protected by automatic block signals.

It will not be amiss to emphasize again that the chief reason why this work has been carried out with economic success is that the division, taken as a whole, was so located originally that permanent and effective betterments could be made at a minimum of expense. To get a clear understanding of the matter the previous betterment work that has been done on this district should be known.

Temporary Trestle Nearly Five Miles Long; Northern Pacific Grade Revision.

Originally the road was built from Staples to Fargo with 1 per cent. ruling grades. In 1897, by an expenditure of $217,000, the district was so revised that the grades were reduced to 0.4 per cent. virtual, leaving, however, 20 miles of eastbound pusher grade near Hawley. At that time more expensive improvements were not economically advisable, but all of the work was done with a view to future permanent revision.

In 1906 traffic had grown to such large proportions that the construction of a second main track became an absolute necessity. This track could not be laid alongside the old one, but had to be properly and permanently located, fulfilling the demands of the present and anticipating those of the future. Ultimate economy was the aim.

The Northern Pacific is not only stronger financially by reason of this betterment, but is also owner of what is undoubtedly the finest stretch of railroad in the state of Minnesota. The new line, indeed, compares equally with the best modern construction on the trunk line systems of the east; a fact which is pregnantly suggestive of the true status of western ideals in railroad construction and of the firm, solid character of the prosperity of the great empire lying west and north of the Mississippi and Missouri valleys.

The construction work which was done directly by the company was carried out under the supervision of S. A. McCoy, Assistant Engineer. W. L. Darling, Chief Engineer, is responsible for the general design and execution of the entire project.

The writer wishes to acknowledge his indebtedness to the Northern Pacific Railway Company for the data, maps, etc., which accompany the article, and also to acknowledge the personal courtesy and assistance of Howard Elliott, President of the Northern Pacific, W. L. Darling, Chief Engineer, and S. A. Bratager, Principal Assistant Engineer.

The Proposed Elimination of Grade Crossings at Worcester, Mass.

BY CHARLES B. BREED,
Associate Mem. Am. Soc. C. E.

Although the state of Massachusetts was the first to undertake, in a systematic manner, the abolition of grade crossings, this has sometimes been accomplished with such deliberation that the progress of the work has not been as rapid in Massachusetts as in some other states. There has been more than one reason for delay in the advancement of this work in Massachusetts. In the first place, the grade crossing statute of 1890, together with its subsequent amendments, provides that the apportionment of cost shall be divided as follows: The steam railroad shall pay 65 per cent., the municipality not over 10 per cent., and the remainder shall be apportioned between the state and the street railway companies which may be operating in the streets where grade crossings occur, and which are benefited by their elimination. With this fixed apportionment of costs, it is evident that the interested parties, in their overzealousness for certain advantageous features of design or construction may delay the settlement of the whole matter for an unreasonable length of time. Furthermore, it always takes considerable time to awaken public interest in these important matters, so that it frequently happens that the municipality does not realize what its needs and desires are until the hearings relative to the grade crossings have been well under way. The whole proceeding is one of education for the municipal authorities, who, as a rule, are dealing with this important problem for the first time. The railroads, on the other hand, are thoroughly familiar with such matters and frequently their preliminary studies of any particular situation have been made several years in advance of the city's designs.

The city of Worcester, in the early stages of the grade crossing discussions, furnished a good example of lack of preparation and familiarity with the problem. The earliest commission to consider the grade crossing problem in Worcester, appointed by the Superior Court in 1890, reported on the elimination of the crossing at Grafton street only, and recommended that the railroad should be elevated 2 ft. and the street depressed 13 ft. The city then appointed a commission of three civil engineers, including the city engineer, who, after making an exhaustive study of the problem, reported on five different methods of abolishing the crossings and recommended the adoption of a plan for elevating the railroad and depressing the streets a small amount. Later, a commission, composed of 12 citizens, considered the whole subject and reported favorably on track elevation. Several Acts, presented by the city of Worcester, passed the state legislature and delayed the settlement of these questions until finally, in 1900, another special grade crossing commission was appointed by the Superior Court under the statute of 1890. The report of this commission has recently been made a decree by the court. After nearly 17 years of study and discussion the matter has finally been decided and the work, which will be briefly described hereafter, will probably be started next spring.

The city of Worcester is located about in the middle of the state, where the topography is somewhat rolling. The northerly portion of the city is quite hilly, that district being given up almost entirely to residences. In the southerly and easterly portions are the railroads, located through rolling country, and adjacent to them are the manufacturing industries for which the city is noted.

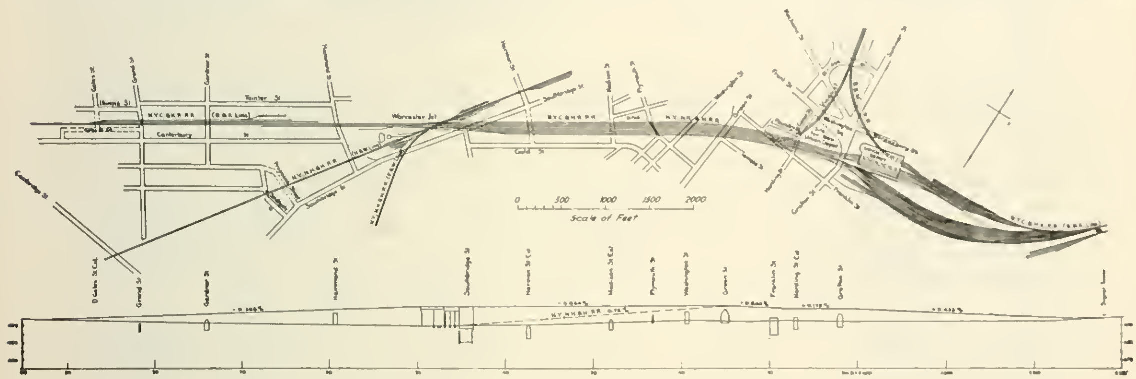
Referring to Fig. 1, it will be seen that the Boston & Albany division of the New York Central runs in a general east and west direction. At the present time the Norwich & Worcester and the Providence & Worcester divisions of the New York, New Haven & Hartford run along parallel to and on the south side of the Boston & Albany from Worcester Junction to the Union Depot, the passenger traffic running into the station on the south side of the Boston & Albany tracks. The freight traffic of the New Haven, however, crosses the Boston & Albany at grade at Worcester Junction to reach the New Haven freight house, which is located on the north side of the Boston & Albany. Furthermore, all interchange of freight between the New Haven and the Boston & Maine is made by crossing the Boston & Albany at grade near Franklin street and by passing over the short location, called the "Viaduct," which is used at the present time for freight traffic only. The Boston & Maine joins the Boston & Albany at the Union Passenger Station. Its passenger trains run into the Union Station, crossing Summer street and Shrewsbury street at grade, and its freight traffic goes over the Viaduct and connects with the Boston & Albany or crosses it at grade to reach the New Haven road. The work which is to be undertaken is the elimination of these two railroad grade crossings at Worcester Junction and at the connection with the Viaduct, and it is proposed to abolish all the highway grade crossings on the Boston & Albany and two on the Norwich & Worcester, but those on the Boston & Maine have been left for future independent consideration. The remaining street crossings on the New York, New Haven & Hartford within the city limits already pass either over or under the railroad. There are also no grade crossings on the Viaduct, this connection having been originally so built as to pass above the streets. The proposed work also involves building a new union passenger station and the necessary connections with the New Haven tracks from the south side to the north side of the Boston & Albany road, the railroad grade crossing at the junction with the Viaduct is eliminated. On account of this feature it will be seen from the profile that it has been necessary to depress the Hermon street extension and Madison street extension considerably, so as to pass under the New Haven tracks.

From the Union Depot to Worcester Junction, two streets, Franklin and Southbridge, already pass under the railroad and the elevation of the tracks will evidently require no change in the grade of these streets. Grafton street will be depressed about 7 ft. and pass under the tracks, the railroad being supported on a masonry arch, the clear headroom above the street to be 16 ft.; this will be cut down slightly by trolley wire connections for electric car lines which occupy this thoroughfare. This arch is illustrated in Fig. 2.

To eliminate the grade crossings at Summer street and at Shrewsbury street, it was at first suggested that the passenger traffic of the Boston & Maine could be carried over the Viaduct and then switched back into the Union Depot. This objectionable feature of switching led to the suggestion that the new passenger station should be located between the Viaduct and Green street, but it was finally decided that the location, shown on Fig. 1, in the angle between the Viaduct and the Boston & Albany tracks would be serviceable for all three railroads.

The site for the new union passenger depot having been decided upon, it seemed advisable to continue Harding street, carrying it under the railroad so as to connect with Canal street, on the other side of the tracks. The railroad above this street is to be supported on a steel bridge with watertight floor and with provision for deadening the sound of passing trains.

Green street, a street of very heavy traffic, including two electric car tracks, is to be depressed only about 3 ft. The railroad, as at Grafton street, is to be supported on a masonry arch with a headroom of 16 ft., this clearance being measured from the crown of the street to the soffit of the arch.



General Layout of Worcester Grade Revision, and Profile of Boston & Albany Entrance.

Boston & Albany freight yard, which is to remain undisturbed in grade.

On the Boston & Albany this work will involve the elevation of two and a half miles of the two-track main line, a mile and a half of which will be raised to an average height of about 17 ft. above the present grade, while the "run-offs" at each end of the track elevation will require the remaining mile. Fig. 1 shows the plan and profile of this location. It will be seen that the maximum grade on this elevated portion of the road will be 0.540 per cent. for westbound traffic, and 0.398 per cent. for eastbound. Worcester is a division point. The ruling grades on the division from Boston to Worcester are, both westbound and eastbound, 0.57 per cent. For the division from Worcester to Springfield they are for westbound 0.97 per cent., and for eastbound 0.99 per cent. It is obvious, then, that the proposed railroad grades are well within the required limits. Throughout this entire elevation the railroad is to be on an earth embankment with side slopes, except for occasional side retaining walls, where the location is too narrow to admit of side slopes and where the adjacent property is too valuable to be purchased for slopes.

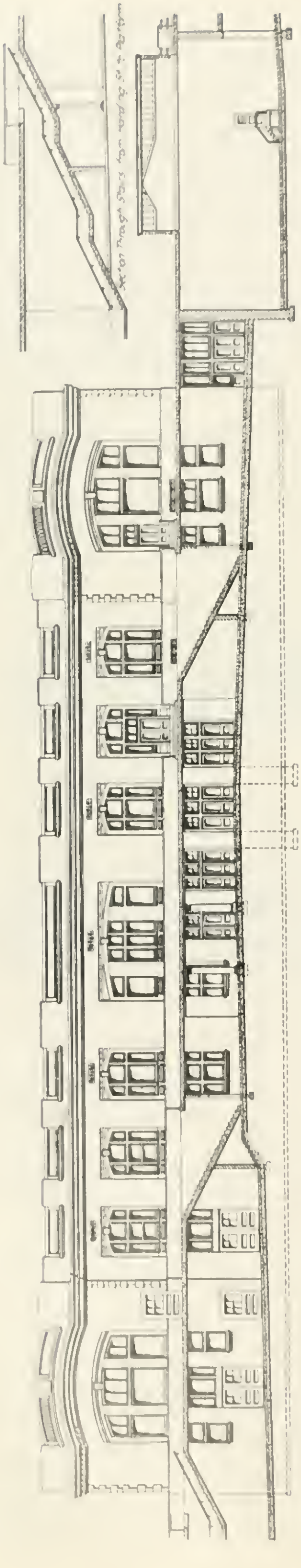
Beginning with Grafton street, which is located just west of the present Union Depot, the work is to be carried on jointly by the Boston & Albany and the New Haven to Worcester Junction, where the New Haven branches off toward the south. At this junction point the New Haven at the present time crosses the Boston & Albany at grade and it has been decided to eliminate this railroad grade crossing at the same time that the highway grade crossings are abolished. Beginning at this junction point, the New Haven tracks will pass under the Boston & Albany tracks with a clear headroom of 18 ft. and will ascend on an 0.72 per cent. grade toward the east on the north side of the Boston & Albany tracks (as shown in Fig. 1) until they meet the grade of the Boston & Albany tracks, about at the junction with the Viaduct. By relocating the New

Washington street will be depressed about 5 ft. and the railroad will be carried over the street by a solid floor steel bridge, the clear headroom to be 14 ft. At Plymouth street, where the present grades on the street are already steep, it has been deemed advisable to close the street to team travel, providing only a subway for pedestrians to pass under the railroad. This subway is to be 12 ft. wide and 10 ft. high, the outer walls to be of quarry-faced ashlar granite and the abutment walls to be of concrete, faced on the interior of the subway with white enamel bricks. The subway will be approached by stairs at either end, these stairs and the floor to be granolithic.

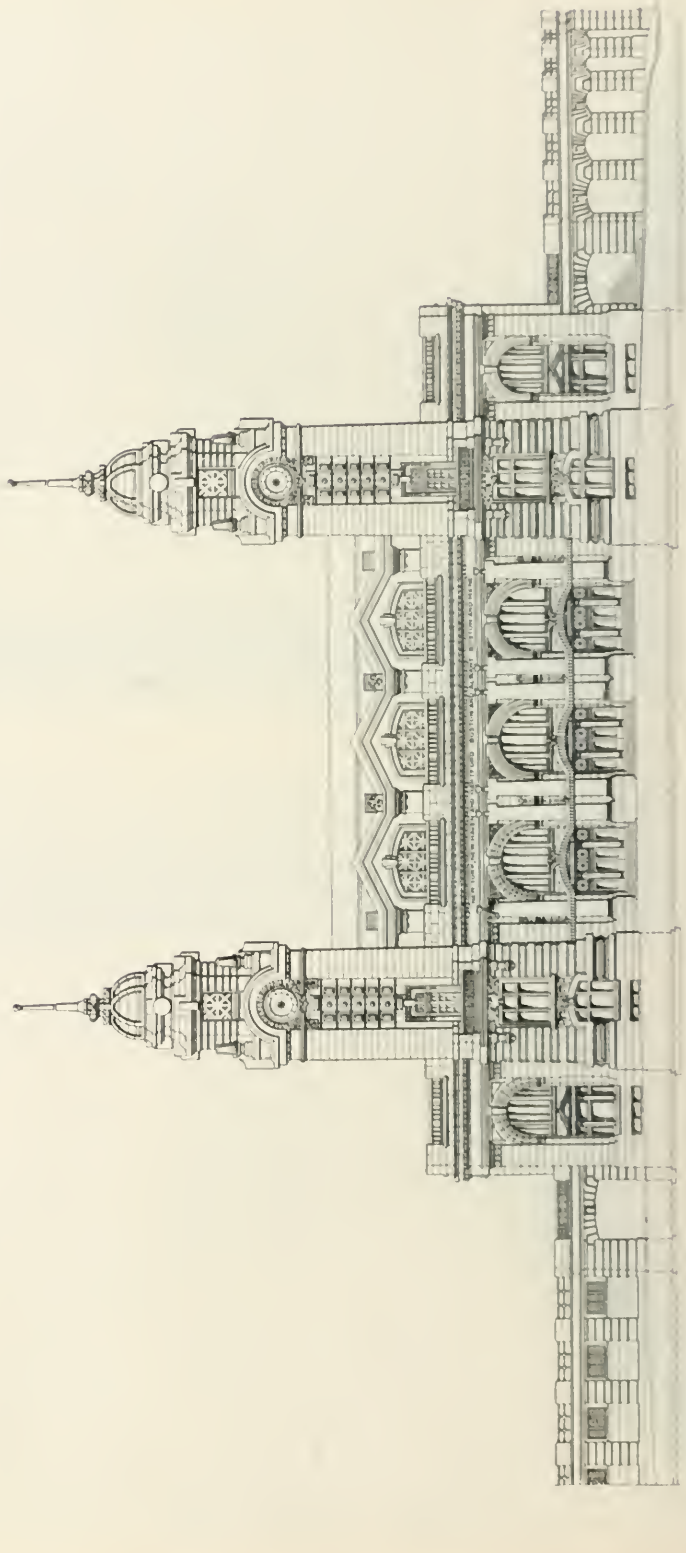
On account of the necessity of closing Plymouth street to carriage travel, Madison street, which does not now cross the railroad location, is to be extended and carried under the railroad by means of masonry arches whose headroom will be 14 ft. In a similar manner Hermon street is carried under the railroad with a headroom of 16 ft.

West of Worcester Junction there are but three grade crossings on the Boston & Albany, Hammond street, Gardner street and Grant street. At Hammond street it is proposed to leave the street at its present grade, and to carry the railroad above it by means of a solid floor steel bridge with a headroom of 13 ft. Gardner street is to be depressed about 11 ft., this heavy depression being necessary because the railroad grade has begun to fall rapidly so as to allow Gates street to be extended and to be carried above the tracks. At Gardner street a masonry arch with a clear headroom of 15 ft. will be constructed.

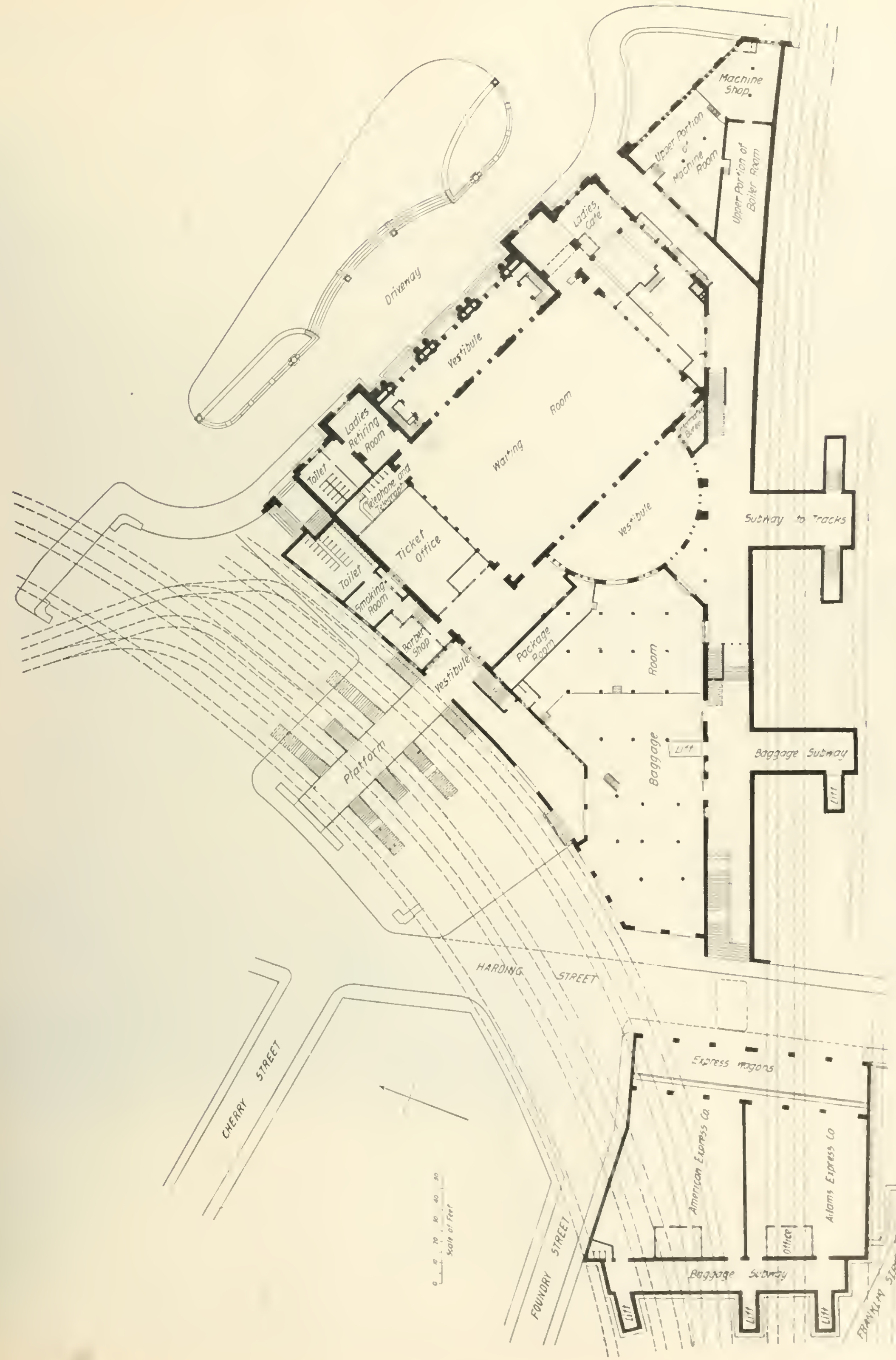
Grand street, which now crosses the railroad, will be closed to team travel; but a foot subway, slightly smaller but similar



Side Elevation and Section Through Subway; Proposed Worcester Station.



Front Elevation of Proposed Worcester Station.



Ground Plan of Proposed New Station at Worcester, Mass.

to that proposed for Plymouth street will be provided. In partial substitution for Grand street, an additional street, Gates street, which does not now cross the railroad, will be extended and carried above the railroad crossing of the Boston & Albany by means of a steel highway bridge having a clear headroom of 18 ft. above the rail. On the southerly side of the railroad location this new street will branch and run in both an easterly and westerly direction connecting with Grand street and Canterbury street, as shown in the plan of Fig. 1.

These changes in street grades will in several instances affect the grades of adjoining streets, the most extensive changes being on Illinois street, where it is made to conform to Gates street. The proposed street grades are in some instances large. On Washington street, for example, the grade will be 5.75 per cent.; on Madison, 5.50 per cent.; on Hammond, 7.86 per cent., and on Gates, 5.60 per cent. These somewhat steep grades on Washington and Hammond streets are practically no steeper than exist on these streets to-day and neither of them is occupied by street car tracks. The steepest grade to be introduced on thoroughfares where street cars are operated is on Green street, where there will be a short 2 per cent. grade.

In all cases where the streets are to be depressed or extended, the roadways are to be paved to conform to the rest of the street, sewers are to be relaid and strengthened, and gas and water pipes are to be lowered where necessary, the latter to have a cover of at least 5 ft. of earth. The sidewalks are to be at the same grade as the roadway in all instances and to be paved in most cases with granolithic.

On the Norwich & Worcester line, the grade crossings at two streets, Southgate and Cambridge street, are to be eliminated as a part of the entire project. The grade of the New Haven tracks from Worcester Junction to Southgate street will remain practically unchanged, the railroad passing over Hammond street as at the present time, and as the grade of the Providence & Worcester line is not to be changed, Southbridge street, which now passes under the railroad, will be unaffected.

Southgate street, in its present location, will be abandoned except that a footway will be carried under the tracks. A new street, however, is to be constructed just north of Southgate street so as to pass under the tracks by means of a masonry arch which will have a clear headroom of 14½ ft., the grades of approach being 6.25 per cent. on the west side and quite flat on the east side where it runs to a junction with Southbridge street.

In a southerly direction from Southgate street, the grade of the railroad is to be depressed by a 0.20 per cent. grade until Cambridge street is reached, where the tracks will then be about 11 ft. lower than at present. Cambridge street is to be raised about 10 ft. so as to pass over these tracks with a clear headroom of 18 ft. The street will be carried over the tracks by a steel highway bridge with wooden plank floor, the grades of approach on both sides being 5 per cent.

On account of the elevation of the Boston & Albany tracks at their junction with the Viaduct it will be necessary to raise the entire Viaduct, beginning at the point where it joins the Boston & Maine and ending with a raise of about 15 ft. where it joins the Boston & Albany tracks. This will impose an up-grade of 0.55 per cent. in the place of a down-grade of about 1.3 per cent. on the portion of the Viaduct south of Front street. The grade proposed for the Viaduct between Front street and the Boston & Maine Railroad will be 1.42 per cent., which is a little steeper than the present grade. The Viaduct will be on an earth fill for the most of its length except the portion between Front street and Foundry street which will be built on a steel viaduct. Since these tracks already pass above the streets this extra elevation of this railroad will evidently require no change in the streets in that vicinity.

The tracks of the Boston & Maine from the junction of the Viaduct to the present union station will be discontinued and removed, and in the future all the trains both freight and passenger of the Boston & Maine will approach the new union passenger station over the Viaduct.

The new union passenger station (Fig. 3) is intended to be one of the handsomest and best planned stations in Massachusetts. Its proposed site will be nearer the business center of Worcester than the present station and its approach much more convenient. The foundations of the building are to be of reinforced concrete. On the granite base, which is to show about 7 ft. above the first floor level, will rest the exterior walls of light cream colored brick, the same brick is to be used for inside walls in the baggage rooms and toilets. The ornamentation for the exterior walls will be of dull finished cream-colored terra cotta. The building is to be fireproof throughout.

The floors of the main waiting room and of the vestibules, restaurant and siderooms will be of cement. The waiting-room will be finished with a wainscoting of marble and with marble door and window finish to match, and the plastering is to be finished in imitation of Caen stone. All interior wood finish will be of red birch.

The staircases will be either cement or iron, the plumbing and lighting thoroughly modern. Subways and elevators are provided where necessary and there will be installed in the building the Kenney Vacuum System for cleaning as well as the necessary heating and hot water facilities for the restaurant. The architects are Watson & Huckel, of Philadelphia. It is estimated that this station will cost about $500,000.

In apportioning the cost of this entire work the grade crossing commission has decided that the Boston & Albany shall pay the entire cost of the site for the new union passenger station and also 65 per cent. of the total cost, including land damages, of all work west of Worcester Junction, and 32.5 per cent. of the alterations between Worcester Junction and Harding street, and also 65 per cent. of the cost of alterations east of Harding street.

The New York, New Haven & Hartford Railroad will pay 65 per cent. of the total cost of alterations, including land damages, on its railroad south of Worcester Junction, 32.5 per cent. of all work between the junction and Harding street, and 32.5 per cent. of the total cost of raising the Viaduct.

The Boston & Maine is to pay 32.5 per cent. of the cost of alterations on the Viaduct and 65 per cent. of the cost of removing their tracks from the junction with the Viaduct to the present union depot. The commonwealth of Massachusetts is to pay 25 per cent. of the total cost of all alterations ordered except the cost of the site for the new station and for constructing Harding street extension. The city of Worcester is to pay the entire cost of extending and building Harding street and also 10 per cent. of the total cost of all other alterations ordered by the decree.

In apportioning the cost that shall be borne by the street railways, the commission has decided that all public service corporations having rights in the streets within the limits of the alterations prescribed are to care for the several structures owned by them at their own expense.

The grade crossing commission which has finally brought this difficult problem to a solution is made up of the Hon. James R. Dunbar, Professor George F. Swain and Judge James H. Flint, the latter succeeding Henry P. Moulton, deceased. The cost of the entire project will be in the neighborhood of $3,000,000.

New Bridge Derrick Cars; Chicago, Milwaukee & St. Paul.

The bridge and buildings department of the Chicago, Milwaukee & St. Paul has recently built a heavy steel derrick car and some wooden derrick cars of unusual design and capacity. An illustration of each kind is shown herewith.

The steel derrick car is of 50 tons rated capacity, and is designed to allow construction of steel trestle work 80 ft. ahead of the trucks, or place a 95-ft. steel girder in position without the use of falsework. The car frame is structural steel. It is 51 ft. long over end sills and 9 ft. 10 in. wide over side sills. The frame overhangs the trucks 5 ft. on the boom end and 6 ft. on the cab end. The trucks are 30 ft. center to center. The boom is adjustable, its smallest length being made up of two 21-ft. sections. By the use of various combinations of 15 and 21 ft. intermediate sections this length can be increased successively from 42 ft. to 57, 65 and 80 ft.

30-Ton Wooden Underframe Derrick Car; Chicago, Milwaukee & St. Paul.

In the subjoined table the figures in the second column show the capacity of the boom for the corresponding length in the first column. The third column gives the distance the boom can swing from the track center line when carrying the respective loads shown in the second column and using the outrigger. The fourth column gives these distances when not using the outrigger. The lower end of the boom swivels in a self-lubricating ball-and-socket joint bushed with phosphor bronze.

Length of boom.	Capacity of boom for this length.	Swing of boom — Using outrigger	Swing of boom — Without outrigger.
80 ft.	10 tons.	26 ft. 9 in.	12 ft. 0 in.
65 "	20 "	19 " 6 "	8 " 6 "
57 "	35 "	19 " 0 "	8 " 3 "
42 "	50 "	15 " 6 "	6 " 9 "

The boom tackle is composed of two seven-sheave blocks with $\frac{1}{2}$-in. side plates, reeved with 15 parts of $\frac{7}{8}$-in. steel wire rope. The sheaves, which are self-lubricating, are 24 in. in diameter and have phosphor bronze bushings. The tackle supporting the 50-ton hook is composed of a five-sheave and a four-sheave block, with $\frac{3}{16}$ in. side plates reeved with 10 parts of $\frac{3}{4}$-in. wire rope. The sheaves are 21 in. in diameter, and, like the boom sheaves, are phosphor bronze bushed and self-lubricating. These blocks were designed and made by the railroad company. The A frame, when erected for operation, stands 21 ft. above the top of the rail. It folds back by revolving on a casting at its base, so as to reduce for shipment the height from top of rail to top of frame to 16 ft. 8 in.

The outrigger for increasing the capacity of the car for side lifts is an I-beam almost as long as the car is wide. It slides in and out of the casting at the foot of the A frame, and when extended affords a point of support 5 ft. 9 in. from the center of the track.

The cab frame, which is steel, is sheathed with common box car siding, and has a sliding front and folding side doors which afford ample view for the engineman and wide openings for exit. The cab contains a 50-h.p. hoisting engine, with two drums and four spools. Besides the air-brakes, the air-pump supplies four riveting hammers, at 100 lbs. pressure, from two storage tanks under the car floor. A propelling device and enough excess counterweight are provided to move the car with an 80-ft. girder at the end of a 57-ft. boom.

The 30-ton derrick cars are similar to some others recently built by the St. Paul, except the A frame, which has been added to the top of the tower to increase the effective height of the mast and thus diminish the stresses on the top tackle and boom. This A frame can be removed when the car is to be shipped, reducing the height of the tower to 15 ft. The car is of extra heavy construction, with center and side sills reinforced by 15-in. channels. In the attachment of the steel tower to the car there is provision for resisting any twisting due to side lifts by the derrick. The trucks also are extra heavy.

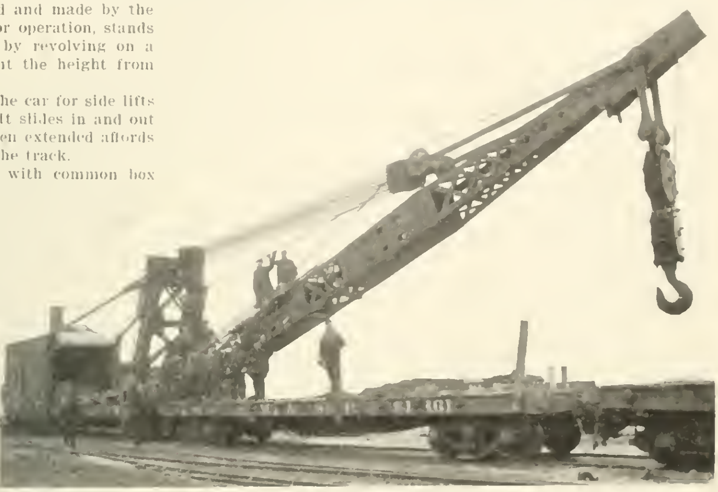
The tower has a foot-step for the boom at the base and a revolving connection at the top for the top tackle. These connections are in a vertical line, making the mast the greatest effective height which the height over all will allow. This latter dimension is limited by through truss bridge clearances. It is important that it should not exceed this height to enable the car to work in and around such trusses.

The top tackle consists of a four-sheave block fastened by eye-bars to a forging. This forging revolves horizontally about a vertical axis, while the block itself revolves vertically on a horizontal pin. The other end of this tackle has a similar block turning on a pin which passes through plates on the boom. These connections allow movement in any direction without introducing eccentric stresses. A $\frac{3}{4}$-in. wire rope is used. The load tackle consists of three-sheave blocks and $\frac{5}{8}$-in. wire rope, the rope passing over the end of the boom and back to the engine. The hoisting engines, water tanks, coal bins, etc., are so placed in the cab as to have the greatest effect as counterweights, and yet give enough working space for the engineman and winchman.

Equipped for work these cars will weigh 132,000 lbs., of which 74,000 lbs. is on the front truck and 58,000 lbs. on the rear truck. They are equipped with a self-propelling device attached to one of the rear axles. The weight on the rear truck exceeds the counterweight requirements by an amount sufficient to enable the car to propel itself while carrying a 70-ft. girder at the end of a 50-ft. boom. The rated capacity of the car is 30 tons at the end of a 30-ft. boom and 20 tons at the end of a 50-ft. boom.

These cars are fitted for any class of bridge work. One car can put a 70-ft. girder in place without falsework, and an 80-ft. girder in place using falsework. Two cars working together are needed for anything longer or heavier than this. One car has the capacity and boom reach to erect, without traveler, all single track through or deck truss spans of 200 ft., C., M. & St. P. specifications. The cars are part of the bridge and building department's erecting organization, which erects all of the company's bridges.

We are indebted to C. F. Loweth, Engineer and Superintendent of Bridges and Buildings, for this description.



50-Ton Steel Derrick Car; Chicago, Milwaukee & St. Paul.

Track and Ballast.

At a recent meeting of the Iowa Railway Club two papers on "Track and Ballast" were read, the first written by H. Rettinghouse, Division Engineer of the Chicago & North-Western at Boone, Iowa; the second by R. R. Auerbach, Roadmaster of the Chicago Great Western at Marshalltown, Iowa. These papers were followed by a discussion. An abstract of the papers and the discussion is given below.

Mr. Rettinghouse. Good track means first, good roadbed and drainage. Often I have seen carload after carload of gravel, cinders or other dry material put under track in some particularly soft cuts, only to churn up in a short time with the underlying soft mud. In such a case good judgment would dictate a little work on drainage ditches and tiling, with better results certain. Good drainage should be had in mind during construction of the roadbed, which should be built with extreme care. Ditches in cuts and along low embankments should wherever possible be made continuous and leading to the nearest outlets. Adequate waterways under tracks should be built. The question of drainage should be paramount. Modern engineering methods of determining drainage areas and the consequent volumes of drainage to be disposed of, are doing much toward perfecting drainage conditions and thereby helping to make good track. In the colder climates, especially where track maintenance is a difficult problem because of the heaving of track, there should be more attention paid to perfect drainage of roadbed, than at a location where frost does not penetrate deep enough to cause heaving of track. The roadbed should not only be perfectly drained, but should be of proper consistency to receive ballast and track, so that the material from it will have no tendency to churn up with the ballast after it is placed. If the material forming the roadbed is of such nature that it will not fulfil these conditions, it is often necessary to place a layer of cinders or coarse rock on top of it so as to leave the ballast unimpaired.

Second, comes good ballast. The proper preparation of the roadbed and sub-grade is most important. The roadbed should be slightly sloped from the center line of track each way so as to permit quick drainage of such moisture as will penetrate through ballast. It is easy to do this with new beds previous to the track laying. When there is old track to be reballasted it is essential that the old ballast be removed from between the ties to the bottom of ties at the ends, and the excavated material leveled off to the shoulder of the roadbed so as to leave no ridges and leave no obstruction to the flow of sub-drainage.

Of the different kinds of ballast that have come under my personal charge and observation I will name the following:

(a) Broken stone or slag. (b) Gravel or sand. (c) Cinders. (d) Earth.

(a) Broken stone or slag.—From all points of view there is nothing better than stone ballasted track. Opinions differ, however, as to the size of crushed stone or slag. Some favor crushed stone averaging 2-in. cubes, washed so as to be absolutely clean and free from stone dust. Others advocate a size as small as $\frac{3}{4}$ in.; a mixture of all sizes between and including these two extremes, a crusher run article with a limit to 2-in. stones and a certain proportion of dust in the mixture. I advocate the last of these classes. I find that with broken stone or slag there is a tendency for the sharp edges of the fragments of stone to bury themselves in the bottom of the ties through the impact of trains. It is difficult to keep track in good line through the further tendency of broken stone fragments to roll one way or the other. On lining track they tend to again crowd back and throw track out of line. With the mixed material this objection is reduced to a minimum and the smaller particles will fill out the voids. As to the small amount of dust, it will with a few rains wash down to sub-grade and by forming a coating over the subgrade be helpful to drainage.

It is often held that broken stone or slag is too expensive as compared with gravel. I cannot agree with such an opinion as the one item of life of ties is an important factor in the cost of maintenance. The porous nature of stone ballast prevents its speedy rotting and thereby proves a long time investment. The thickness of stone or slag ballast and for that matter all other ballast should be no less than 12 in. from sub-grade to bottom of ties, while 18 in. is much better. The material should be hard and not subject to crushing. Limestones and granites, trap and flint rocks are most commonly in use. Only the hardest sand stones are admissible.

(b) Gravel and sand. Good gravel which must be composed of stony parts that will not rapidly decay, and run in sizes from coarse sand to pebbles 2 in. in diameter, is extremely scarce. There must be no clay or earthy substance in it in order that it may drain freely and not churn when soaked by rain. The proportion of sand must not be too large nor must there be an excess of pebbles. The proportion should be about three parts sand and five parts coarse pebbles. These specifications are hard to fill. Utter and nearly ruinous disappointment has followed the opening of certain gravel pits, which were said to have been thoroughly tested, and on the strength of such tests bought at fancy prices, only to be found composed of three-quarters fine sand and one-quarter fair and usable gravel.

Good track can be made with gravel ballast. The ballast can be maintained somewhat more cheaply than stone ballast, but as it is less porous it will foul more speedily and will hasten decay of ties. Sand ballast is used only when other material is unavailable or on unimportant track. It is objectionable on account of the large amount of dust raised from it by passing trains, although excellent track can be made with it. The coarser the sand the better. The greatest objection to sand ballast is that it is less porous than other ballast and therefore greatly hastens decay of ties and fouls quickly.

(c) Cinders. I know a railroad manager who will not allow the use of cinder ballast on either main or branch lines. He does not even favor it on passing or side tracks immediately adjoining main track. He objects to the so-called "sink holes," but his opinion is rather radical. I know of one important western railroad which has cinder ballast on several hundred miles on one of its most important main lines. Cinder ballast has been advocated as giving less resistance than any other and appears springy and therefore would make a good riding track. Because it is springy it requires frequent "picking up" and consequent renewal. It never gives the appearance of first class track and is for that reason tabooed on most of first class lines, though it is used a great deal on side tracks and industrial spurs.

(d) Earth. Track ballasted with earth is in trackman's language called "mud track." It is well named. There is yet a good deal of earth ballasted track in this and other western states. I know of many miles of such track, which is really good as long as it does not rain, but when the rain comes down it is very poor track indeed. Maintenance of earth ballasted track is quite expensive and ties are eaten up rapidly. One big item of expense during the summer months is the removal of weeds.

Ties.—Good ties are essential to good track. All ties of soft as well as hard wood have doubled and trebled in price in a very few years. Economy in their use is therefore imperative. It requires good judgment on the part of section foremen and road masters not to jeopardize the safety of track for the sake of false economy. The percentage of oak ties used to-day is far larger than the soft wood ties such as cedar, hemlock and tamarack, and is greater than it was some years ago, notwithstanding the fact that many more miles of railroad have been added since that time and the total number of ties used enormously increased. Experiments are being made to find a substitute for wooden ties in steel or concrete, but as yet no satisfactory substitute has been found. The only salvation for the railroads seems to lie in planting trees and it is gratifying to see that many railroads are starting to do that.

Rails and Fastenings.—There is a great variety in fastenings. The old style fish plates have seen their day and the cast chair is a curiosity. The effort is to get a rigid joint. There is a little danger of overdoing this by creating such rigidity of joints as to overshadow the rail proper.

Good Men.—When the young Edwin Booth set out in his dramatic career, he went to an old actor with this question: "What must I do to play Hamlet? I wish to play Hamlet, I must play Hamlet, and I will play Hamlet." The old man, with the fire of enthusiasm in his eye, said: "Well, if you put it that way, if you want to play Hamlet you must read Hamlet, you must eat Hamlet, you must drink Hamlet, and by the Gods you must *be* Hamlet." I have often said to a young man fresh from college who wishes to be a trackman and roadmaster: "If you want to be a trackman you must read track, eat track, drink track and live track."

The American roadmaster or supervisor of track, as he is sometimes called, is a type distinctly of his own. Whether he has a college training or has risen from the ranks, in all cases he must be a good general, and above all a good trackman. Unlike his brother on the European continent, he has a comparatively large district under his charge and is always a busy man. Every wreck, every washout and every mishap demands his personal attention. It has become a serious problem of late to find section foremen, and this is at present one of the greatest difficulties with which the roadmaster has to deal. Most track laborers to-day are foreigners who offer no suitable timber for promotion, and it takes considerable discretion and ability of the foreman in dealing with that class of labor to accomplish what he is expected to do and keep his track in good condition. Railroads have seen fit to pay track laborers less than other laborers and as a result the intelligent and promising men in this department tend to go into other fields.

Mr. Auerbach: Cinders for ballast cannot seriously be considered by a road doing anything but a small business, although they are undoubtedly cheapest in the first place. When traffic is not heavy they do very well to widen narrow fills to put in wet cuts and other weak places. These places can usually be repaired with the cinders that are made by the company using them. On a road using heavy power and running a good many trains a day, cinders are not a satisfactory ballast. They are altogether too light to stand much heavy pressure from above, and they are not heavy or compact enough to keep track in line unless an unusually broad shoulder is used. Consider the substance of cinders, the non-compact clinkers, the brittle and uneven stone-like pieces, and the almost powdered ash. Per cubic foot cinders weigh about one-fourth as much as gravel and one-sixth as much as rock. When cinders are used as ballast, the clinkers are not broken by the bar or shovel when tamped, but soon become crushed by the heavy weight of the rolling stock. You can dig down under ties where cinder ballast has been in for a year or more and you will not find one clinker. They become crushed by the traffic over them. This crushing puts the track out of line and subsequently out of surface. The track goes out of line because the weight of the cinder shoulder is not sufficient to hold it. To be sure track will always go out of line if allowed to get out of surface, or vice versa, but it will not get as much out of line or surface, or as easily so, with a stiff and substantial shoulder and a firm bed as it will with a light and loose one such as cinders give.

Cinders are best in wet places where there is a broad, flat subsoil such as yards. But on new dumps they are decidedly bad. The water easily drains through them, but does so mostly in certain places, forming pockets and cutting away parts of the dump. This year on my territory we filled some 20 bridges. Where cinders were unloaded on these filled bridges and rained on heavily, we had parts of the new dump cut away by an unequal amount of water going through the less compact part of the cinders. I unloaded 200 cars of cinders on one section this summer. The cinders were put under as fast as received. Two months after they were put in, leaving a good top and line on track, it was necessary to re-raise this track. This was done about September 1, and track is in such condition now that it will have to be gone over again in the spring. The ground formation under these cinders is of the best. Cinders in yards are excellent. They drain well, are hard and present a good appearance if kept clean.

Ballast cannot be entirely taken away from a track. Roads that are dissatisfied with their cinder track and want to improve it should put gravel on and reballast it. I have seen gravel put on over cinders with excellent results. The coarser gravel very soon forms a cushion with the cinders.

Gravel or rock? This is the vexing question.

Gravel.—The reasons for having coarse gravel for ballast are obvious. With fine gravel there is too much sand. The sand washes, is dusty and while the fine gravel is almost as heavy as the coarse, it is not nearly as substantial or enduring. It cannot be tamped to give as firm or lasting a bed as gravel made up mostly of stones about the size of the end of your finger, because the large amount of sand found in the finer gravel will work out when dry and when wet will churn.

Coarse, pure gravel is considered by many to be the ideal ballast, but let me surprise some by saying that if a small amount of clay is added to this gravel we have more nearly a perfect ballast. The need of this clay is not so apparent in newly ballasted track, but as the track gets older and parts of the gravel wash away and rain begins to form small ditches in the shoulder of it, then it becomes noticeable that the gravel has not packed hard enough to turn water or to leave it as originally dressed. But if mixed with this gravel is about 10 per cent. of clay, just enough to cement it, rains will not affect it, and the older it becomes the harder it gets, forming a strong, cement-like shoulder and bed. It can be maintained with less work and expense than any other ballast. I can show you four miles of such ballast on a trunk line in this vicinity that has not been touched for three years, and is at present in as good line and surface as any track in this part of the country. I can also tell you of a large road in this state that has coarse gravel for ballast, which has issued instructions to its section men that they should, whenever possible, mix with the gravel a small amount of clay. However, great care must be taken that there is not too much clay in the gravel, as too much would be worse than none at all, for in wet weather the track would churn and work.

The cost of maintenance of gravel ballast is approximately the same as for cinders and the finer grade of gravel, except that it does not have to be gone over so often. What I mean to get at in comparison to rock is that a light raise of joints or centers can be made. I might add here that, except rock, track should be lifted as little as possible, and should never, if it can be avoided, be raised out of face. The old tie bed made by years of service is always preferable to a newly made one.

Rock.—It is true that from section men to roadmasters comparatively few handle crushed stone intelligently. The reason is, rock ballast is comparatively new to us. There is a vast difference between rock and the nearest thing to it, coarse gravel. Rock track cannot be kept up with less than from 10 to 15 per cent. more force than is necessary to maintain gravel or any other ballast the year round. You cannot lift a joint here or a center there in rock. It must all be taken out of face. That is, you cannot make a light raise of a joint or center, such as a half inch, because the dimensions of crushed stone generally used cannot be got under such a light raise, and in order to get up the low place of a half inch you must raise it higher than necessary to make it level with the rail on each side of it; consequently, in order to get a true surface you will have to raise the rails adjacent to this joint, and so on, and in doing so you are lifting the track out of face, or making a new cushion for it. It is impossible to make light raises and keep them up. You cannot get under enough ballast to hold them. You lift a joint only. The quarters on each side will come up somewhat, too, and there is no crushed rock small enough to put under these quarters where the joint is raised a little. But still you will find foreman after foreman trying to do this kind of patchwork on rock track. It is simply time wasted.

In rock track you practically have no choice of the quality of ties. Nothing but oak or ties of equally hard wood should be used. Rock on a solid formation will penetrate softer ties, shorten their life, and ultimately affect the surface of the track. In the maintenance of rock track too much attention cannot be paid to the way in which the ties are tamped. No track becomes so easily center-bound and swinging as rock. Ties in rock should only be tamped at the ends and under the rail, never in the centers. Don't try to do this tamping with anything but tamping picks. Bars are not properly shaped and shovels are out of the question. Rock track should always be lined before being raised. Raising track before lining it will invariably disturb its surface. Compared with other ballast the care of rock track is very slow. But when once laid it will remain that way for some time, and the force caring for it can be reduced half until such time as it requires attention again. Perhaps this possible reduction of half the force when rock is in good shape would seem to lessen the cost of maintenance of rock to equal that of other ballast. But on the other hand the additional force required to put rock in good order when it is partly run down more than offsets by from 10 to 15 per cent.

The best feature of rock ballast is its drainage. Nothing short of a cloud-burst will affect it, and churning and working track is unknown. I have in my territory about two miles of track on a hill that washed out every time there was an unusually hard rain. It was so situated that the water poured on it from the adjacent hills. We had both gravel and cinders on this piece of track. That is, we had them from one washout to another. We finally put rock ballast in, and since then have never been troubled with washouts. I might mention here that this piece of rock track, two miles long, has not been raised or lined for two years, and is in good shape now.

Mr. Rettinghouse: There is one point in the last paper that I cannot entirely agree with. The claim was made that the best track men would not disturb track after it has been once settled. I have found in my experience that the raising of the joints was always considered as an expedient. We go over a piece of track every year, and if the material is there we always have found it better to raise the track two or three inches and it would keep the track in better shape.

Mr. Farquharson (Roadmaster, Chicago, Rock Island & Pacific): It is all right to raise track if you don't raise it too high, but enough so you can bar tamp it. But when you raise it so you can't bar tamp it, the places where it is settled away will have to be bar tamped to make good track. Two or three inches would make good track with bar tamping.

Mr. Hayes (Roadmaster, Chicago, Rock Island & Pacific): In 1905 I made some tests for gravel ballast. It was almost entirely under water on the Coon river, what would be called a practical well-washed gravel. We put a large amount of this in track in 1905 but found that the gravel did not hold as well as it should because there was not enough clay in it to bond. Therefore it has not given good satisfaction. We have been using a large amount of gravel the last year or so which gives good satisfaction and which has a certain amount of clay which causes it to bond. I think gravel ballast is a great deal cheaper than rock and gives just as good satisfaction.

Burnt gumbo has not been mentioned. I think from experience that it gives about as good track as you can want with as small an amount of attention as any other and less attention than gravel requires. It costs a little more in the beginning.

Mr. Jones (Superintendent, Chicago, Rock Island & Pacific): A good track man has the same opinion of water that the devil has of holy water. He wants to get rid of it as quickly as possible. Some experience we have had in the last two years on our road may be of value. Our dumps were pretty narrow and also the cuts, so that all the water that fell near the track ran down on it. It was impossible to secure money necessary to widen our cuts with steam shovels and use the material taken therefrom to widen our banks, so we were forced to take care of it with tile. On our division we have put in the last two years something like 27 lineal miles of tiling, using sizes from 4 and 6 to 8 in. In placing the tiling we put it as nearly as possible in the bottom of the cut, which, as the cuts were narrow, was from 3 to 4 ft. from the end of the ties. We put the tiling from 3 to 4 ft below the bottom of the tie and gave it a good drainage from the center of the cut to each end, making the ditch we dug to place the tile as narrow and as straight as possible. Then we filled our ditches with cinders from the top of the tile to the bottom of the ditch. The result has been that with the heavy downpours of rain or cloudbursts which we have occasionally in Iowa, there is little if any water that runs on the surface of these ditches out of the cuts. The water goes down through our cinder bed and into the tile and runs out through the tile instead of over the surface, the result being the water does not get much opportunity to get into the track or dump through the cuts and we have secured with a small outlay what we consider the best possible results from this method.

Burnt gumbo is too expensive in this part of the country because of the price of coal and high comparative cost of slack. There was a time 20 years ago when coal mines were glad to give the railroads the slack for hauling it out and some coal mines paid the railroads something for hauling it away. At that time the burnt gumbo could be made at a very reasonable price, as the principal cost is the burning of it for ballast. A couple of years ago some burnt clay we burned because we had to carry coal so far and paid so much for it, if I recollect it correctly it cost close to $1.50 per yard deposited on the roadbed for placing under the ties, making an almost or quite prohibitive figure for that class of ballast.

The ballast Mr. Hayes speaks of that we got from the Coon river, river washed gravel near Commerce, I think we placed under the ties for approximately 43 cents a yard. I think it was figured 43 or 43½, and that included the cost of loading the ballast which we were able to load at about 6 cents per yard and we hauled that 70 or 75 miles. During the summer of 1906 we put in nearly 60 miles of Grettinger ballast which we hauled I think 250 miles, paid a foreign railroad company a pretty heavy mileage, and my recollection is that it cost, loaded by steam shovel, 3 cents a yard and cost us 72 cents a yard placed under the ties at that distance. Stone ballast ordinarily costs considerably more than that, at least 50 to 75 per cent. more. In this country I believe it is extremely difficult to get a first class quality of solid rock, and unless you do, it is very expensive and makes mighty bad track in a short time. The softer particles disintegrate very fast from the moisture and the frost. Then they break and pump under the joints in a short time. I know of stone ballast put in within two or three years in an adjoining state which at the time was considered very good ballast, but within the last six or eight months they have been compelled to ditch at almost every tie and joint allowing the water to get away from the track on account of disintegration. Yet it was considered fairly good rock at that time.

These papers have stated the differences between maintenance of gravel ballast and rock ballast too closely. I believe it must cost us at least 25 per cent. more to maintain rock ballast than gravel and from 75 to 100 per cent more to change out ties in rock than it does in gravel ballast. The ballast we secured that Mr Hayes spoke of being river washed has proven rather unsatisfactory ballast. As mentioned in one of the papers it is "alive." we can't tamp it with a bar because if we do we drive it out from the other side of the tie and we can only shovel tamp it. I am satisfied, however, that this ballast is getting better. It has been in now over two years and it is getting better because the dirt and clay blown or carried in is becoming mixed with it and holds it in bond. The Graettinger gravel has a fair quantity, perhaps from 5 to 10 per cent. of foreign matter in it, that is, a sort of a clay, more like a disintegrated iron ore, and that gravel in a very few weeks or months at least after put on a track will become perfectly solid almost as much so as disintegrated granite, which without question is the best ballast that is in use to my knowledge.

I think the gentlemen in their papers where they have spoken so harshly against cinders have gone a little too far. Cinders without any question are "the poor man's friend," and we have cinder ballast on our railroad under heavy traffic, under heavy engines; one stretch I recall of some three miles put in two years ago last spring about 12 in. under the ties still remains good track and the section on which this three miles of cinder ballast is located, averages one man, besides the foreman, during the past season because we could not get men in that vicinity because the other railroads were paying higher wages than we were permitted. They may have lost sight of the fact that there is a great difference in cinders, perhaps greater difference in cinders than in gravel. Some coal makes ashes almost entirely, with some clinkers mixed in. Other coal makes hard sharp cinders and the hard sharp cinders in our experience do not disintegrate and bed down as explained in the papers, and while cinders are not so good as rock nor as good as gravel, they are better than poor gravel and they are much better than no ballast at all.

Mr. Bettinghouse: I believe I said in the paper that my experience was limited to that one instance and also that the suggestion had been made to wash all gravel. I got this information from the proceedings of the American Railway Engineering and Maintenance of Way Association of a few years since, but there was nothing said about the outcome of that experiment. It reminded me of that one instance where we used naturally washed gravel. The statement has been made by Mr. Jones that he found track that was ballasted with such washed gravel improving through the addition of clay. It is evident that you are not much bothered with heaving track in this vicinity. My experience has been in a very cold climate and heaving track was one of the greatest troubles we had. The minute we put any particle of clay in our ballast we would have a great time. I have seen track heaving so much that it required a full sized tie each side of the heave. Consequently it heaved over 6 in. This was all due to poor gravel or clay sub-soil. If there is no trouble with heaving, perhaps clay would be best.

The exchange of ties or renewing of ties in stone ballast will cost a great deal more than in gravel ballast. The cost of gravel ballast depends on the equipment at your disposal. That is to say the kind of steam shovels and ballast cars and the methods of unloading, etc. It is a most important item, as every practical man will know, to have the equipment as perfect as possible. In the years 1905 and 1906 I was in charge of track in Wisconsin and no expense was spared. We had some very large steam shovels with 5-yd. dippers; we had ballast cars, side dump cars; Lidgerwood unloaders, any quantity of them—no scarcity of equipment whatever. We had spreaders that were operated with air, and as a consequence I think that we handled our gravel about as cheaply as it could be handled, and I think it came very near to the figures mentioned by Mr. Jones, so I presume he had the same kind of equipment. We ballasted about 60 miles of single track with a yardage of 4,500 to the mile, which is very heavy ballast indeed, amounting to practically 18 in. under the ties. That ballast cost us from 23 to 33 cents a yard for different sections and depending on the haul. I had in the same year another stretch of 10 miles with a different kind of a ballast where the cost ran up to something like 50 cents a yard. It was because we had to haul over another road, and our calculation as to the number of trains we could haul each day was knocked in the head. Instead of hauling four trains I could only get three through, and of course that means a whole lot of difference. The cost of broken rock ballast is I think safe to assume a dollar a yard as an average cost, meaning the entire cost of the production of rock, hauling and putting under the track. We have on the North-Western now a crusher near Cedar Rapids which has been put in operation in the early spring, and we have not produced this year the rock as cheaply as we should. A great deal of that is due to the fact that much more stripping was necessary than we first anticipated. We will undoubtedly get the cost down during the coming year to about 40 cents a yard and perhaps less. It should be gotten out for 35 cents a yard. In that case the rock ballast track should not cost more than 75 cents a yard complete figuring on a 10-cent basis. It should be put in for 25 cents a yard and we figured 10 cents for hauling.

I mentioned in my paper broken stone and slag as you notice but I had particular reference to the Chicago & North-Western track between Chicago and Milwaukee. I don't know whether any of you gentlemen have traveled over that line, but it is said to be one of the best tracks in the country. The trains are very fast and very numerous. I believe that most of that distance, some 83 miles, is ballasted with broken slag, obtained from the rolling mills in that vicinity.

Mr. Breheny: Drainage I consider primarily essential. From my observation of the results from placing tile in some of the wet cuts recently, I am about ready to believe that considering the expense to which the managements feel able to go, that it is a very good alternative and very satisfactory. As to the cinder ballast, I must take exception to what the papers infer or intimate, for I believe that the cinders from the Iowa coal when a sufficient amount of it is put under the ties with a good sub-grade and provision made for good drainage and track properly put up, that it does make a comparatively good riding track and the maintenance expense is nominal, about equal to gravel. The quality of the cinder is no doubt to be considered in this respect. I did have a little experience this summer with cinders made from Colorado coal which approaches very nearly a lignite in lightness. The cinder is so light as to be almost entirely unsuitable as ballast. In the second paper on ballast I notice at the outset the use of cinders in wet holes is suggested, but later condemned in arguing against placing cinders where they will produce a pocket. I believe if you put cinders in a wet hole in an embankment and the track continually settles it will produce what is called a sore spot.

With the rock I believe that the class of soil making the subgrade should be considered. There are localities in Colorado where the sub-grade is a gumbo or material known as "doby," and the slag or rock is shown by experience to be too heavy in that it settles very readily into the "doby" and the "doby" works up around the end of the tie and you have got to be continually digging it out and refilling. We found by experiment that it was impracticable to place anything heavier in the way of ballast than cinders or disintegrated granite.

Disintegrated granite is the best ballast I have seen. Rock ballast is no doubt first class, but I do believe it has a rigidity that is not experienced in the riding of gravel or cinder ballast. It has an effect very close to that produced by slag. The slag in the vicinity of Denver or Pueblo is not used as much for ballast as might be expected considering the quantity in which it is furnished, and when asking as to why this is so the majority of the answers were that it was too heavy for the sand or "doby" sub-grade and they did not consider it provided as good a ballast for the locality in which it was burned as did the disintegrated granite. The expense of the disintegrated granite, both in its original cost and considering its ultimate cost in the maintenance, compares favorably with that of our gravel, and while it is in itself a material that drains well, yet I believe that in a proper cross section there can be exceptionally good drainage. In the locality to which I refer the slag was used for the most part in rip-rapping, protecting embankments, covering trestle bridges as a protection against fire hazard and comparatively little of it under track as a ballast. The disintegrated granite is readily obtainable, works nicely, and we found by experience that it was a little more easy to secure labor to work in the disintegrated granite than it was where stone or slag was used as a ballast. This is possibly a feeling that existed in that locality only. We got the disintegrated granite from the Colorado Springs & Cripple Creek District Railway in the North Cheyenne canyon, beginning at mile post 5, about five miles up in the hills from Colorado Springs. The available granite pits have been worked out from that to mile post 8, three miles.

The Illinois Central's Birmingham Line.

The Illinois Central began active investigation for a line to Birmingham, Ala., early in 1901. The topography of the region presents many difficulties to railroad construction, and to determine the feasibility of a line from some point on the present line required careful investigation. Surveying parties were put in the field in 1902, and a number of routes projected from points all the way from Jackson, Miss., to Jackson, Tenn., on the existing line. As a result of these surveys, the most feasible location appeared to be between Jackson, Tenn., and Jasper, Ala., 176 miles, by way of Tuscumbia and Sheffield, passing through Chester, McNary and Hardin counties in Tennessee, Tishomingo county in Mississippi, and Colbert, Franklin, Winston and Walker counties in Alabama. It was decided to make traffic arrangements with the Frisco System between Jasper and Birmingham, 41 miles. The line, as located, followed the general direction of the headwaters of Deer river out of Jackson, through Madison and Chester counties, ascended to the summit of the divide between the valleys of the Mississippi and Tennessee rivers in Hardin county, and thence descended to the valley of the Tennessee river and followed it to Tuscumbia, 104 miles. At Tuscumbia, the line broke sharply from the Tennessee valley and ascended to the top of Sand mountain, the watershed between the Tennessee and Black Warrior rivers, near Double Springs. From Double Springs south, a tortuous descent was made into Jasper by way of the valleys of Sipsey and Clear creeks, both tributaries of the Black Warrior. The maximum grade on this section was 1 per cent., and the maximum curvature 4 degs.; but from Jackson to a point 17 miles south of Tuscumbia the maximum grade was only 0.5 per cent. and the maximum curvature 3 degs. The air line distance from Jackson to Birmingham is 184 miles and the distance by the location described is 215 miles. The 176 miles of this to have been built would have cost about $10,000,000, or $50,000 a mile.

The financial depression of 1904 deferred further action in the matter until the spring of 1905, when arrangements were made for the following trackage rights:

Mobile & Ohio from Perry, Tenn. (near Jackson), to Corinth, Miss., 51 miles.

Northern Alabama from Haleyville, Ala., to Jasper, 41 miles.

Kansas City, Memphis & Birmingham from Jasper into Birmingham, 41 miles.

This lessened considerably the mileage to be built. It was necessary only to build a connection 3.06 miles long with the Mobile & Ohio at Jackson; a line 80.1 miles long, leaving the Mobile & Ohio at Corinth and connecting with the Northern Alabama at Haleyville; and freight terminals in Birmingham. The connection at .01 per cent. for half a mile each way from passing siding stations. The maximum curvature for the line is 3 degs., except for one curve of 4 degs., 2,085 ft. long, near the Haleyville end, which was necessary to secure the most economical location for crossing Brush creek. All curves of 2 degs. and over have spiral easement approach curves. The profile, parts of which are shown herewith, gives a clear idea of the work encountered, and the accompanying photographs show the nature of the cuts which were made. The geology of northern Alabama according to the authorities shows sub-carboniferous rock masses and coal measures. As a matter of fact, however, very little rock was encountered in large masses, but many of the cuts contained disintegrated rock, cemented gravel and rock seams separated by clay and sand. In certain cuts this clay was indurated and very difficult to remove.

Stephenson Hill cut, stations 3,991 to 4,022, near Corinth and

Birmingham Line of the Illinois Central.

Jackson presented no particular problems in railroad construction, being a standard single-track line laid with 85-lb. rails on gravel ballast. The corporate name of the line is the Jackson & Southeastern Railroad.

The line from Corinth ascends directly to the top of the ridge dividing the watersheds of the Tombigbee and Tennessee rivers, known locally as the "dividing ridge." This ridge is cut up by cross ranges of hills of moderate elevation, which are well wooded but without undergrowth. They are made of clay, with an occasional seam of sandstone. The location continues on the top of this ridge into northern Alabama, striking the Northern Alabama at Haleyville. The section traversed in Alabama is a portion of what is known as "Apalachian America," and the foot-hills of the Blue Ridge

Railroad Terminals in Birmingham.

mountains. This district has been referred to as the "land of saddles and bad roads," where a great variety of climates prevail, and where there is a survival of pioneer conditions, woodcraft and the open fire-place with the "stick and mud" chimney—in every way an unpromising land for railroad building. The line runs through Alcorn, Tishomingo and Itawamba counties in Mississippi, and Franklin, Marion and Winston counties in Alabama. The part in Mississippi, 42.28 miles, was built under the corporate name Mississippi & Alabama Railroad, and the portion in Alabama, 37.82 miles, under the name Alabama Western Railroad.

While the line is laid on the dividing ridge, it, nevertheless, involved very heavy grading to get the kind of line desired, that is, a maximum grade of 26.4 ft. to the mile, compensated .04 per cent. per degree of curvature, with an additional compensation of

Chub Hill cut, stations 1,781 to 1,798, shown in the illustrations, are two of the largest cuts on the line. The former contained 196,000 cu. yds. and the latter 106,000 cu. yds. Besides these, there were numerous cuts of over 100,000 cu. yds.; the fills were correspondingly large, as the line was built on a balanced grade line. The total material moved on the entire line from Corinth to Haleyville was 5,500,000 cu. yds., or about 70,000 cu. yds. to the mile.

Near the Haleyville end of the line, Brush creek, a small tributary to the Tennessee river, cuts a wide, deep gap in the dividing ridge, and it is here that, after thorough study and careful investigation requiring numerous preliminaries, it was decided to cross the gap by a steel viaduct, in preference to increasing the length of the line by staying on the top of the ridge and building around the gorge into Haleyville. The general dimensions and weights of this viaduct are:

Total length, face to face of parapets . . .	1,230 ft. 7¼ in.
Maximum height, base of rail to masonry	171 " 2 "
Total weight of structure . .	1,943 tons
Total amount of masonry . . .	1,550 yds.

It consists of ten 75-ft. deck plate girder spans, nine towers with 40-ft. deck plate girders, and two 60-ft. deck plate girder approaches. The 60-ft. approach spans rest on concrete abutments and rocker bents. The towers and rocker bents rest on masonry piers on solid rock foundations. The tops of the piers are all 5 ft. 6 in. square, varying from 6 ft. to 24 ft. in depth, according to conditions. The masonry piers are all stepped on the outside to permit future extensions to the masonry for a second track.

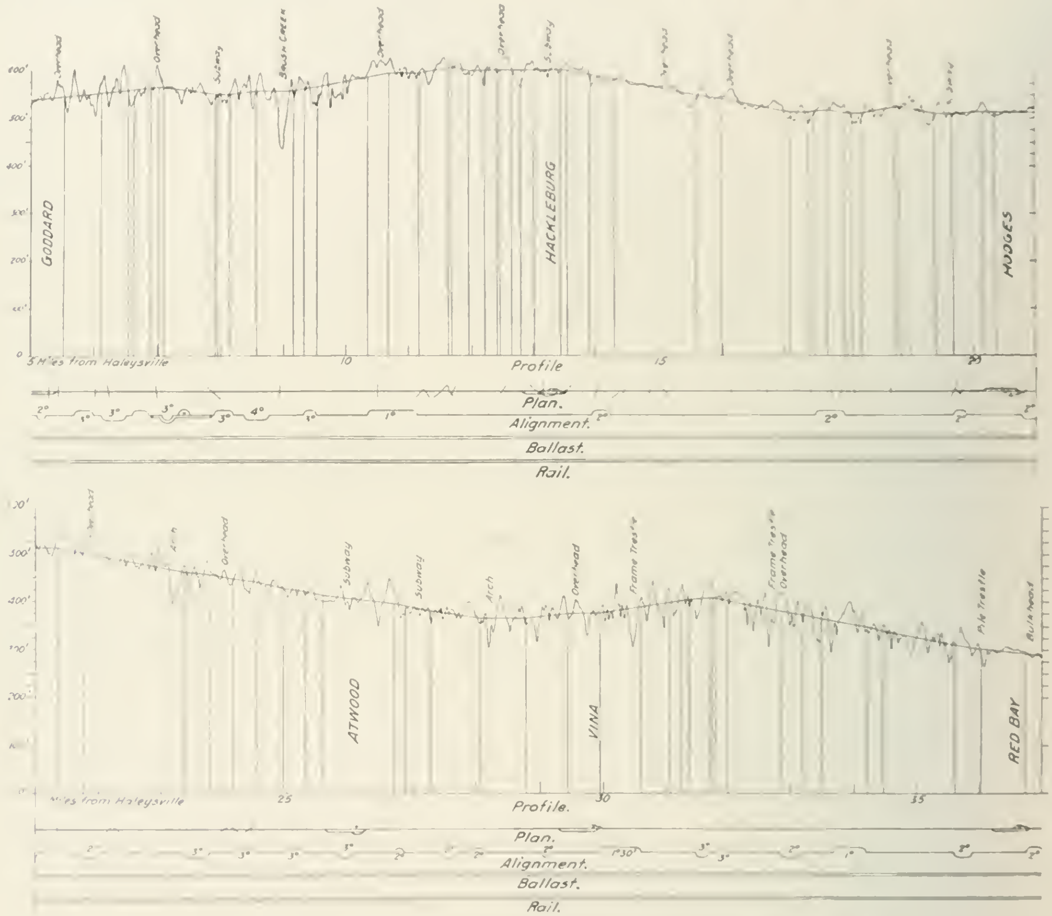
The tower spans are fixed at both ends on the columns and the 75-ft. spans on each side are alternately loose and fixed at the ends. The towers themselves are fixed at diagonally opposite corners of the bases, expansion being provided for at the other corners. Each of the towers consists of four columns joined by diagonal braces of channels. Each column is made up of two plates and four angles. Two angles are riveted to each plate, the two plates being spaced 21¼ in. and laced with 3-in. x 2-in. x ⅜-in. angles. The towers are built in one, two or three sections, according to the height. The top sections, the middle sections, and the base sections, respectively, for all towers, are built of similar elements. The steel for the viaduct was furnished by the McClintic-Marshall Construction Co., Pittsburgh, Pa. It was erected by the Strobel Steel Construction Co., Chicago, with a double trolley traveler as shown in one of the photographs herewith. The total time from beginning the work of erection until trains were allowed to cross the viaduct was 40 days.

The design of the columns in the present towers allows for future double-tracking of the viaduct by erecting additional columns on each side. To install this second track, the masonry will be extended and additional columns placed and connected to the present columns by struts and diagonal braces, and one additional deck plate girder span will be added to each side of the viaduct 8 ft. from the center line between the present girders, the present track being moved to one side so as to rest on one of the present girders and one of the new girder. The new track will rest on the other two girders, one new and one old.

The Brush Creek viaduct and the overhead crossing of the Southern Railway are the only noteworthy bridge structures on the line. The Southern Railway crossing, which is the only railroad crossing on the line, is a through girder bridge, 71 ft. long on concrete abutments. All other bridging is Illinois Central standard six pile, open deck, single-track trestle. The smaller openings have cast iron pipe.

The buildings for the line are in keeping with the kind of country in which they are located. The depot and office building at Corinth, shown in the illustration, is a combination freight and passenger station, with operating officers' headquarters on the second floor. The local stations have combination freight and passenger depots of a size suitable to the needs of the community. A cotton platform and a stock pen are provided at each station.

The section foremen's and agents' houses, which are alike, are story-and-a-half frame structures, designed to afford comfortable living quarters in a warm climate. They have two large living rooms, 16 ft. x 16 ft., separated by a wide hall leading to a porch



Condensed Profile from Goddard to Red Bay; Birmingham Line of the Illinois Central.

Overhead Crossing of Southern Railway near Corinth, Miss.; Mississippi & Alabama Railroad.

in front, 8 ft. wide, and a rear porch 6 ft. wide. Back of the dining room, and connected with the main portion of the house by a latticed porch, is a large kitchen. The second floor, or attic, is fitted up for sleeping rooms and is reached by a stairway from the hall. The interior furnishings are plain. The two living rooms each have an open fire-place finished in common ashlar and red sandstone.

Houses are also provided for section laborers, near the section foremen's houses. These laborers' houses are also story-and-a-half, with a front and back covered porch, each 6 ft. wide, extending the full length of the house. The two rooms are 16 ft. x 16 ft., but are not separated by a hall as in the section foremen's dwellings. The attic is reached by a stairway from the kitchen and is fitted up for sleeping rooms.

The type of water station used is shown in a photograph; it is a 100,000-gal. tank with steel underframe on concrete footings. Those water stations located at points where there is a passing track have a penstock between the tracks.

Brush Creek Viaduct, Showing Traveler.

Stephenson Hill Cut; Mississippi & Alabama Railroad.

Type of Water Station.

Chub Hill Cut; Alabama Western Railroad.

The finished grade is 24 ft. wide in cuts and 18 ft. wide on fills. The theoretical side slope in cuts is 1 to 1, and on fills 1½ to 1. In the cuts are side ditches 4 ft. wide and 1 ft. deep. The track is laid with A. S. C. E. section, 85-lb. rail, and is ballasted with gravel, the ballast being obtained from pits located on the line. Passing tracks 3,200 ft. long are placed at intervals of about six miles.

Wherever possible, public highways are carried either over or under the tracks. In many instances it was necessary to buy extra property on which to divert a highway, in order to eliminate a grade crossing.

To operate the line at the outset to the best advantage, terminal facilities have been provided at Corinth and Haleyville. These comprise a coaling station, water station, turntable and the necessary tracks.

Traffic arrangements with other companies provide that improvements be made on their respective lines which will enable the Illinois Central to operate from Jackson, Tenn., into Birmingham, 220 miles, by providing only a few additional facilities at Jackson, where it now has freight terminals, and by building complete freight terminals in Birmingham. The passenger trains will use the new union station along with all other roads now entering Birmingham. The freight terminals in Birmingham consist of a city yard, a freight house and a three-story storage warehouse equipped with electric freight elevators, on the property bounded by First and Second avenues, and Thirteenth and Sixteenth streets; also an outer yard at East Thomas. The city yard is convenient to the wholesale district, as well as being centrally located for the entire city business.

The storage warehouse at the corner of Sixteenth street and First avenue was formerly the Brewer building. It is 196 ft. 6 in. x 111 ft. and has been entirely remodeled. It is three stories high and equipped with electric freight elevators. In remodeling, it was divided into three sections, separated by fire walls. The entire top floors and two-thirds of the second floor are used for the storage of freight. One-third of the second floor is used for offices. Two of the yard tracks extend into the building on the ground floor. The ground floor space fronting on the alley between First and Second avenues is for inbound freight. A one-story addition, 342 ft. long and 30 ft. wide, has been built along First avenue. This addition, with the portion of the first floor of the original building facing First avenue, constitutes the outbound freight house.

The city yard connection is made with the 'Frisco System at Ninth avenue and Twelfth street, and required the construction of 2,800 ft. of double main track in Twelfth street from Ninth to Second avenues laid with 85-lb. rails. The yard contains 7,000 ft. of track. At First avenue and Twelfth street a single-track connection, 700 ft. long, is made with the Birmingham Southern. The outer yard, containing 47,000 ft. of track, connects with the Frisco at East Thomas, through which suburb a single track 1.95 miles long has been built.

Other terminal facilities are located adjacent to the outer yard; they comprise a 20-stall engine house, a machine and repair shop, a store-room and a joint office building for the operating and mechanical departments. These buildings are all of brick. There are also a 75-ft. turntable, two Illinois Central standard 125-ton coal pockets, two standard concrete cinder pits, a 100,000-gal. water tank with steel underframe on concrete foundations, a 10-in. penstock, a pumphouse and at [illegible], and the necessary piping and fire protection.

The construction of the line was begun in February, 1906. The grading and track laying of the section in Mississippi was completed during October, 1907, and the Mississippi & Alabama Railroad was put in operation during December, 1907. The part in Alabama was put in operation February 1 of this year.

The line should have good traffic from the start. Birmingham is an important manufacturing center, the iron trade being its leading industry. The Alabama ores, because of the phosphorus and silicon they contain, are especially suited to the open-hearth process. The steel industry in Birmingham has grown to large proportions in the last 12 years. In the same period the manufacture of cotton goods has quadrupled. The resources of the country traversed by the new line include coal, timber and agricultural products, of which cotton is the most important.

Brush Creek Viaduct; View of Structure.

Among Austrian railroads, briquettes are used only by the State Railroads. They used, last year, 33,000 tons made at Pilsen, Bohemia, and 11,000 tons of English briquettes. The coal used during the same period amounted to 1,400,000 tons. The briquettes were of two sizes, one weighing 2.2 lbs. and the other 4.4 lbs., both kinds being oval. The price for the Bohemian briquettes was about $3.60 a ton and for the English briquettes, about $5.80.—*Consular Report.*

Combination Freight and Passenger Station and Division Offices; Corinth, Miss.

Russell Harding.

Russell Harding died in New York City on March 3, 1908, from complications following a surgical operation. He was an exceedingly able railroad man. His early railroad experience was largely on the Gould lines, to which he later returned as an executive, but his first great reputation was made under James J. Hill on the Great Northern, of which entire system he was made general superintendent two years and a half after going to the road as superintendent of the Dakota division. His rapid advancement on the Great Northern resulted in his return to the Gould lines, which he had left as Superintendent and Division Engineer, as Vice-President and General Manager of the St. Louis Southwestern, an office which carries with it the presidency of the St. Louis Southwestern of Texas. In this capacity he proved himself a bright and capable executive officer and after about two years was called to be executive head of the Missouri Pacific system as Vice-President and General Manager, his authority later including the Denver & Rio Grande and the Rio Grande Western. It was on the Missouri Pacific that Mr. Harding made his most notable record. The road during the four years in which it was in his charge made great advances both in prosperity and in physical condition.

Mr. Harding was born on July 24, 1856, at Springfield, Mass. At the age of 14 he entered railroad construction service; three years later he was office boy and paymaster for his father, who was then a contractor on the Portland & Ogdensburg, a road part of which now belongs to the Maine Central, and the Vermont division of which belongs to the St. Johnsbury & Lake Champlain. In 1873, when he was 17, he went to Texas and worked for three years in the engineering department of the International & Great Northern. During the three years from 1877 to 1880 he was station agent, operator and ticket seller on the same road. In 1880 he was appointed Assistant Engineer of Construction of the International & Great Northern, and during the next six years was Engineer of Construction, Superintendent of Construction, and Resident Engineer in charge of tracks, bridges and buildings. In 1886 he was transferred to the Missouri Pacific as Superintendent and Division Engineer of the lines in southern Kansas, with headquarters at Wichita Falls, a post which he held for eight years.

Russell Harding.

Then he went to the Great Northern as Superintendent of the Dakota division, with headquarters at Grand Forks, N. Dak. Eighteen months later he was appointed General Superintendent of the Western district, with headquarters at Spokane, Wash., and 11 months after that General Superintendent of the entire Great Northern system. This position he held for a year and nine months. In the fall of 1898 he became the operating head of the St. Louis Southwestern, and on March 12, 1900, of the Missouri Pacific. In August, 1904, he left the Gould lines to take active charge of the "Great Central Route," made up of the Pere Marquette, the Cincinnati, Hamilton & Dayton, and the Chicago, Cincinnati & Louisville, being elected President of the first and Vice-President of the other two. When this system was bought by J. P. Morgan & Company for the benefit of the Erie Railroad, Mr. Harding was elected Vice-President of the Erie also, a position which he held for only a month, when the Erie retired from its purchase of these roads. In November, 1905, he left active railroad service to act as an adviser of H. B. Hollins & Company, bankers, of New York, to whom his extensive and successful experience proved to be of great value. He was associated with this firm up to the time of his death.

Mr. Harding had both ability and an attractive personality. In his business life he was courteous and kind; by his employees he was beloved, and to the lowest of them he was accessible. The men on the Missouri Pacific, with whom and over whom he worked, he regarded almost as his children. One of his strong points as a railroad officer was the fact that during his whole career there was harmony between him and his employees. His gracious manner and courtly dignity were bound up with a kind heart.

His genial character was shown to best advantage in his home life. He and his wife, who survives him, were an unusually congenial and loving couple. He was also a devoted son. His loyalty and affection to his mother were outwardly evidenced during her lifetime by the fact that a week never passed without his writing to her.

His remains were taken to Portland, Me., and laid beside those of his father and mother at a point chosen by himself on the slope of a hill overlooking the railroad.

Corporate Management Versus Government Control.*

My experience in the conduct of independent and impartial examinations of books of account and affairs has covered many years and has been concerned with the federal government, state governments and city governments. It has covered the field also of railroad, street railway, light, power and other public service corporations. It has dealt with industrial corporations, the so-called "trusts." It has taken me into banks, trust companies and insurance companies; into educational and charitable institutions. I think I may say it has taken me pretty generally over the whole field of public and private busi- my eyes have seen, it is the unas- ness, and if I am to judge by what sailable truth that almost any one of the men who stand at the head of our great business institutions is far more competent to run the government, and would run it more economically, more wisely and more honestly than any of those who are in the business of running governments.

I know as a matter of fact that the management of our great properties is generally intelligent and economical, and that the management of our government bureaus is generally loose, irregular and frequently dishonest; and when I read the articles with which so many of our newspapers and magazines are filled nowadays, reflecting on the men whose genius is developing the country's resources, and when I hear the proposals of politicians, from the most eminent to the least, for the passage of laws to hamper and restrict the energies of these men on the theory that their integrity is open to suspicion, my mind inevitably brings up the contrast that I always observe between a corporation's way of doing things and a government's, as disclosed by their respective records and books of account.

For the purpose of this comparison, incompetency and dishonesty need not be separated. Putting them together it is my deliberate estimate, that, judged by the highest standards prevailing in the best conducted corporations, there is less than 10 per cent. of both among men in the management of corporations generally, and at least 90 per cent. of both among public office holders, and I base this estimate upon my experience as a public accountant.

The men entrusted with the management of the corporations are better fitted to administer the affairs of such corporations and to exercise judgment in matters concerning both the investor and the public which takes their product or utilizes their franchises, than are those men who hold public office qualified to fill even their own positions, much less to undertake administrative control over corporations. The facts that prove this do not deal with the mere matter of honesty and efficiency. The organization of a public bureau is much less compact, much less harmonious in its operation than the organization of a great railroad or a great industrial corporation. The men at the head of such business organizations, in practically every case are experts, working diligently, in harmony, and ready to work to the limit of their endurance, with full and direct control of their subordinates. On the other hand, nothing can be more notorious (the results are obvious to every public accountant who investigates) than the fact that in nine cases out of 10 the

*From an address by Elijah W. Sells, C. P. A., before the Certified Public Accountants of New Jersey.

head of a public department spends most of his time promoting his political interests, and the employees generally, protected by the civil service regulations, are looking to see how little rather than how much work they can get into their appointed short hours.

Curve Superelevation.

BY M. L. BYERS,
Chief Engineer, Maintenance of Way, Missouri Pacific Railway.

The constantly increasing speed of trains, together with the radical change in the height of the center of gravity of the locomotive, due principally to the introduction of the wide firebox, has caused the subject of superelevation of curves to assume greater importance than was formerly the case.

The usual basis for determining the amount of superelevation is a formula in which the factors are the radius of the curve and the speed of the train. If it were possible to regulate the speed of trains so that all passed around the curve at the same speed, this formula might be practically satisfactory; on the contrary, however, it is always necessary to make the superelevation a compromise between the speed requirements of various trains. If the curve is prepared to exactly suit the speed of the fastest train, such as the limited mail train when it is several hours late, then difficulty is experienced in connection with the operation of the slow freight trains. If, on the contrary, the curve is elevated to suit the speed of the slow freight trains, then the track may be absolutely dangerous for unrestricted high-speed traffic and it may be necessary to place restrictions on the speed at which the curve can be used. It becomes important, therefore, to determine the limitations of safe operation and also to understand the practical effects on curved track of the various forces encountered in connection with train operation thereon.

Some years ago Mr. J. C. Bland, Engineer of Bridges, of the Pennsylvania Lines West of Pittsburgh, proposed to apply to the solution of the problem of superelevation of curves the fundamental principle employed in the design of masonry structures, namely, that the resultant of all of the forces must, for safety, lie within the middle third of the structure. Translating this into terms of track conditions, it means that the resultant of the centrifugal force and the weight of the locomotive (or car) must fall within the middle third of the space between the two rails of the track, the proper speed for a given elevation, or the proper elevation for a given speed being that which will cause the resultant to fall in the center of the track. From these assumptions we may derive formulae as follows:

Let G = Gage of track in feet (assumed in tables as = 4 ft. 9 in.)
- E = Superelevation of outer rail in feet.
- E_1 = Superelevation of outer rail in inches.
- V = Velocity of train in feet per second.
- V_1 = Velocity of train in miles per hour.
- F = Centrifugal force in pounds.
- W = Weight of locomotive in pounds.
- R = Radius of curve in feet.
- H = Height of center of gravity of locomotive in feet.

Proper Speeds and Elevations.

Construct Fig. 1 so that *df* shall represent the gage of the track G, *fe* the superelevation E; *bc* the horizontal line from the middle point *c* of the line *df* will represent the centrifugal force F, and the perpendicular *ab* the weight W of the locomotive, such that the resultant shall be perpendicular to the track and shall pass through the center point *c*.

In the similar right triangles *abc* and *def*, we have

$$ab : bc :: dc\ (= df, \text{ approx.}) : ef,$$

or W : F :: G : E

$$\text{or } E = F\frac{G}{W}$$

$$\text{but } F = \frac{W}{32.2} \times \frac{V^2}{R} \text{ (= Centrifugal force)}$$

Substituting we have

$$E = \frac{W}{32.2} \times \frac{V^2}{R} \times \frac{G}{W} = V^2\frac{G}{32.2\,R}$$

$$\text{or } V^2 = 32.2\,R\frac{E}{G}$$

$$\text{or } V_1^2 = 1.2\,R\frac{E_1}{G} = R\frac{E_1}{4} \text{ when } G = 4.75$$

$$V_1 = \sqrt{R\frac{E_1}{4}} = \text{Proper speed for a given elevation and curvature} \quad \text{(A)}$$

$$E_1 = \frac{4V_1^2}{R} = \text{Proper elevation for a given speed and curvature} \quad \text{(B)}$$

Maximum Safe Speed.

In Fig. 2, lay off the horizontal line *al*, and from any point *b* lay off *be* so that *be* shall represent the gage of the track and the perpendicular *em* to the line *al* shall represent the superelevation of the outer rail. From *c*, the center line of the track, erect a perpendicular to *be* such that *cd* shall represent the distance from the top of rail to the center of gravity of the locomotive, the point *d* representing such center of gravity.

Lay off on *be* the point *f* such that it shall lie on the middle third of the track and, consequently, that $cf = \frac{1}{6}$ gage of track $= \frac{G}{6}$.

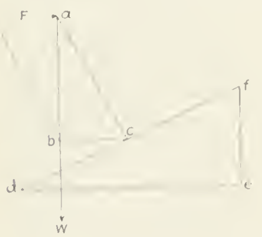


Fig. 1.

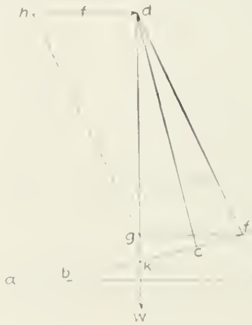


Fig. 2.

Fig. 3.

Draw *df*, and draw *fg*, a horizontal line intersecting at *g* the vertical line *dg* let fall from *d*.

Draw *gh* parallel to *df*.

If *dg* represents the force of gravity W, equal to the weight of the locomotive, acting through its center of gravity *d*, then will *dh* represent the centrifugal force F, acting also through the center of gravity *d*, of the locomotive, such that the resultant of these two forces shall pass through the point *f* on the edge of the middle third of the track, and being the maximum safe centrifugal force under the conditions.

As it does not involve a material error we will assume that

$$be = bm\ (= G)$$
$$cd = kd\ (= H)$$
$$fg = fk.$$

In the similar right triangles *bme* and *dck*

$$bm : em :: cd : ck$$

$$G : E :: H : ck, \text{ or } ck = H\frac{E}{G}$$

As $cf = \frac{G}{6}$, we have

$$kf\ (= fg) = ck + cf = H\frac{E}{G} + \frac{G}{6} \quad (1)$$

In the similar triangles *bme* and *fgk*,

$$bc : cm :: fk : kg$$

$$G : E :: \left(H\frac{E}{G} + \frac{G}{6}\right) : kg$$

$$\text{or } kg = E\,\frac{\left(H\frac{E}{G} + \frac{G}{6}\right)}{G}$$

$$dg = dk - kg.$$

Substituting for *dk* its value H and for *kg* its value in (1)

$$\text{we have } dg = H - E\,\frac{\left(H\frac{E}{G} + \frac{G}{6}\right)}{G} = H - \frac{E}{G}\left(H\frac{E}{G} + \frac{G}{6}\right). \quad (2)$$

If, in the right triangle *dgf*, we represent *dg* as equal to W, the weight of the locomotive, and fg as F, the maximum allowable centrifugal force, we have

$$dg : gf :: W : F$$

$$\text{or, } F = W\frac{gf}{dg} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Substituting in (3) the values of dg and gf in (2) and (1) respectively, we have

$$F = W\frac{gf}{dg} = W\frac{\left(H\frac{E}{G} + \frac{G}{6}\right)}{H - \frac{E}{G}\left(H\frac{E}{G} + \frac{G}{6}\right)}$$

But $F = W\frac{V^2}{32\frac{1}{6}R}$ ($32\frac{1}{6}$ representing g, the force of gravity).

Eliminating F, and dividing through by W, we have

$$\frac{V^2}{32\frac{1}{6}R} = \frac{\left(H\frac{E}{G} + \frac{G}{6}\right)}{H - \frac{E}{G}\left(H\frac{E}{G} + \frac{G}{6}\right)} \text{ or, } V^2 = \frac{32\frac{1}{6}R\left(H\frac{E}{G} + \frac{G}{6}\right)}{H - \frac{E}{G}\left(H\frac{E}{G} + \frac{G}{6}\right)}$$

$$\text{or, } V_1^2 = 14.95\,R\frac{\left(H\frac{E_1}{57} + 0.8\right)}{H - \frac{E_1}{57}\left(H\frac{E_1}{57} + 0.8\right)}$$

But, as E_1 will seldom or never be greater than 12 in., and as H will seldom or never be greater than 10 ft., the expression $\frac{E_1}{57}\left(H\frac{E_1}{57} + 0.8\right)$ will never exceed 0.61, or say, 6 per cent. of H, and so may be neglected, causing the formula to become, for practical use

$$V_1 = \sqrt{R\left(\frac{E_1}{4} + \frac{12.0}{H}\right)} = \text{Maximum safe speed in miles per hour} \ldots\ldots\ldots\ldots (C)$$

If we assume that the locomotive may stop on the curve, we have for that condition $V_1 = 0$, whence $\frac{E_1}{4} = -\frac{12.0}{H}$, or, $E_1 = -\frac{48.0}{H}$ = maximum safe depression of low rail. ....(D)

Determination of Height of Center of Gravity of Locomotive.

The height of the center of gravity of a locomotive can be determined experimentally as follows:

1. Weigh the locomotive, which should, for the purpose, contain the maximum amount of water in the boiler.

2. Place the locomotive so that the wheels on one side are on the track scale in such position that they are some 6 in. higher or lower than the opposite wheels; measure carefully the exact difference in elevation of the two sets of wheels and obtain the weight S, carried by the wheels on the scale. The forces acting are as shown in Fig. 3, where a represents the center of gravity of the locomotive, ac the line of action of the weight of the locomotive through its center of gravity, and S and S' the reactions of the supports of the two sets of wheels.

In the similar right triangles abc and dfe we have $ab : bc :: dc : fe$ (1)

in which $de = G = df$ (approximately, since ef is small)
$ab = ac$ (approximately, since bc is small)
$cf = E$ = superelevation,
and $ab = H$ = height of center of gravity of locomotive.

Substituting in (1), we have

$$H : bc :: G : E$$

$$\text{or } H = bc\frac{G}{E}.$$

If we let W = weight of locomotive, acting along the line ac, and S and S_1 the portions of the loads carried by the two rails c and d respectively, then, taking the origin of moments at d, we have

$$S_1 \times de = W \times dc, \text{ or } dc = S_1\frac{G}{W}.$$

Since $de = G$

$$dc = bd - bc = \frac{G}{2} - bc$$

Substituting, we have

$$S_1 \times G = W\left(\frac{G}{2} - bc\right)$$

$$bc = bd - dc = \frac{G}{2} - S_1\frac{G}{W}$$

$$H = \left(\frac{G}{2} - S_1\frac{G}{W}\right)\frac{G}{E} = \frac{G^2}{E}\left(\frac{1}{2} - \frac{S_1}{W}\right) =$$

Height of center of gravity of locomotive. (E)

Lateral Movement of Track Due to Centrifugal Force Exceeding Frictional Resistances Between Tie, Ballast and Subgrade.

Superelevating the outer rail of a curve does not destroy the centrifugal force; it merely transfers its effect to the track, and, in order to prevent motion resulting from the action of this force, the frictional resistance between the different layers of the ballast or subgrade, must be equal to, or greater than, the centrifugal force. When the speed is greater or less than that given by formula A, there is also a tendency for the tie to slide on its bed of ballast.

Let F = Centrifugal force = $\frac{W}{32\frac{1}{6}} \times \frac{V^2}{R}$

F_1 = Frictional resistance = cW, where
c = Coefficient of friction between tie and ballast, etc.

For safety, F should probably not exceed $\frac{c}{2}W$

$$\text{Then } \frac{c}{2}W = \frac{W}{32\frac{1}{6}} \times \frac{V^2}{R}$$

$$\text{or } V = \sqrt{16\,Rc}$$

Velocity which will cause sliding of track, ballast or subgrade. (F)

Let us investigate the case of R = 640' (a 9 deg. curve, about).

Then $V = \sqrt{10{,}240\,c}$.

For $c = 1$, V = 100 ft. per second = 70 mi. per hour = safe speed.

$= \frac{1}{2}$ = 71 ft. per second = 47 mi. per hour = safe speed.

$= \frac{1}{4}$ = 50 ft. per second = 33 mi. per hour = safe speed.

So the danger is not one to be entirely neglected; it is practically evidenced by the difficulty experienced in maintaining, in good line and surface, curves used at widely varying rates of speed.

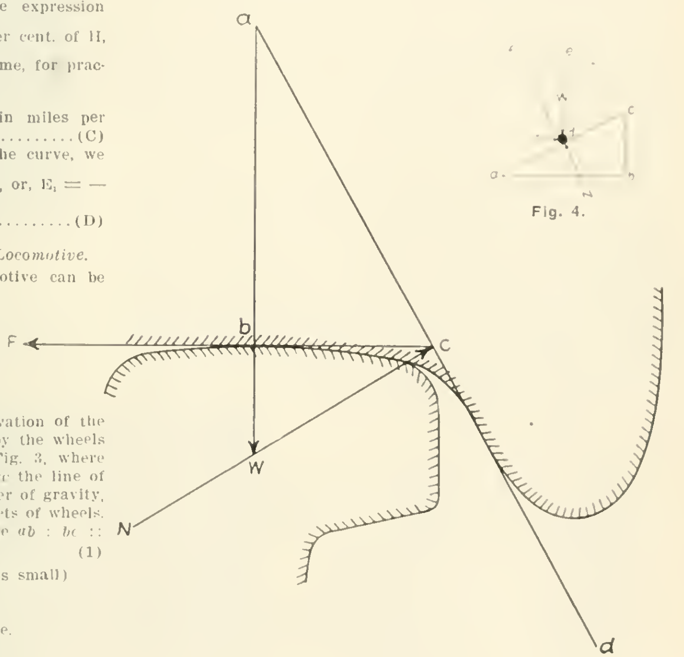


Fig. 4.

Fig. 5.

Lateral Movement of Track Due to Excessive Superelevation.

The slowly moving train is in the position of a weight on an inclined plane, where the three forces, W, N and T produce equilibrium (see Fig. 4).

From which we obtain $ab : bc :: de : ef$
or, $G : E :: W : T$

$$T = W\frac{E}{G}$$

Figure 4.

But the horizontal component T should not, for safety, exceed $\frac{c}{2}W$, so that $W\frac{E}{G} = \frac{c}{2}W$

$$\text{or } E = G\frac{c}{2} = 2.37\,c = \ldots\ldots\ldots\ldots (G)$$

For $c = 1$ E = 2.37 ft.

$= \frac{1}{2}$ = 1.18 ft.

$= \frac{1}{4}$ = 0.59 ft. = 7 in., which is a lower limit than that usually required to keep inside the middle third the resultant of all the forces for the fast moving train.

Wheel Flange Mounting Rail.

Fig. 5 shows the relative position of the wheel and rail when the flange is crowding the side of the rail. It is evident that one effect of centrifugal force exerted on the wheel will be to cause it to rise and that sufficient pressure would enable the wheel to mount the rail.

As the force F is resisted by the normal to the line *ad*, the vertical component resulting must equal W, the weight of the wheel before the wheel can rise, this condition will result under the following relation:

$$F : W :: ab : bc$$

$$F = W \frac{ab}{bc}$$

but, in practice, $ab = 2bc$,

which gives $F = 2W$.

But, $F = W \frac{V^2}{32^1/_6 R}$

Substituting, $2W = W \frac{V^2}{32^1/_6 R}$

or $V^2 = 64^1/_3 R$

$V = 8 \sqrt{R}$ approx. or $V_m = 12 \sqrt{R}$

For a 6° curve, $V = 12 \sqrt{955} = 360$ miles per hour approximately.

Evidently under ordinary conditions there is no danger of accident on this score; however, where an engine is improperly counterbalanced and running at high speed it is known that at times there is almost no pressure exerted by the wheel on the rail and it would seem possible that, under these conditions, a case might arise where the wheel will be lifted up and forced over the rail by the centrifugal force.

General Remarks.

All formulas in regard to the proper superelevation and safe speed for curved track are more or less open to the criticism that they are far more accurate theoretically than the data upon which their practical use is based.

All track, and especially curved track, requires more or less constant attention in order to preserve a reasonable degree of accuracy of line and surface. Inasmuch as any deviation from the true circular curve means a sharper resultant curve, errors in alinement produce the same effect as the uneven superelevation of a circular curve, and conversely, errors in uniform superelevation of a circular curve produce the effect of the curve being out of line.

When curves are not spiraled it is necessary to commence the encountered and the tendency of course is toward overturning the locomotive in the direction of the high rail. Naturally perfect results cannot be obtained under this condition and it has become the general practice to spiral all sharp curves.

It is known from shop tests of locomotives that with some engines at high speeds, due to imperfect counterbalancing, there are times in the revolution of the driving wheel where there is absolutely no pressure on the rail from that wheel, the pressure having been transferred to the opposite driver which carries an abnormal load for the instant. This, of course, introduces a new factor in determining the resultant of the various forces at work on curved track and with a locomotive running at a speed higher than that corresponding to the elevation of the curve serious results might in some case be produced.

The long rigid wheel base of some locomotives has, of course, the effect of considerably increasing the pressure of the flange against the head of the rail.

General Conclusions.

1. It is undesirable to use a greater superelevation than that which will permit any locomotive to stop with safety on the curve.

2. Curve tables which state not only the proper elevation for a given speed, but also the safe maximum speed for a given elevation for the locomotive with the highest center of gravity in use on the railroad, should be used.

3. All curves should be given such superelevation as will make them safe for the maximum speed at which a fast train will be apt to use them, or special instructions restricting the speed should be placed on the time cards.

4. All curves of 1 deg. or over and used by trains at high speed should be spiraled and the change from zero to maximum superelevation should occupy the limits of the spiral.

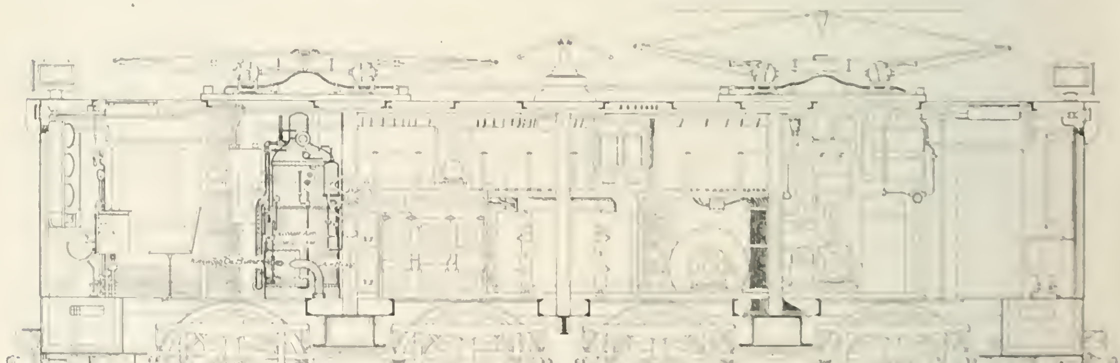
5. The ill effect of high center of gravity, long wheel base, and inadequate counterbalancing of locomotives, should be kept in mind with a view to minimizing their undesirable results on the track.

6. As the superelevation selected is usually a compromise between opposing speed conditions, the extent of the variation of the extreme conditions from the compromise should be kept in mind and the character of the track regulated accordingly.

Train Heating on Electric Divisions of Steam Railroads.

BY CHARLES M. RIPLEY.

The establishment of great passenger terminals in New York City, involving extensive tunnel systems and other improvements looking not alone to the more economical and expeditious handling of traffic, but also (and in a measure primarily) to the minimizing



Locating of Heating Apparatus in New Haven Electric Locomotive.

superelevation on the straight line some distance in advance of the point of the curve, a very general practice being to place one-half of the run-off on the straight line and one-half on the curve. The result of this practice may be illustrated as follows:

Assume a curve with 6 in. of elevation, then the elevation at the point of curve will be 3 in.; just before reaching the point of curve the effect produced is that of encountering on a straight line a spot where one rail has become 3 in. out of surface, this would be regarded as a dangerous condition inasmuch as it tends to overturn the locomotive in the direction of the low rail; immediately upon passing beyond the point of curve on to the curve, the condition of a curve with but one-half of the proper superelevation is

of accidents due to the obscuration of signals by reason of smoke in the tunnels, has led to the employment of electric traction within the terminal stations and for a distance of several miles along the right of way. The adoption of electric traction at once gave rise to the problem: How shall the passenger coaches be heated after the steam locomotive is supplanted by the electric locomotive which is to haul the incoming train a distance of several miles, and, conversely, must haul the outgoing train an equal distance before it can depend upon steam from the steam locomotive to heat its coaches?

In the solution of this problem economy as well as efficiency must be studied. To install obsolete stoves for temporary use in the individual coaches, a method of heating as ineffective as it is fraught

End View of Heating Apparatus.

with danger, was not to be thought of. To heat the cars by electricity, while perfectly feasible, involves not only the expense of equipping every coach with electric heating apparatus, in addition to the steam pipes which would be in use during the major portion of the run, but also involves the considerable loss of efficiency always accompanying heating by electricity.

Side View of Heating Apparatus.

The mechanical engineer has been called in to give assistance to the electrical engineer in this heating problem, and there have been devised two methods now in successful operation; one adapted to the rolling stock of the New York Central and the other to that of the New Haven.

So far as these methods are identical, they may be briefly described as follows:

In the electric locomotive is installed a vertical boiler, which, as soon as the steam locomotive is unhooked and replaced by the electric motor, is connected to the regular piping system of the train. Thus, with virtually no interruption steam heat is supplied to the coaches, regardless of the change in the mode of traction, without necessitating any addition to the regular heating apparatus of the coaches. The fuel for this boiler is ordinary commercial fuel oil.

The photograph shown herewith was taken in the inside of one of the New York Central electric locomotives, and shows the oil-fired auxiliary steam boiler now used in heating trains on the electric division. The apparatus consists of a multi-tubular boiler mounted on a cast iron firebox lined with brick. The boiler has 800 copper tubes ½ in. in diameter and fitted with steam and water gages, try cocks, safety valve set to 80 lbs., blow-off connection and automatic feed-water regulator.

Water and oil are carried in two steel tanks under pressure. The pressure of the water is 135 lbs. per square inch, which is sufficient to supply the boiler without employing a feed pump. The oil is stored at a pressure of 25 lbs. per square inch. The air for supplying this pressure is taken from the main reservoir in the locomotive air-brake apparatus and is reduced to feed the oil tank by means of a regulating valve.

The water tank is of 200 gal. capacity and is filled by attaching a hose on either side of the locomotive and opening the vent valve on the top of the tank. The water is then forced up into the tank by the pressure on the mains. Try cocks are fitted to test the height of the water in the tank. The oil tank, which is 40 gals. capacity, is fitted with two glass gages to enable the operator to ascertain the amount of oil contained.

Water is led to the boiler through an air trap. In the photograph the screen is shown thrown back to better show the apparatus under the boiler. The Kirkwood oil-burning system manufactured by Tate, Jones & Co., Inc., of Pittsburgh, Pa., which supplies the fuel for the boiler, is arranged to use either air or steam to atomize the oil. The change is made from one to the other by means of a three-way cock. Air is used to start the fire and steam when boiler pressure is reached.

The main difficulty in connection with oil as a fuel is to obtain complete combustion of the ordinary commercial fuel oil. In order to obtain this complete combustion of such oil it must first be completely atomized. To atomize each gallon of oil there is required approximately 60 cu. ft. of free air at a pressure of 15 to 25 lbs. per square inch. There must then be supplied by one or the other of two means, approximately, 1,440 cu. ft. more to give sufficient oxygen to the flame.

The New York Central apparatus is arranged to allow considerable space around the nozzle of the Kirkwood burner, through which air from the surrounding atmosphere is drawn into the combustion chamber by the force of the injected atomized oil. This method of drawing in the 1,440 cu. ft. of air has been known to result in a noisy burner at times, and it has been open to the objection that it is difficult to control the amount of air drawn in. It is also obvious that the use of a greater amount of compressed air than is necessary for atomizing is required in order to draw in a sufficient amount of the surrounding air. This method makes out with compressed air any deficiency in the quantity of surrounding air drawn in. A decided advantage, however, in this method is that it makes unnecessary the expense of installing any extra blowing apparatus and drive for same, both of which take up considerable room in the rather confined space of the electric locomotive.

The electric system of the New Haven road is rather unique in the field of American electric traction, inasmuch as transformers are used in the locomotive to reduce the voltage of the alternating current supplied. The advisability of cooling these transformers by air needs no comment; an air-blast apparatus has been used both to cool the transformers and to assist in burning the oil. The accompanying drawing illustrates a New Haven electric locomotive, in which a Kirkwood oil burner is installed. A low-pressure fan blast at from 3 to 4 oz. pressure is used for blowing into the combustion chamber the necessary air for combustion. Thus compressed air is needed only for atomizing the oil.

This scheme cuts down the amount of compressed air used and increases the efficiency of the fire. It enables the operator or fireman to completely control the nature of the fire by varying the quantity and pressure of the air pressure blast for combustion. The oil and compressed air for atomizing is regulated by one lever, and the ratio between the oil and the compressed air for atomizing always remains at a constant point, which has been found to be the best for complete atomization. The fireman or operator cannot make an inefficient or smoky fire, the regulation of the air blast varying only the nature of the fire from a soft and non-oxydizing flame to a hot concentrating fire.

Both the New York Central and the New York, New Haven & Hartford railroad heating systems are simple to operate, and no extra men are required in the cab to operate them, this work being part of the duty of the fireman.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

X.

LINE TRAFFIC IN THE UNITED STATES COASTING TRADE.

The United States coasting trade has always been composed of two elements and the line traffic in its service has been the sport of at least two circumstances.

The two elements of the coasting trade are, first, the local exchanges between the various parts of the United States, which are ever growing; and second, the collection of produce at convenient places for export, and the distribution of imports from greater to lesser ports. This foreign trade factor is an uncertain one, having fluctuated greatly from time to time in our history. This fluctuation arises, and with it the changes in line traffic, from the differing degree of development of our line traffic from the various American ports to foreign ports. If there are many ports on an equality of foreign connection there is little need for collection and distribution among them in connection with the foreign trade. If some ports have a great predominance in foreign line connections the coasting trade will center at such ports and develop largely.

The second factor that has influenced the line traffic, has been the growth of the American railroad system. At one time the coasting vessel was almost the only means of getting from port to port. Then came the railroad which took away from the coasting vessel all possible claim to being a fast line connecting the various parts of the United States. This left the coasting lines only such traffic as they could snatch from the competition of the speedy railroads above and from the slower and cheaper schooner and latterly the yet cheaper barge below.

In its origin, coasting line traffic is closely akin to the ocean line traffic as was pointed out in the article on the "Origin of Line Traffic." In the Colonial time the coasting trade was light and with the small vessels of that day each colony traded direct with the mother country, more directly, indeed, than do many of the American commonwealths at present. In the era between the Revolution and the War of 1812, the same conditions prevailed and one port was almost as good as another. This was the period of greatest democracy among American seaports. New Orleans, Charleston, Savannah, Baltimore, Philadelphia, New York, Boston and Salem were more nearly on an equality than they ever have been since. The difference in their population was surprisingly small. Each had that breadth of sea connection which the enterprise of her merchants brought; and it was a wide range, as these cities, with the exception of Salem, were the metropoli of states which in the days of the confederation were not only politically independent, but also commercially independent and isolate except for the merchant ship that roved alike to foreign and to coasting ports.

The close of the war of 1812 changed all this. New York straightway, upon the declaration of peace in December, 1815, became the center of packet lines to Europe, especially Liverpool the great market for cotton and other American produce. By 1820, these lines had multiplied until there was a weekly sailing on regular schedule and the ships were the fastest on any sea. These New York packets carrying mail, passengers and fast freight straightway put into our coasting trade the stimulus for regularity that ripens into line traffic. If the New York packet left regularly it was an advantage to reach New York just before she started, and it was desirable to get the European mail and passengers and goods started down the coast at regular intervals so the New York lines were really the mother of the coasting line services that sprung up promptly upon its inception.

The New York foreign connections had an influence not measured solely by the founding of coasting lines, for they served also as a magnet to draw to New York the chartered vessels from the South Atlantic ports. This influence was not alone in producing this result, for the claim was also advanced that the New York merchant gave better credits and other inducements than were to be obtained further south. Transportation, however, was no weak force in this drawing influence, and the decade 1821-31, the ten years following the establishment of New York's weekly service to Liverpool, saw a marked shifting of foreign trade. The country at large and particularly the south was prosperous. The foreign trade of the port of New York increased 100 per cent. in eleven years following 1821, and that of Virginia with its tidal estuaries declined two-thirds, and so did that of South Carolina. This, however, did not mean a declining commerce, despite the alarm and the investigations by commission and convention. It was merely a growth in the coasting trade by which New York absorbed the foreign trade of smaller ports that had dealt directly with Europe in the epoch of the merchant carrier 20 years before.

New Orleans was far enough away not to be so greatly influenced by New York's maelstrom and retained her commercial independence all through the packet ship epoch and practically down to the Civil War. The gulf packet lines went to New Orleans as did those of the Atlantic to New York and to a lesser degree to Boston. Until 1860 Galveston traded entirely through New Orleans, and the connection of New York and New Orleans was rather slow in founding. The reasons of this were that New Orleans was rather independent of New York in the foreign trade, and New York was rather independent of New Orleans in the coasting trade through her ability to secure cotton, lumber, meat and grain and naval stores at nearer ports.

From 1820 to 1840 there was a large development of coasting packet lines along the American coast from Portland, Maine, to New Orleans. The earliest of these lines appears to have been in 1820 from New York to the southern ports. Baltimore had had a line to Norfolk as early as 1785, but this can scarcely be called a coasting line because it was entirely on inland waters. In 1826 Baltimore had its first regular service by sea, a line to Savannah and New Orleans.*

Upon the founding of steam connection between New York and Savannah in 1848 there were six packet lines connecting these two ports.†

The difficulties of sail navigation on such a windy, stormy and dangerous coast as that of the American Atlantic made the line service of packets, at best, but irregular and undependable. Efforts were early made to put steamers in the coasting service, but the steamer in its origin was a river craft and its first successes in giving that line traffic with a schedule having an arriving as well as a departing end, was in that part of our shore waters which partly resembles a river and which is also adjacent to the Hudson the original home of the steamboat.

Long Island sound, being a kind of compromise, half sea, half bay, was a good place for the steamer to experiment with line traffic on salt water. In its traffic development, Long Island sound was a sort of offshoot from the Hudson river, the first home of the steamer. For at least 40 years the same boats were used interchangeably on the two bodies of water. During the war of 1812, boats built for the Long Island route to New Haven were unable for fear of the enemy to run on the sound and were put on the Hudson in 1811. In March, 1818, the two steamers built for the sound began a service from New York to Norwich, the steamers connecting with each other at New Haven, one attending to each end of the route. In 1822 they were withdrawn from the New York, New Haven and New London route, because of the retaliatory law of Connecticut against the New York steamboat monopoly of Fulton, and sent instead to Providence and Newport. This action of the New York and Rhode Island Steamboat Co. was regarded as hazardous in the extreme, because of the dangers of going into the open sea to round Point Judith. The venture was a success, and the forbidden Connecticut traffic was picked up at Long Island points whither it was taken in connecting sailing packets. The Providence line kept on and the two trips each way per week in 1822 were changed to four trips per week in 1825. In November, 1821, the New Haven Steamboat Company was organized by the shareholders of the packet company running between New York and New Haven and steamers were put on the route.

The efforts of sailing vessel owners to get a tax laid upon steamboat passengers failed in the sound states, but a new line to Providence in 1827 was a more serious blow to the finances of the pioneer company, because it cut the fare down from $10 to $6. In 1831 it was cut to $1, then to $3, but the next year it was $7 by each line.

By this time, line traffic by steamers was well established on the sound, and it has continued from that day to this. In 1835, when the railroad connecting Providence and Boston was completed, the sound steamers established schedule connections which were as good as those of the trains with which they connected, and such connection by high-class steamers has been continuous, although there are freight lines having no such scrupulous schedule connection with the railroads.

The thorough and efficient line organization of the steamers on Long Island sound in 1830 was far different from the situation on those routes that had to stand the full fury of the Atlantic

*"Chronicles of Baltimore," J. T. Scharff, p. 420.

†Morrison's history "American Steam Navigation," p. 448.

The 20 years 1818-1838 were a time during which the steamer was evolving from a river craft to a sea craft and the short journeys along the Atlantic coast tempted men to try the coasting trade before the ship was ripe for it. For five years beginning in 1820 the steamer "Robert Fulton" plied unprofitably on the route from New York to New Orleans via Charleston and Havana. At the end of this time she was converted into a sailer. Between 1836 and 1839 steamers were run from New York to Charleston and from Baltimore to Savannah, and another attempt was made on the route to New Orleans. Two terrible disasters, coming in the midst of the great financial depression, caused all these attempts to be given up by 1839; and just at the time the Cunard and other companies were succeeding with their steamer lines on the Atlantic, the coasting lines in the open sea came again to consist entirely of sailing packets. In 1842, there was no steam coasting line outside of protected shore waters, but the North Atlantic steam lines with their previously unknown precision made louder the demand for relief from the uncertainties of packet, and 1846 was the real beginning of steam service and therefore of regular line service between New York and Charleston. Spofford & Tiletson, shipping merchants of New York, contracted to carry the United States mail, and despatched the first steamer in September. In 1848 there were similar steam mail contracts to Savannah and New Orleans. The service to Norfolk, which had been tried and given up in 1835, was permanently established in 1844 by the founding of the Clyde Line to Baltimore. Richmond was connected with New York in 1835 and Boston with Philadelphia in 1852. For ten years, beginning 1850, Philadelphia was actively connected with New York by the outside route.

The Quaker City, 1854; 1,143 Tons. Regular Line to Charleston.

The route affording the most excitement during this period was that to the Isthmus of Panama. The gold rush of 1849 made plenty of travel in that direction and put a high price upon transportation in that direction. Lively competition ensued for the prize, sometimes the vessels stopped at Charleston or Havana or New Orleans, or all three, or none of them. Sometimes there was one line, sometimes there were several. The keenest competition was that between the Pacific Mail and the United States Mail Company, whose rivalry wound up in a consolidation in 1850 of the service to Chagres in the hands of the United States Mail Company.

In March, 1852,† there plied from New York seven lines of coasting steamers, one to Philadelphia, two to Norfolk, two to Charleston, one to Savannah and one to New Orleans via Havana. There were no less than ten diligent advertisers of lines to the Isthmus of Panama making connection for the Pacific at Chagres or San Juan de Nicaragua. Some of these lines had only one steamer, and during this month of March, 1852, a total of 20 steamers left New York in the San Francisco trade, while 30 departed on the seven lines of the coasting trade, Charleston being the destination of nearly one-third of the 30,000 gross tons involved. The height of the San Francisco rush was probably in February, 1849, before the isthmian routes were in full operation; during that month 22 sailing vessels left New York for California with 2,000 passengers. There were ten from Boston and other ports in proportion.

†*Railroad Gazette*, Aug. 15, 1902, p. 638. An excellent and thorough article by Ray Morris, to which the author is much indebted.

The date 1850 may be taken as marking the firm establishment of steamer lines on the transatlantic service, and it also marks their thorough establishment and extension in the coasting trade. In this work perfection followed quick upon the heels of installation, for the fifties mark the period of highest relative development of the coasting trade. The Collins and Cunard liners raced across the Atlantic to and from New York, and the wealthy, luxurious southerners had no such service from their own ports to Europe. They must connect with New York, but the railroads were in that day a poor dependence for they were new, rough and bad, breakdowns were common, changes were frequent, sleeping cars were practically unknown. What roads there were in the south commonly connected the interior with the nearest port rather than with the North. Hence the traveler who could sought the coasting steamer to New York whether he were bound to Europe or only to the northern states. The coasting steamers that went to Charleston and Savannah were next only to the Collins line in comfort and luxury, and they were as fast as the coasting lines have ever been until very recently. Their passenger traffic was extensive.

The Civil War, of course, entirely demoralized the trade and transportation with the south for a time. During a few years succeeding the war, however, the lines resumed their antebellum importance. The railroads were still inadequate and the passengers still sought the steamer. At the same time there was general prosperity and a great traffic movement that brought shipping profits and led to the creation of many lines. There were in March, 1872, 23 deep water lines in the place of the seven lines in 1852 at New York, besides smaller lines and sound and river boats. During this month these lines despatched 117 steamers with about four times the tonnage total of 1852. The average tonnage was almost exactly 1,000 tons per vessel.

The predominance of New York in the transatlantic line traffic and consequently in the coasting lines caused it to become quite largely the clearing house for the coasting trade. Go to New York and transfer was the easiest way. From the Civil War onward that city had steam connection with the coast of Maine at Portland, with the leading gulf ports, and with the chief ports between. In 1859, the Boston Chamber of Commerce tried to improve the connections of its port, because the only way from Boston to points below Baltimore was by sailing vessel direct or by transshipment at New York. In 1854 the Merchants & Miners' Transportation Company, a combination of Maryland and Massachusetts capital, had started service which connected Baltimore with Boston without making a New York stop, and the agitation of commercial interests in Boston in 1859 had the service which also included Providence extended to Savannah in addition to the two Chesapeake ports of Baltimore and Norfolk. Excepting the interruptions due to the war, this service has been steadily maintained, and is one of the few important services that does not touch New York, and the only one that steams regardlessly past that port. The other services on a par with this have been the Boston services to Maine and the Canadian Maritime Provinces and the Philadelphia lines to Savannah and Florida points, but these Philadelphia lines have not been steadily maintained.

Steamer Texan. The American-Hawaiian Line Connects New York and San Francisco via the Tehuantepec National Railway.

The decade following 1873 marks an epoch in the coasting line traffic. The country then suffered from general hard times with the accompaniment of reduced traffic, loss of dividends, failures, reorganizations, consolidation and forced economies. For the coasting lines, this was accentuated by the development of the railroads into effective competition for through passengers, mail and fast freight. This loss threw the coasters into a distinctly secondary position. They could not compete with the railroad in these respects, and it was recognized as being of no use to try, so the speed did not increase. Greater efficiency was sought in a larger and more economical vessel. The passenger traffic had changed from the general body of travelers to those persons who, for special reasons, wanted a slow sea journey. This brought about a considerable summer traffic and a negligible winter traffic.

These changes in condition recorded themselves in the statistics of the traffic. In March, 1882, the 23 New York lines of 1872 had become 11, the 117 clearances had become 109, but the average size of steamer had increased about 50 per cent. During this period, also, the railroads which had dealt such competition, also began to annex the steamer lines, the best examples of this being the Morgan Line to New Orleans and the Savannah Line. Ten years later, these were the most efficient lines on the coast.

From 1880 to the present there have been surprisingly few changes in the coasting line traffic, other than in its increase in quantity. The departures from New York in the month of March have been approximately as follows: 1872, 120,000 tons gross, 1882, 160,000, 1892, 280,000, 1902, 410,000. In 1872 Boston led by being the destination for over a sixth, with Norfolk and Charleston closely following. In 1882 Norfolk had a fourth with Boston and Charleston considerably in the rear. Ten years later Norfolk was still first with more than a fifth, and Savannah and New Orleans following. In 1902, Norfolk led with a fifth of the whole, with New Orleans and Boston pushing it for first, and crowding each other for second place.

This growth of tonnage is essentially for the freight service, as passengers and speed have been steadily declining in the manager's mind, since the loss to the railroads of the mail service that occurred 30 years ago. Exceptions to this should be made for the Morgan Line (Southern Pacific), which connects New Orleans with New York in five days, and is a link in a transcontinental route, and also of the passenger service of the Old Dominion Line to Norfolk and the much advertised passenger line to Maine through Long Island sound. The extensively patronized passenger boats of the Long Island sound routes are not included in the above cited figures of New York traffic which are for deep sea vessels only.

Mention should also be made of the regular services that have been maintained throughout nearly the whole of the last hundred years between New York and Philadelphia by sea, and between Philadelphia and Baltimore via the canals during the season of open navigation. The Chesapeake bay with lines connecting Norfolk with Baltimore and Washington is in the class with the Hudson river in respect to earliness of the development of lines, the frequency of service and the type of steamer used.

The years 1906 and 1907,* following a long period of quiescence, were a time of interest and excitement in coasting trade circles. At the beginning of 1907 Boston had seven coastwise companies with lines to ten American ports between Eastport and Jacksonville. New York had 12 companies with lines to 19 ports between Portland and Galveston. Philadelphia had five companies with lines to eight ports from Boston to Savannah. Baltimore had three companies reaching six ports, including Boston and Savannah. The interest of the year centered in the rapid and mysterious consolidation of at least nine companies in the hands of Chas. W. Morse. His plans were uncertain, but he was in a position to go far towards controlling rates where he had no competition, or to make lively war with the two great railroad coasting line owners, the New York, New Haven & Hartford and the Southern Pacific. These companies made some defensive moves. The latter company announced† its intention of ordering very large new ships and of improving the service and extending it to give Galveston and New Orleans connections for New York, Philadelphia and Baltimore with stops also at Havana. The New Haven road purchased the Boston and Philadelphia steamship line and the fleet of the Merchants & Miners' Transportation Co.

The ten companies controlled by Mr. Morse in 1907 were, first, the Kennebec, Boston & Bangor Steamship Company with services from Boston to Maine points; second, the Eastern Steamship Company with lines from Boston to Portland, Eastport and New Brunswick ports; third, the Clyde Line with 21 steamers running from Boston to Charleston, Brunswick (Georgia) and Jacksonville; from New York to Philadelphia, Charleston, Jacksonville, Wilmington, N. C., Georgetown, S. C. and lastly to ports in San Domingo; fourth, the Maine Steamship Company, which with the Eastern Steamship Company has 22 ships, New York to Portland; fifth, the Metropolitan Line, four ships, New York to Boston; sixth, the Mallory Line, 11 ships from New York to Mobile, Brunswick, Ga., and Galveston; seventh and eighth, two lines on the Hudson river; ninth, the New York and Porto Rico Steamship Company with nine ships, and tenth, the Ward Line to Cuba with 20 ships.‡

From the examination of such an array as this it becomes plain why the newspapers referred to Mr. Morse's almost complete control of the Atlantic and Gulf shipping. He had more than half of the companies, much more than half of the ships and a complete equipment of services to the whole coast and all of the Greater Antilles except Jamaica. The lines that remained without the grip of Mr. Morse or a strong railroad company were few and comparatively insignificant. The developments of the enterprise were watched with great interest by persons taking cognizance of the coastwise situation. Despite the many theories few anticipated the sudden and spectacular toppling of the whole structure.

The structure itself was impressive but showed its weakness from afar. Physically its anatomy was good. With one focus at Boston many lines radiated to the eastern ports. New York, the greater of the two service foci, had a fine array of lines to the southward, including as extreme ports San Juan, Porto Rico and Vera Cruz. With these southern lands there is great and growing trade. The service groups were finally articulated by lines connecting New York and Boston.

The elements of weakness were financial. Some of the purchased companies were secured at a high figure. The whole was held by a holding company, "The Consolidated Steamship Lines Company," which had an ambitious scheme of capitalization for replacing $86,757,000 of securities with $118,757,000. Watering stock on land is one thing, but watering it on the water is another. It seems to be a case where like cures like. The real property value of the 97 steamships, 65 lighters, seven tugs and the wharves, piers, etc., was put at $45,000,000 by the bankers who tried to justify it on the basis of prospective profits because "The fundamental idea of this consolidation was the benefits to be derived from concentration of control which would result in the working of all lines under one management, the securing of the lowest possible cost of operation, the elimination of idle tonnage, the curtailment of pier room, harmonious working arrangements between the various lines, the most favorable price for the purchase of supplies and fuel, the lowest cost of insurance, repairs, legal expenses, etc."

High purchase prices, watered stock, over-building of new ships and strong competition with strong rivals were bad, but despite these drawbacks, some well-informed steamship managers think that he might have succeeded had he stuck to the shipping business. But this was not to be. Mr. Morse busied himself in Wall street where high finance, trust companies, pyramid banking, corners in copper and alliances with Mr. Heinze caused his financial downfall to be one of the first symptoms of the 1907 panic. The steamship pyramid fell with the banking pyramid and by the end of October 1907, the great holding company of the year before had become an empty shell. Its 120 millions of securities were worth six millions, its New York offices even were closed up and its headquarters removed to Boston. Within a week the underlying companies were transferred to their old managements. In explanation of this move H. P. Booth, President of the Cuba Mail Steamship Company said: "The different lines forming the Consolidated Steamship Co. will in future be run independently, just as they were before the consolidation. We shall attend to our business just as if there had never been a consolidation and the other companies will do the same as we do." Any earnings after paying interest on the underlying bonds were to go to the Consolidated Company.

But this reorganization was insufficient and by February 1908 the clamor of the holders of unpaid coal and other bills was so great that receivers were appointed in three states and the final dissolution of this greatest of coastwise combinations into its original elements was assured. For a time it was questionable even if its promoter would be able to maintain his personal liberty while attempting to extricate himself from his wonderful financial tangle.

(*To be continued.*)

*New York Commercial, July 3, 1907.
†New York Commercial, Feb. 15, 1907.
‡Marine Review, Mar. 14, 1907, and Railroad Gazette, Nov. 23, 1907.

New Railroad in Africa.

The Benguella Railroad is now being built between Lobito and Katanga, Africa. The principal object of the new road is to tap the rich mineral field of Katanga, in the southern part of the Congo Free State. It will traverse the entire province of Angola and open vast areas to commerce. It may eventually be extended to connect with the Cape to Cairo and Rhodesian systems. This would shorten the journey to Pretoria or Johannesburg by 3,000 miles, and reduce the time occupied in transit by four or five days. It is expected that the line will reach Katanga in about four years. It will open up a copper industry which, it is believed, will become one of the greatest industries in Africa. Besides copper, the minerals of Katanga are tin and gold.

*Marine Review, Mar. 14, 1907.

GENERAL NEWS SECTION

NOTES.

The pay of freight handlers on certain districts of the Erie has been reduced from $1.50 to $1.35 a day.

It is estimated that 20 per cent. more people went to the New Orleans Mardi Gras festivals this year than last.

It is understood that over 200 short-line railroads have joined in a petition to Congress for a readjustment of the pay for carrying mails.

The Pennsylvaania Railroad has opened a new headquarters at Trenton, N. J., for the instruction of motive power men of the New York division in the operation of air brakes.

The third of the Pennsylvania's four tunnels under the East river, connecting New York and Long Island City, joined its headings on March 5. The fourth may be through by the end of this week.

The Erie is said to have annulled the movement of all freight trains on Sunday, except those carrying live stock and perishable merchandise. The order will remain effective until business conditions improve.

The Baltimore & Ohio has announced that it will restore, on April 1, the old rate of $1.15 per ton on bituminous coal from the Fairmont district to Cleveland and Lorain. The rate has been $1.05 for some little time.

The Burlington announces for the coming summer excursions to Colorado common points between June and October, on the same basis as last year without regard to the efforts to maintain passenger business on a uniform 2-cent basis.

The Boston & Maine has sent a circular to its conductors, trainmen and firemen asking them to accept a 5 per cent. wage reduction to continue only until July 1, it being agreed that upon the first day of July this reduction shall be discontinued. This arrangement has been accepted by the employees of the road.

Announcement is made that the United States Steel Corporation has 95,000 stockholders on its books, a number considerably larger than any before recorded in the history of the company. The Steel Corporation believes that the entire number of shareholders probably approximates 125,000, owing to the fact that many bankers and brokers carry blocks of Steel securities under one name for a large number of holders.

The Wisconsin Railroad Commission has dismissed a complaint against the use of gasolene motor cars between Madison and Freeport, Ill., on the Illinois Central Railroad. The complaint was made on the ground that the motor was "dangerous and inadequate as a means of locomotion." The commission, in dismissing the complaint, held that the use of the motor cars marks an advance in railroading and will result in great benefit to the public.

The Interstate Commerce Commission is opposed to the Fulton bill prohibiting railroads from advancing rates in the face of a protest made by a single shipper until the commission shall have passed upon the reasonableness of the increase. The commission says that to give to the protest of a single shipper the effect of preventing the advance of any rate until the reasonableness of that advance can be affirmatively determined by the commission, would establish a hard-and-fast rule of doubtful fairness to the railroads and of questionable advantage to the public. Until conditions become more stable, the commission believes that wider latitude of discretion on the part of carriers than this measure allows, should be permitted.

The Sargent Re-Railer.

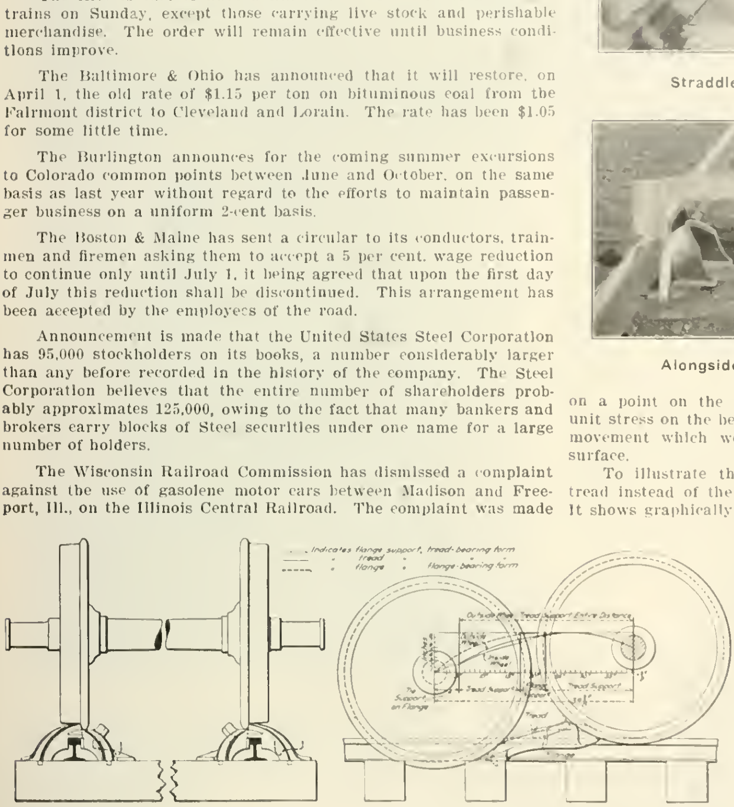
Two improved forms of car replacers, on which the treads of the wheels, instead of their flanges, bear, are illustrated herewith. The principle on which all car replacers work is to raise the wheels by inclines and guide them laterally to the rails by ridges or grooves engaging on the flanges, or by sloped surfaces down which the wheels slide to the rails. By using the tread-bearing principle in the replacer here shown, the concentration of weight

Straddle-Rail Type of Sargent Re-Railer.

Alongside-Rail Type of Sargent Re-Railer.

on a point on the wheel flange is avoided, thereby reducing the unit stress on the bearing surface, and also the resistance to lateral movement which would result from the flange cutting into this surface.

To illustrate the advantage of picking up the wheel on its tread instead of the flange, the accompanying chart was prepared. It shows graphically the travel of a 36-in. wheel from a position off of the rail, between two ties, to complete rerailment, and shows the proportionate rate of elevation for both the tread-bearing and flange-bearing forms. It will be observed that the former affords tread support for the outside wheel for the entire distance, and for the inside wheel for all but 15 per cent. of the distance. The initial lift for this form as compared with the other is lessened by an amount equal to the height of the flange, or $1\frac{1}{8}$ in. Also, the use of wooden wedges to start the wheel on the replacer is unnecessary; the derailed wheel rests on the ties on its flange, so that the tread runs directly on the replacer.



Comparative Wheel Travel on Tread-Bearing and Flange-Bearing Re-Railers.

Another advantage claimed for this form of replacer is that because of the tread-bearing construction the metal may be so disposed as to produce a lighter section than commonly used, without sacrificing strength. The weight of a pair of either of the two types—straddle-the-rail and alongside-the-rail—is from 160 to 180 lbs., as compared with some other replacers weighing 220 to 270 lbs. George H. Sargent, Chicago, is the designer.

Waterproofing a Track Elevation Bridge on the Lake Shore.

The track elevation bridge on the Lake Shore & Michigan Southern at Sixteenth street and Park Manor, Chicago, was waterproofed with "Sarco" waterproofing. As on most track elevation bridges, the space below ties was small and it was essential to have a hard-surfaced, elastic waterproofing which would withstand the effect of vibration from moving loads and the cutting of the rock ballast. A first coat of "Sarco" primer No. F. was thoroughly brushed over the surface of the concrete to form an anchorage for the heavier following coats. Next a coat of "Sarco" No. 6 waterproofing was mopped on while hot. Above this were laid two coats of "Sarco" mastic with joints broken, about a 6 in. lap being allowed. These coats of mastic were made from "Sarco" mastic and flux, and grit about the size of torpedo gravel No. 2, in such proportion as to form a hard surface and yet be elastic enough to take care of contraction and expansion and vibration without checking.

The mastic was taken from the mixing kettle and poured on the concrete, being floated fairly smooth with a wooden spatula. The joints were made by using a strip of wood ⅝ in. thick against which to work the mastic waterproofing. After the mastic was applied, a coat of the No. 6 waterproofing was mopped on the surface while hot. The ends of the bridge were waterproofed by carrying a burlap curtain over the drain. This curtain was made by applying a coating of "Sarco" primer to the surface of the concrete followed by a coat of No. 6, a layer of burlap, another coat of No. 6, a second layer of burlap and a final coat of waterproofing forming an impervious curtain to carry the water from the bridge floor to the drain. This method, it is claimed, makes a satisfactory, durable and efficient waterproofing for the special needs of track elevation work. The work was done by the Standard Asphalt & Rubber Co., Chicago.

Climax Track Drill with Forged Steel Hooks.

An improvement in the "Climax" track drill is shown in the accompanying illustration. The new feature is a forged steel hook. The regular hooks, which answer well the requirements of ordinary work, are made of malleable iron and therefore will break, and when broken they must be replaced with new ones. To do away with this trouble the forged steel hook was designed. It is made amply strong, the material being $^9/_{16}$ in. x $1\frac{1}{2}$ in., and it is fastened to the body by ⅝ in. bolts, which are ⅛ in. larger than used with the malleable iron hooks, to obviate shearing them off.

The form of the hook makes it possible to drill a hole within

Improved Climax Track Drill.

½ in. of the end of the rail. The set screw at the top saves making adjustments at every hole, one setting only being necessary. The handle is a convenience in moving, and also in collapsing the drill for the passage of trains. Another device, quickly adjusted, enables the hook to be extended over a guard rail or a patent rail joint, which is a great convenience and a time-saver. This hook permits the use of a special combination chuck for either flat or twist drill bits; this chuck is too long for the ordinary hooks. "Climax" track drills are made by Cook's Standard Tool Co., Kalamazoo, Mich.

If the State Mined the Coal.

The retail price of coal in Philadelphia is always an important theme in that city of small salaries and keen economists. State ownership finds favor with many. What a fine thing that would be! Quay is dead, but his spirit still lives. Think of the rake-off on the \$50,000,000 of necessary purchases each year for the hard coal mines! Mules at 25 cents per pound, pipe at 10 cents per cu. in., rope 3 cents an ounce and other mystifying bills as for furnishing the Harrisburg capitol! Under state control coal would cost the people of Philadelphia \$20 per ton.—*Coal Trade Journal.*

Scherzer Rolling Lift Bridge at Cleveland, Ohio.

The Cuyahoga river winds for several miles through the city of Cleveland. It was originally narrow, shallow and crooked, but many improvements have been made, and it is now navigable for large vessels. The river is spanned by more than 20 bridges, both highway and railroad. Nearly all of these structures were originally

End View, 230-ft. Scherzer Bridge, Showing Method of Construction Without Interference with Traffic.

of the center pier swing type, a number of them have been removed and replaced by rolling lift bridges.

The Baltimore & Ohio crossed the old river bed (a short branch of the Cuyahoga) on the line of West River street to reach the ore docks on the north side of the river. A long span single leaf Scherzer rolling lift bridge was placed in service at this point a few months ago, replacing a swing bridge used by the railroad company for many years. The accompanying plan contrasts the channels of the old and new bridges. The old bridge had its center pier on the westerly side of the river, with an approach extending well out into the channel on the opposite side. In the new structure the main supporting piers on which the bridge rolls are on the easterly side of the river with the front or rest pier on the edge of the far side of the channel, making the entire width of the river available for navigation. The plan illustrates, too, the particular advantage of the rolling lift bridge in making available all dock space adjacent to the bridge, the disadvantage of a swing bridge in this respect being particularly apparent when the main pier is at one side of the channel, as was the case in this instance.

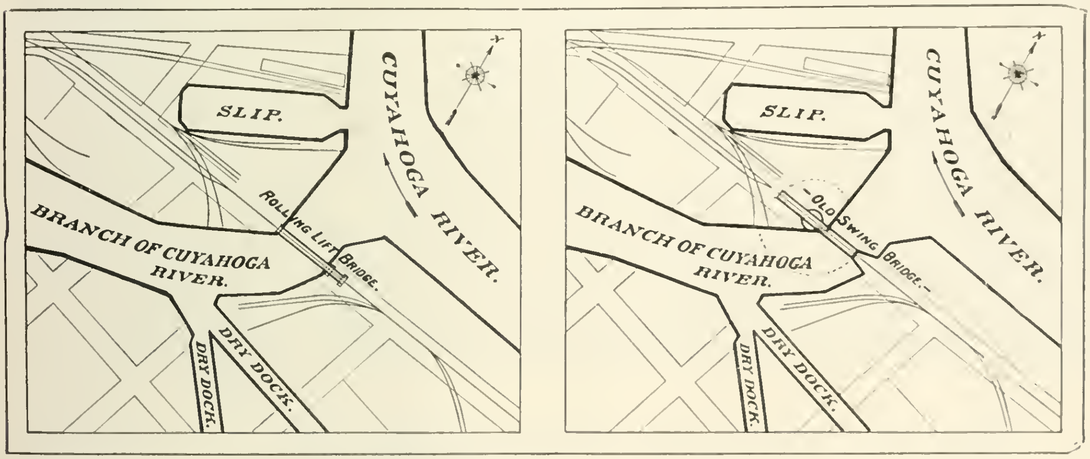
Drawings of this bridge were shown in the *Railroad Gazette* of March 15, 1907. The movable span is 230 ft. long, center to center of bearings. It is the longest span single leaf bascule bridge in the world, the clear channel for navigation, measured between faces of piers, being 210 ft. The total length of steel work, including the short plate girder fixed approach span at the rear end of the bridge, is 334 ft. The bridge is 20 ft. wide, center to center of trusses, and the minimum clearance above the ties is 22 ft. The counterweight is of concrete carried in steel boxes in the plane of each truss, the bridge being counterweighted so as to be at rest in all positions.

It is operated by two a.c. electric motors of 75 h.p. each, the controller governing the motors being in the operator's house. The motors are equipped with solenoid brakes operated by an independent switch on the switchboard in the operator's house. Power is applied in the operation of the bridge by pinions on the main operating shaft engaging with fixed racks placed on independent supports outside of each truss. The operator's house also contains indicators which show to the operator, both day and night, all positions of the bridge during operation. Indicators are also provided showing the positions of the end latch. Signals are placed at each end of the bridge interlocked with derailing switches and with the end latch and main operating controller.

The substructure consists of one front pier, three main piers, carrying the track girders on which the bridge rolls, and an abutment supporting the rear end of the plate girder approach span. These piers are of concrete carried on piles.

The bridge was erected without interfering with traffic over the old swing bridge or with the operation of the old bridge for the passage of vessels. Two of the photographs show the method of erection, the front pier of the new bridge being built under the old swing span on the channel side of the center pier. The main piers of the new bridge were built under the approach to the swing bridge, the superstructure being erected on these piers

Side View of 230-ft. Scherzer Bridge in Cleveland, Under Construction.



Location of New Lift Bridge and Old Swing Bridge Over Cuyahoga River.

Scherzer Bridge in Closed Position.

so as to provide ample clearance for the operation of trains over the old bridge at all times. The building of the bridge was in charge of J. E. Greiner, Assistant Chief Engineer of the Baltimore & Ohio. The superstructure, operating machinery and electrical equipment was designed by the Scherzer Rolling Lift Bridge Co., Chicago, which also supervised the construction and erection. The substructure was designed and built by the railroad. The superstructure was built by the King Bridge Co., Cleveland, Ohio, and the steel work erected by the Pittsburgh Construction Co.

The Hurley Track-Laying Machine.

The Hurley track-laying machine, illustrated herewith, does its work automatically. A pair of reversible, stationary engines supply power for operating the machine and for propelling the construction train of some 30 cars. The supply car following the disconnected from those in the rear by taking out one bolt and slackening the other, leaving the angle-bars on the rear end of each rail. After the rail is disconnected it is brought forward by means of power rollers located on the lower chords of the truss to a point about 20 ft. in advance of the machine car wheels. Here the rail is grasped by specially constructed tongs and lowered until it drags on the previously laid rail. When within about a foot of the end of the latter it is swung forward by one man until the angle bars drop over the ball of the first rail, when it gravitates to place. The clamp over the angle-bars then is applied and the tongs released. The joints are completed while the train is moving the 20 ft., and the quarter spiking is continuous.

The gearing is so arranged that as the train moves forward it supplies the required amount of material at the front. The front end of the truss is made to admit of swinging to curvature and depositing the ties to the center line. It is immaterial whether

Hurley Track-Laying Machine on the Chicago, Cincinnati & Louisville.

machine has an elevated platform for coal and water, and the rails and ties pass under this platform to the machine. The cars nearest the machine carry the ties and the rail cars are back of these.

The rails and ties are moved forward to the machine car as follows: The construction train consists of ordinary flat cars, each equipped with two flanged rollers, one on each side, 7 ft. center to center, equidistant from each end of the car. The rails are fed to these rollers from the rear cars by a hoist, and are connected together by inserting one bolt in each end of their angle bars. The continuous line of rails thus formed on either side, from the rail cars over the tie cars and to the machine, are utilized as tie conveyors. The tie cars are provided with a crossing plank on which the ties are loaded so as to permit the rails to pass over the rollers and freely under the ties.

On each side of the machine car, 7 ft. center to center, is a cluster of upper and lower power rollers which grasp the rails between them and pull the entire line of connected rails forward. the rails are laid with square or broken joints, as each side is worked independent of the other.

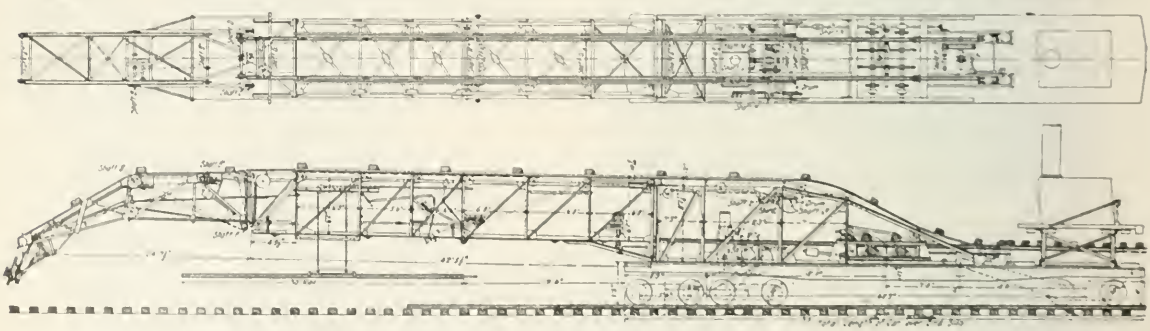
Among the claims made for it are: The machine car has high tractive power while the actual power consumed is small.

The machine is moving constantly though slowly in order to economize the power and time usually lost by stops and delays. It requires no locomotive, and therefore saves this cost.

It begins laying track in 15 to 20 minutes after starting to connect up; it can be stopped and disconnected by simply uncoupling cars from machine.

It lays track to line, to any curvature, on any grade, on trestles, or in tunnels. Has been successfully operated in long tunnels by artificial light. Lays track equally well night or day, in winter or summer, and in any kind of weather.

It lays track at the rate of 2 to 4 miles a day. The capacity of the machine is determined by the number of rails that can be laid and connected in front. On one occasion 84 rails per hour



Plan and Elevation of the Hurley Track-Laying Machine.

Work is begun on the tie car nearest the machine. As the rails pass beneath the ties, men roll the latter down on to the moving rails, as many ties being placed on each rail length as are needed in track. The ties are carried to the machine in this way, the tie men working backward from car to car.

From the front end of the machine car, extending over the roadbed and about 8 ft. above it, is a 68-ft. steel truss. When the rails with the ties arrive at the machine they separate. The required number of ties per rail are delivered, one at a time, by a trip, to an endless chain tie conveyor (with attachments) and are carried over the top chords of the truss to its extreme end, where they are deposited on the roadbed, one at a time, as the machine moves forward, thus spacing them so that they are easily straightened by two men.

The rails move along the lower chords of the truss, and, after passing through the friction rolls previously mentioned, they are were laid on each side. Forty good men will lay and quarter-spike 3 to 4 miles per day.

The office of the Hurley Track-Laying Machine Co. is at 1740 Railway Exchange building, Chicago.

For Railroad Library at Wisconsin University.

James J. Hill has given the University of Wisconsin, Madison, Wis., an additional $2,000 for the development of the "James J. Hill Railway Library," which was established by him with an endowment of $5,000 in 1905. Nearly 9,000 books, pamphlets, periodicals and papers have been secured for the library. The material relates to the history and development of railroad systems of England, Germany, France, Belgium and Holland, besides those of the United States. Mr. Hill's gift was the result of his interest in the work of Prof. Balthazar H. Meyer, of the department of political economy in the University of Wisconsin, and chairman of the Railway Commission of Wisconsin, while Prof. Meyer was securing material for his monograph dealing with the Northern Securities case, published some time ago.

Report on Quebec Bridge Failure.

The three commissioners appointed by the Canadian government to investigate the cause of the collapse of the Quebec bridge, August 29, 1907; Henry Holgate, C.E., John G. C. Kerry, C.E., and John Galbraith, Dean of the Faculty of Applied Science and Engineering in the University of Toronto, have presented their report to the Canadian Parliament. The commissioners do not think that either the general design of the Quebec bridge, the methods of financing the enterprise, the payments of money that have been made to or by the company, or in its interest, or the obligations that the company has undertaken under various contracts and agreements have direct connection with the fall of the bridge. Their positive findings are as follows:

(a) The collapse of the Quebec bridge resulted from the failure of the lower chords in the anchor arm near the main pier. The failure of these chords was due to their defective design.

(b) The stresses that caused the failure were not due to abnormal weather conditions or accident, but were such as might be expected in the regular course of erection.

(c) The design of the chords that failed was made by P. L. Szlapka, the Designing Engineer of the Phoenix Bridge Company.

(d) This design was examined and officially approved by Theodore Cooper, Consulting Engineer of the Quebec Bridge & Railway Company.

(e) The failure cannot be attributed directly to any cause other than errors in judgment on the part of these two engineers.

(f) These errors of judgment cannot be attributed either to lack of common professional knowledge, to neglect of duty, or to a desire to economize. The ability of the two engineers was tried in one of the most difficult professional problems of the day and proved to be insufficient for the task.

(g) We do not consider that the specifications for the work were satisfactory or sufficient, the unit stresses in particular being higher than any established by past practice. The specifications were accepted without protest by all interested.

(h) A grave error was made in assuming the dead load for the calculations at too low a value and not afterward revising this assumption. This error was of sufficient magnitude to have required the condemnation of the bridge even if the details of the lower chords had been of sufficient strength, because, if the bridge had been completed as designed, the actual stresses would have been considerably greater than those permitted by the specifications. This erroneous assumption was made by Mr. Szlapka and accepted by Mr. Cooper and tended to hasten the disaster.

(i) We do not believe that the fall of the bridge could have been prevented by any action that might have been taken after August 27, 1907. Any effort to brace or take down the structure would have been impracticable, owing to the manifest risk of human life involved.

(j) The loss of life on August 29, 1907, might have been prevented by the exercise of better judgment on the part of those in responsible charge of the work for the Quebec Bridge & Railway Company and for the Phoenix Bridge Company.

(k) The failure on the part of the Quebec Bridge & Railway Company to appoint an experienced bridge engineer to the position of Chief Engineer was a mistake. This resulted in a loose and inefficient supervision of all parts of the work on the part of the Quebec Bridge & Railway Company.

(l) The work done by the Phoenix Bridge Company in making the detail drawings and in planning and carrying out the erection and by the Phoenix Iron Company in fabricating the material was good, and the steel used was of good quality. The serious defects were fundamental errors in design.

(m) No one connected with the general designing fully appreciated the magnitude of the work nor the insufficiency of the data upon which they were depending. The special experimental studies and investigations that were required to confirm the judgment of the designers were not made.

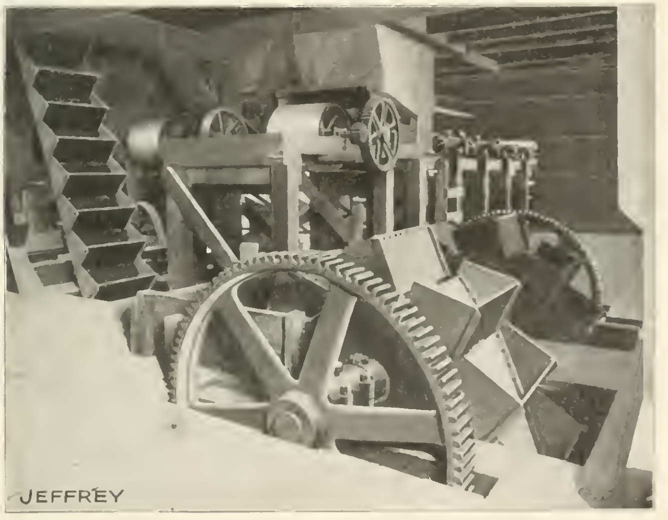
(n) The professional knowledge of the present day concerning the action of steel columns under load is not sufficient to enable engineers to economically design such structures as the Quebec bridge. A bridge of the adopted span that will unquestionably be safe can be built, but in the present state of professional knowledge a considerably larger amount of metal would have to be used than might be required if our knowledge were more exact.

(o) The professional record of Mr. Cooper was such that his selection for the authoritative position that he occupied was warranted, and the complete confidence that was placed in his judgment by the officials of the Dominion Government, the Quebec Bridge & Railway Company, and the Phoenix Bridge Company was deserved.

The report contains appendixes describing the history of the proposal to bridge the St. Lawrence river at or near the city of Quebec; the history of the Phoenix Bridge Company; the effect of financial limitations upon the design of the bridge; the history of the development of the specifications; a description of the organization of the development of plans and of the method followed in the design; a statement of material, shop work and inspection; a statement discussing transportation and erection, and a discussion of the difficulties that arose during erection, and of the events at the time of the collapse of the structure. Some of the parts of especial interest will be treated more fully in a subsequent issue of the *Railroad Gazette*.

Elevating and Conveying System of the Cedarcliff Stone Co.

An unusually large stone crushing and shipping plant was recently completed by the Cedarcliff Stone Co. at its works near Cedarcliff, N. Y. An important feature of the plant is the complete system of elevators and conveyors for handling stone through the various processes of preparation and shipment. A series of elevators and conveyors takes the stone from the crushers to the revolving screens and thence to the storage grounds. Another series delivers the sized product from the storage grounds to cars, or to vessels on



Elevators to Crushers and Screens, and Belt Conveyors to Storage Bins.

a nearby river, as the case may be. The first system, illustrated herewith, consists of three elevators and two belt conveyors. Each of the elevators is 65 ft. high from center to center of wheels. Two of these elevators, standing side by side, handle the product of one No. 9 and four No. 6 Gates crushers. The stone from each elevator is delivered to a revolving screen, from which the tailings go back to two No. 6 crushers on each side and are recrushed. Everything which passes through the screens is received by the third elevator, which stands directly behind the other two, and which delivers it to the finishing screen in the top of the building.

The finishing screen separates the stone into 2 in. and $\frac{3}{4}$ in. sizes and screenings, which pass through a $\frac{3}{4}$-in. hole. The screenings are carried away about 100 ft. by a 14-in. "Century" belt conveyor. The 2-in. and $\frac{3}{4}$-in. products are carried to the storage grounds by separate belt conveyors 24 in. and 18 in. wide, respectively. They are shown in one of the accompanying illustrations. They discharge into the proper compartments by automatic trippers.

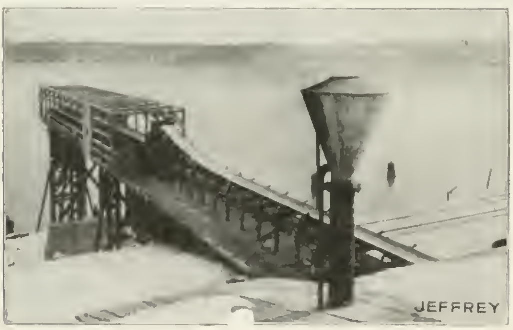
The plan of ground storage is, so far as we know, unique in stone-crushing plants. It is said to be much cheaper in first cost and maintenance than bins. The plan is the same as is used for coal, the storage space being 160 ft. x 100 ft. The distributing conveyors are 35 ft. above the ground, giving a storage capacity of about 8,000 cu. yds.

The distributing conveyors rest on concrete columns 35 ft. apart, center to center, each column being 12 ft. x 7 ft. in plan, and having a ventilating shaft 8 ft. x 3 ft. in its center from top to bottom. Underneath the column, in the center and running the length of the storage ground, is a conduit cut out of solid rock, 8 ft. x 8 ft.

inside and 160 ft. long. The walls and floors are concrete and the roof is of 12-in. I-beams, 2 ft. apart, filled in with concrete. In this roof bin-gates are placed every 6 or 8 ft. Over the tunnel stone will be piled to a height of 35 ft.

To convey the crushed stone to railroad cars or to barges a 36-in. belt conveyor travels the length of the tunnel. It receives the stone through the roof gates and delivers it to an elevator 45 ft. high, center to center of wheels. This discharges to another belt conveyor, 36 in wide by 200 ft. long, which goes over the railroad tracks and to the wharf, as illustrated herewith. The stone is discharged by a tripper either at the wharf or into a small pocket over the railroad tracks, from which it is loaded into cars. The loading conveyors have a capacity of about 400 tons an hour. They are driven independently, so that the barges or cars can be loaded without reference to the main plant.

Conveyors over Storage Bins.



Conveyor from Bins to Cars and Vessels.

The elevator buckets, which are 30 in. long, are carried by two parallel chains of special design, made for the heaviest work. They are the "Michigan" type of Jeffrey "Climax" steel chain, made double width to give greater bearing surface on the head and foot wheels. They are designed to carry a steady load of 6 to 7 tons, and have a factor of safety of 15.

This elevating and conveying system was installed by the Jeffrey Manufacturing Co., Columbus, Ohio.

Bitumen-Emulsion Waterproofing Compound.

Wunner's "Bitumen-Emulsion" waterproofing is a German preparation for use on masonry or concrete. Among the properties claimed for it, verified by tests and in service, are: It is non-porous and impermeable to water under all pressures; makes an absolute bond with the protected material, and if this is metal expands and contracts with it without injury to the bond; is unaffected by heat, cold or sudden temperature changes, does not separate from masonry under settlement, jars or vibration, and does not break unless the foundation breaks first, is not abraded by wind or weather, will not decompose or disintegrate, and is insoluble; does not interfere with the setting of cement mortar, and is easily applied.

This waterproofing compound is a thick black fluid which mixes readily with cement mortar. It is applied by mixing a small quantity in ready made cement mortar or in concrete. A report of a test made in Germany by the Royal Building Inspection Department at Saarburg at the request of the Imperial authorities shows excellent results for this compound. The test was in competition with seven other highly recommended waterproofing materials. As a result of the tests the German Empire became the largest consumer of the Bitumen-Emulsion, using it in fortifications, harbors, railroads, bridges, canals, canal locks, etc.

This material has been in use in this country for about a year. A photograph is shown herewith of the Junction Avenue bridge of the Wabash in Detroit, Mich., which is waterproofed with this material. This bridge is of I-beam and concrete construction. It is claimed that the bond between the metal and the waterproofing coat is absolute, and is unaffected by the vibration, which is considerable. The Wabash bridge, at Forest Park, St. Louis, which is of ornamental design (*Railroad Gazette*, Oct. 28, 1904), was waterproofed with the Bitumen-Emulsion last May, after other materials had failed. In the basement of the West Street building, New York City, leakage was completely stopped by this compound after various other methods had been tried without success.

Junction Avenue Bridge of the Wabash, Detroit, Mich.

Theodore F. Koch & Co., Chicago, are sole agents for the United States.

A New Wooden Smoke-Jack.

The smoke-jack here illustrated represents several years of experiment and effort to produce a light, durable, fireproof jack that will stand the test of acid, smoke fumes, steam, etc., without decay or corrosion. It is made of the best quality of dressed and matched lumber. The inside surface is smooth and offers no projections or cracks in which sparks can lodge. The wood is noncombustible. It is said that tests extending over three years have proved this, and that the fireproofing compound is hermetically sealed within the cells of the wood so that its effectiveness is permanent. Cast iron bands, which are specially treated to resist the effect of smoke and acids, are placed outside and inside the jack to give it the necessary strength and rigidity.

The Dickinson Smoke-Jack.

The part of the jack above the roof is octagonal in section so as to better resist wind pressures. The short inside diameter is 36 in.; below the roof the jack is 24 in. square. This allows ample ventilating space for removal of the steam, smoke and gases from the upper part of the roundhouse. The ends of the hood are given a steep pitch to prevent smoke from rebounding into the house. The hood is 8 ft. long, 6 ft. high and 40 in. wide at the bottom, with 12 in. hanging sides to enclose the locomotive stack. These dimensions, however, can be made to suit any requirements.

These jacks are made by Paul Dickinson, Inc., Chicago.

Strauss Trunnion Bascule Bridges.

The trunnion bascule type of drawbridge is almost as old as the swing bridge, there being many early examples of it in Europe. In 1839 the North Eastern of England built a double-leaf trunnion bascule, which remained in service until recently. In 1867 the city of Copenhagen, Denmark, built a double-leaf highway bridge, 56 ft. 8 in. clear span, which is also still in service. In 1892 the city of London built the famous Tower bascule, which is 226 ft. 6 in. span, c. to c. of trunnions. This is the largest and heaviest bascule in the world.

In 1902 the city of Chicago began building a series of trunnion bascules over branches of the Chicago river; it has built seven to date, some of them being unusually large and heavy structures. The city of Milwaukee has five trunnion bascule bridges in successful operation.

The Strauss designs of bascule bridge are claimed to represent the complete development of the trunnion type. The first one was built at Cleveland, Ohio, for the Wheeling & Lake Erie in the fall of 1905. Since then 11 additional bridges of this type have been built, are under construction, or are ordered. These include the monumental Knippels bridge at Copenhagen, Denmark, and the 170-ft., single leaf, double-track bascule bridge for the Chicago & North-Western at Kinzie street, Chicago.

The Strauss designs embrace a number of modified forms of trunnion bridge, all intended to increase economy and effectiveness. The principal features are the pivoted counterweight and the parallel link mechanism, which apply to both the overhead and underneath counterweight types illustrated herewith. The following are some of the claims made: It was the first bascule bridge in which a concrete counterweight was substituted for cast iron. It is the only bascule which is exactly balanced, and, being at the same time positively connected to the foundations, it is free from any danger otherwise attendant on the erection and service operation of such a structure, especially in case of accident. The truss members all center in the trunnions, and all the loads are transmitted directly to the foundations at the same point, in all positions of the span. The trunnions give a surface bearing, thus avoiding any injurious effects of line bearing. The absence of tail locks and other adjusting devices lessens maintenance cost and danger. The ease with which the number of tracks can be increased, the lessened delay to traffic because of the single channel and the greater speed of operation, and finally, its moderate cost, make it a desirable bridge for railroads.

The Strauss Bascule & Concrete Bridge Co., Chicago, is the designer and builder.

Strauss Bascule Bridge, Overhead Counterweight Type; Staten Island Rapid Transit.

Strauss Bascule Bridge, Underneath Counterweight Type; St. Louis, Iron Mountain & Southern.

A Cast Steel Tie.

The accompanying illustrations show designs for the use of cast steel for a tie body, both in ballasted roadbed and in special structures, such as tunnels. The steel is placed in the ballast or embedded in concrete as part of the permanent structure, and it need not be disturbed in ordinary track work, except as the ballast itself is raised or moved. The metal is so distributed as to give the greatest strength where it is needed and to give a large area of bearing surface underneath the rails. The ribs, flanges, projections and openings are so placed as to provide a firm hold. In the design, three stresses have been considered: the downward pressure under load, the lateral thrust and the tendency of the rail wave under moving trains to lift the tie. The necessary resiliency of the rail support is provided by the wooden block to which the rail may be fastened in any of the usual ways. This block is carried in a pocket formed near the end of the tie, for such maintenance work as ordinary alinement it is evident that the steel portion need not be disturbed.

In designing the cast steel tie it was held that the following requirements should be fulfilled: (1) The tie should be such as could easily be substituted for an ordinary wooden tie in existing track. (2) There should be a certain amount of elasticity in the rail support. (3) After the tie is imbedded in the ballast it should be possible to make the ordinary adjustments necessary to maintenance without disturbing the tie or the ballast. (4) The design should be such that the bearing surface could be varied to suit different kinds of traffic, roadbed and ballast. (5) The tie should resist downward, lateral and lifting forces. (6) The bearing surface should be greater under the rails than under the middle of the tie, to tend to prevent center binding. (7) The tie should not interfere with ordinary provisions for drainage. (8) It should have a definite scrap value if removed within the period of its assumed life. (9) It should be heavy enough, aside from its grip on the ballast, to partially counteract the lifting force of the rail wave.

These ties were originally designed for use in tubular tunnels where the bearing surface of the tie outside of the rail is restricted. One of the designs illustrated is for use in concrete roadbed, as in tunnels, paved streets, terminals, etc. The tie designed for ordinary use may be extended to hold a third-rail bracket. It is claimed that fewer of these need be used to a rail length, and that lighter rails can also be used without lessening the stability of the track.

A modification of this tie has been considered. It involves substitution of longitudinal stringers on the permanent steel cross ties instead of the wooden blocks. Paul D. Ford, who was a member of the committee on the form of track construction for the Interborough Rapid Transit subway in New York City, recently calculated that the pressure on the stringers under Cooper's E 50 specification, or 50,000 lbs. axle load, with axles spaced 60 in. apart and with 100 per cent. allowance for impact, would be 833 lbs. to the lineal inch and 152 lbs. to the square inch under a rail 5½ in. wide. The calculations of the U. S. Forestry Bureau indicate that 215 lbs. to the square inch is a safe working stress for yellow pine. As a basis for Mr. Ford's calculations, he took creosoted yellow pine timbers 7½ in. wide, 11¾ in. deep and 33 ft. long, the joints between stringers and between rails being alternate. In this design it is proposed to space the ties 55 in. apart, except when laid in concrete or in track not in service during construction, and 33 in. apart at rail joints.

Combination Cast Steel and Wood Tie for Ordinary Track.

In one design illustrated herewith, the inverted T form of the tie body as shown is reduced in height from 6 in. to 3¾ in., and in width from 7¾ in. to 5½ in., including both flanges. These dimensions are tentative and may be varied to any extent. The pockets for the wooden blocks are closed at each end and on one side, and the end walls incline inward at the top so that the block dovetails into them and is held from lifting. The rails can be fastened to the block or the block replaced without disturbing the ballast or the metal part of the tie. It is believed that the tie should have a long life because of the enduring qualities of cast steel.

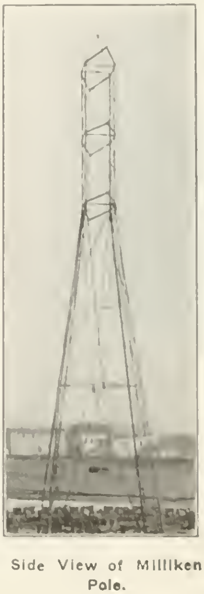
Combination Cast Steel and Wood Tie for Special Track Construction.

The Metal Ties Company, with office at 21 Park Row, New York City, has been formed to handle this tie. J. Stewart Andrews is President, and associated with him are Edgar M. Smith, Charles F. Quincy and James W. Leahy, the inventor of the tie.

Galvanized Steel Poles for Transmission Lines.

The Great Western Power Company, of California, has adopted the Milliken pole, shown herewith, for use in carrying its high voltage power transmission line. It is intended eventually to carry these lines a distance of about 1,000 miles. The power is transmitted on two circuits of three wires each, carrying a current of 100,000 volts. In view of this high voltage and the consequent danger to life and risk from fire involved, great care was exercised in selecting the particular class of poles to be adopted. The pole is designed with three crossarms, the intention being to carry a feed wire on the outer end of each crossarm by suspended insulation. The top of the pole is arranged to take a guard wire. The poles are intended to be used about 750 ft. apart. The bottom of the pole at the ground level occupies a base 17 ft. square. The stub ends of the pole are separate pieces of steel and are of such length as to allow 6 ft. for bedding in the ground. These poles are made entirely of structural steel shapes and are designed to follow the theoretical stresses and produce a pole of given strength and stiffness with a minimum amount of material. There are a great many duplicate pieces, thus making it a simple matter for the purchaser to put the same together in the field.

The poles are designed to stand the following tests: When tested in a vertical position, on an immovable foundation, and with a proper margin of safety a simultaneous horizontal side pull of 1,000 lbs. at the top and 2,500 lbs. at each of the three crossarms, or in other words, a total strain of 8,500 lbs. The crossarms were to support a suspended weight of 1,000 lbs. at their extreme end, and any one of the crossarms to carry at one of these ends a horizontal pull along the line of 3,000 lbs.



Side View of Milliken Pole.

The receivers of Milliken Bros. (Inc.), 11 Broadway, New York City, are manufacturing these poles at Milliken, Staten Island, N. Y., where complete arrangements have been made in the bridge and structural shops for getting out this particular class of structural work.

MANUFACTURING AND BUSINESS.

The Sandusky, Ohio, plant of the Sandusky Portland Cement Co., which was closed down early in December, has resumed work with a full force. The plants at Syracuse, Ind., and Dixon, Ill., are to be started up at once, it is said.

The Lock Joint Pipe Co., 316 Broadway, New York, has secured contracts from the United States Quarantine Department for protecting from marine wood borers, with lock joint pipe, the Department's docks at Charleston, S. C., and Boca Grande, Fla.

The sales of railroad and structural iron paints made by The Alcatraz Company, Richmond, Va., were twice as large during January and February, 1908, as during the corresponding months of 1907. Trade increased particularly in the Middle West and the West.

G. Fred Collins, who has for many years been identified with the railroad supply business as representative of Valentine & Co. and others, and recently as manufacturers' agent in Mexico, has returned to this country to take a position with the Gold Car Heating & Lighting Co., New York.

The Continental Fibre Co., Newark, Del., which started in business in November, 1906, has recently completed an addition to its plant that will enable it to double its output. This company is now one of the largest manufacturers of vulcanized fiber for track insulation. J. P. Wright is General Manager, with headquarters at Newark, and the Wallace Supply Co., Chicago, is western representative.

W. C. Lawson and J. E. Simons have formed a partnership under the name of Lawson & Simons, 505 Fisher building, Chicago, to act as selling agents for various companies. At present they are prepared to quote prices on long leaf yellow pine, oak, fir, creosoted lumber, ties, piling and telegraph poles, tool steel, bolts and nuts, and bar iron and steel. Mr. Lawson has had experience with the American Car & Foundry Co., New York, and has been salesman for the Pressed Steel Car Co., Pittsburgh, Pa., and the Scullin-Gallagher Iron & Steel Co., St. Louis, Mo. Mr. Simons was recently with the Fitz-Hugh Luther Co., Chicago.

To avoid possible confusion through similarity with the name of another corporation, the title Maryland Railway & Electric Supply Co. has been substituted for Maryland Railway Supply Co. of Baltimore city, of which the organization was recently noted in these columns. Changes in the officers of the company have also been made. Charles Elliott is now President and General Manager, Nelson Perin, Vice-President, and Thomas D. Claiborne, Secretary and Treasurer. Mr. Elliott is the son of W. G. Elliott, who was President of the Atlantic Coast Line up to the time of his death. Mr. Elliott served for a number of years in the engineering corps of that road, later going into the railroad supply business, in which he has had considerable experience. Mr. Perin is the son of the late President of the United Railways of Baltimore, and has for some time been engaged in the contracting business, being also Treasurer of the Johnston-Perin Contracting Co. Mr. Claiborne is an engineer and also President of the Johnston-Perin Contracting Co. The headquarters of the Maryland Railway & Electric Supply Co. will be continued at 510 Continental building, Baltimore, Md.

The Fibrous Paint Co., Real Estate Trust building, Philadelphia, Pa., having succeeded to the business of the Pennsylvania Standard Rubber Paint Co., is now the sole maker of "Standard Fibrous" paint. This is a preservative coating for protecting iron and steel structures. It has for the past ten years been used successfully for the preservation of metal structures under conditions where paint mixed with a linseed oil binder is rapidly disintegrated. By adhering closely to iron and steel, its design is to prevent oxidation by forming an elastic waterproof coating impervious to rust-producing agencies, acid fumes and the mechanical abrading action of exhaust blasts; these properties are especially desirable in the coating of bridges, train sheds, car roofs and other metal surfaces exposed to similar conditions. The Standard Fibrous paint is put up in a variety of colors in one, five and ten-gallon packages ready for use. Sales through agencies have been discontinued and the manufacturers now deal direct with the consumer through their own salesmen.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Augusta Southern.—J. M. Featherston has been appointed Assistant Auditor, with office at Augusta, Ga., succeeding B. Anderson.

Birmingham Southern.—Geo. G. Crawford has been elected President, succeeding J. A. Topping; L. T. Beecher, Treasurer, succeeding W. A. Green; F. B. Winslow, Auditor, succeeding S. A. Cameron, who has been appointed Car Accountant. All have headquarters at Birmingham, Ala.

Brookhaven & Pearl River.—M. E. Olmsted, Secretary, has been appointed General Counsel, with office at Harrisburg, Pa., and his duties as Secretary have been transferred to H. C. Homeyer, General Freight and Passenger Agent, who also becomes Treasurer, succeeding G. C. Lignon. Mr. Lignon continues his duties as Auditor. W. H. Baumes is Comptroller, with office at Buffalo, N. Y.

Canadian Pacific.—W. T. Payne, Superintendent at Vancouver, B. C., has been appointed to the new office of Manager of the Pacific steamship service, having charge of company's interests in China, Japan and Hong Kong, with office at Yokohama, Japan.

Cincinnati, Hamilton & Dayton.—F. M. Carter has been appointed Treasurer, with office at Cincinnati, Ohio, succeeding J. E. Howard, resigned. The office of Assistant Treasurer for the Receiver, previously held by Mr. Carter, has been abolished.

De Queen & Eastern.—C. C. Ray has been appointed Assistant Treasurer and General Freight and Passenger Agent, with office at De Queen, Ark., succeeding T. E. Brown, resigned.

Gulf Line Railway.—J. H. Hillhouse, Traffic Manager at Sylvester, Ga., has been elected also Vice-President. C. H. Reynolds, Treasurer at Sylvester, Ga., is now Secretary and Treasurer.

Idaho & Washington Northern.—J. T. McDevitt, Secretary, has been appointed also Auditor, succeeding W. T. Hireen.

Licking River.—A. Siegworth has been appointed Auditor, with office at Chicago, Ill., succeeding C. M. Mohr, who continues his duties as Treasurer.

McCloud River.—D. M. Swobe has been elected Vice-President and Traffic Manager, with office at San Francisco, Cal., succeeding H. O. Johnson, resigned.

Mexican Central.—W. G. Lerch has been appointed Assistant to the President, with headquarters in the city of Mexico.

Peoria & Pekin Union.—H. K. Pinkney, Secretary, has been elected President, with office at Peoria, Ill., succeeding Curtiss Millard, resigned. The duties of Auditor and all matters pertaining to the traffic department have been assumed for the present by the President. J. F. Kiefer succeeds Mr. Pinkney.

Sandy River & Rangeley Lakes.—The officers of this new company, a consolidation of three narrow (2-ft.) gage railroads in Maine, are: Weston Lewis, President; Josiah S. Maxcy, Vice-President and General Manager; Geo. A. Farrington, Secretary and Treasurer; F. N. Beal, Freight and General Passenger Agent, and F. A. Lawton, Superintendent.

Santa Fe Central.—E. R. Paul has been elected Assistant Treasurer, with office at Santa Fe, N. Mex., succeeding Frank Dibert.

Southern Railway & Navigation.—The officers of this company, which operates a terminal line at Chicago, Ill., also steamers and barges on the Ohio and Tennessee rivers, are: D. K. Jeffris, President; Marvin Hugitt, Jr., Vice-President; A. B. Donaldson, Secretary and General Manager; J. T. Jeffris, Treasurer, and W. T. Beckman, General Superintendent; all with office at Chicago, Ill.

Tionesta Valley.—P. M. Newman, General Manager of this company and President and General Manager of the Susquehanna & New York, has been also elected President of the Tionesta Valley, with office at Williamsport, Pa. W. R. Campbell is Assistant to the President, with office at New York.

Operating Officers.

Arkansas & Louisiana.—M. M. Richey has been appointed Superintendent, with office at Little Rock, Ark., succeeding J. Cannon.

Astoria & Columbia River.—E. E. Lillie has been appointed Superintendent of Car Service, with office at Portland, Ore.

Atlanta, Birmingham & Atlantic.—Alexander Bonnyman, Chief Engineer, has been appointed General Manager, with office at Atlanta, Ga.

Buffalo & Susquehanna.—This road for purposes of economy is now operated in one division instead of in two, as formerly. F. W. Allen, heretofore Superintendent of the Northern division, is now in charge of the whole road, with office at Galeton, Pa. The business heretofore handled by the maintenance of way department is now in direct charge of the Superintendent, who will appoint the necessary subordinates.

Boston & Maine.—Fred A. Hortter, who was recently appointed Superintendent of Car Service of the Boston & Maine, was born on May 8, 1870, at New Brighton, Pa. He was educated in the public schools at Boston, Mass., and in 1889 entered railroad service with the Railway Clearing House Association. The next year he went to the Boston & Maine as a tracing clerk in the car service department, being made chief clerk of the car service department three months later. From 1890 to 1908 he served in this position, and on March 2, 1908, was appointed Superintendent of Car Service, succeeding Hoyt E. Howard, who retired at the age of 70 years after 49½ years of continuous service with the Boston & Maine.

Central of New Jersey.—The office of H. G. Sherman, Superintendent of Telegraph, has been moved from Jersey City, N. J., to New York.

Chicago, Burlington & Quincy.—Robert Rice, Superintendent at Hannibal, Mo., has been transferred to the St. Joseph division, with office at St. Joseph, Mo., succeeding A. N. Willsie, who takes Mr. Rice's place at Hannibal.

Coal & Coke.—Edwin Bower, Assistant General Manager, at Gassaway, W. Va., has been appointed Acting General Manager, with office at Elkins, W. Va., succeeding General Manager W. H. Bower, resigned. J. A. Emmart, Purchasing Agent at Elkins, W. Va., has been appointed Assistant Acting General Manager, with office at Gassaway, W. Va., succeeding Mr. Bower. Mr. Emmart also continues his duties as Purchasing Agent.

Delaware & Eastern.—O. F. Wagenhorst, Chief Engineer, has been appointed Superintendent, with office at Margaretville, N. Y., in charge of the transportation and motive power departments.

Delaware, Lackawanna & Western.—E. M. Rine, Superintendent of the Scranton division, has been appointed Superintendent of the Morris and Essex division, with office at Hoboken, N. J., succeeding C. H. Ketcham, resigned; H. H. Shepard, Superintendent of the Syracuse and Utica division, succeeds Mr. Rine, with office at Scranton, Pa. G. A. Poore, Superintendent of the Bangor & Portland Railway division, succeeds Mr. Shepard, with office at Syracuse, N. Y. William Fletcher, Trainmaster of the Bangor & Portland Railway division, will perform the duties of Superintendent of that division until further notice.

Mexican Central.—G. W. Vanderslice has been appointed Superintendent of Terminals at Ciudad Juarez, Chihuahua, Mexico.

Mississippi River, Hamburg & Western.—A. J. Abell has been appointed Superintendent, with office at Monroe, La., succeeding C. H. Bevington.

Missouri Pacific.—The Central district has been abolished. The superintendents of the Central division and the White River division will hereafter report to the General Superintendent at Little Rock, Ark. The Superintendents of the Joplin, the Wichita and the Southern Kansas divisions will report to the General Superintendent at Kansas City. W. J. McKee, General Superintendent of the Central district, has been appointed General Superintendent, with headquarters at Little Rock, Ark. A. De Bernardi, General Superintendent at Little Rock, has been appointed Superintendent of the Omaha division, with headquarters at Atchison, Kan., succeeding W. E. Brooks, transferred, and of the Northern Kansas division, succeeding W. E. Merrifield, assigned to other duties. Mr. Brooks has been appointed Superintendent of the Joplin division, with headquarters at Nevada, Mo., succeeding G. H. Stapp, resigned. J. F. Murphy, Superintendent of the Memphis division, has been appointed Superintendent of the Central division, with headquarters at Van Buren, Ark., succeeding J. M. Walsh, assigned to other duties. H. J. Scheuing, Trainmaster at De Soto, Mo., has been appointed Superintendent of the Memphis division, with headquarters at Wynne, Ark., succeeding J. F. Murphy, transferred.

Morgantown & Kingwood.—C. R. Metzler has been appointed Trainmaster, with office at Morgantown, W. Va., succeeding G. W. Glenn.

Portland & Seattle.—See Spokane, Portland & Seattle.

St. Louis, El Reno & Western.—W. M. Bushnell has been appointed General Manager, with office at Fort Smith, Ark.

Southern.—The office of A. H. Westfall, Superintendent of the Northern division, is now at Greensboro, N. C., instead of at Danville, Va. G. P. Walton has been appointed Superintendent of the Danville division, with office at Greensboro, N. C., succeeding W. R. Hudson, transferred.

Spokane, Portland & Seattle.—E. E. Lillie has been appointed Superintendent of Car Service of this road, formerly the Portland & Seattle, with office at Portland, Ore.

Tonopah & Tidewater.—John Ryan, General Superintendent, has been appointed General Manager, with office at Ludlow (Stagg post office), Cal. The position of General Superintendent has been abolished.

Traffic Officers.

Chicago Great Western.—W. H. Burke, New England agent at Boston, Mass., has been appointed General Eastern Agent at New York, succeeding B. G. Saunders. W. A. Dolan succeeds Mr. Burke.

Licking River.—Malcolm Stone has been appointed General Freight and Passenger Agent, with office at Chicago, Ill.

Missouri Pacific.—R. T. G. Matthews, General Agent of the passenger department at Cincinnati, Ohio, has been appointed Assistant General Passenger Agent at Kansas City, Mo., succeeding C. E. Styles, resigned.

Raleigh & Charleston.—A. T. Vannerson has been appointed to the new office of General Freight and Passenger Agent, with office at Marion, S. C.

Raleigh & Southport.—J. O. Hendley has been appointed to the new office of General Freight Agent, with office at Raleigh, N. C.

St. Joseph & Grand Island.—W. H. Bryning, Assistant General Freight Agent at St. Joseph, Mo., has been appointed Assistant General Freight Agent at Kansas City, Mo., succeeding H. V. Clark.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—W. A. Nettleton, General Superintendent of Motive Power of the St. Louis & San Francisco, has been appointed General Superintendent of Motive Power of the C., R. I. & P. See Delaware, Lackawanna & Western.

Delaware, Lackawanna & Western.—T. S. Lloyd, General Superintendent of Motive Power of the Chicago, Rock Island & Pacific, has been appointed Superintendent of Motive Power of the Delaware, Lackawanna & Western, succeeding R. F. Kilpatrick, resigned.

Mississippi Central.—T. S. Myers, Division Engineer at Brookhaven, Miss., has been appointed Chief Engineer, with office at Roxie, Miss.

St. Louis & San Francisco.—George A. Hancock, Superintendent of Motive Power, has been appointed General Superintendent of Motive Power, succeeding W. A. Nettleton, resigned to go to the Chicago, Rock Island & Pacific. The office of Superintendent of Motive Power has been abolished.

CAR BUILDING.

The Colorado & Southern is asking prices on 200 steel underframe gondolas.

The Calumet Electric is said to be in the market for 15 cars. This is not yet confirmed.

The Illinois Traction Co. is said to be in the market for 60 cars. This is not yet confirmed.

The Chicago, Milwaukee & St. Paul will build 2,500 freight cars of miscellaneous types at its own shops.

The Northern Pacific, as reported in the *Railroad Gazette* of January 31, is asking prices on 80 passenger cars.

The Duluth, Missabe & Northern is again said to be asking prices on 20 passenger cars. This report is not yet confirmed.

The Canadian Pacific passenger equipment referred to in the *Railroad Gazette* of March 6 is to be equipped with the Gold heating system, with Frumveller heater.

RAILROAD CORPORATION NEWS.

BOSTON & MAINE.—A special meeting of the stockholders of the Fitchburg will be held March 18 to authorize $2,400,000 in bonds to refund $2,000,000 bonds maturing on May 1 and to provide part of the funds for improving the line from Johnsonville, N. Y., to Troy. At the last annual meeting an issue of $2,900,000 bonds was authorized for these same purposes. This is to be rescinded. The amount desired has been reduced by $500,000, as some of the purposes of the larger issue have been provided for by the issue of $500,000 one-year notes.

CENTRAL OF GEORGIA.—The Georgia Railroad Commission announces that the Central of Georgia is now the property of E. H. Harriman and that it will be turned over to the Illinois Central whose Birmingham extension, described in another column, is nearly finished. In June, 1907, all the $5,000,000 stock of the Central of Georgia was sold by the Richmond Terminal reorganization committee to Oakleigh Thorne and Marsden J. Perry. It now appears that they were acting as agents for Mr. Harriman, for which service they received 5 per cent. on $3,000,000, the purchase price. The announcement of Mr. Harriman's ownership of the Central of Georgia was postponed until the Illinois Central contest was settled by the election at the recent postponed annual meeting of four directors favorable to Mr. Harriman.

CHICAGO & MILWAUKEE ELECTRIC.—Receivers' certificates up to $1,000,000 are to be issued. The present receivers were appointed on January 28, 1908.

CHICAGO, MILWAUKEE & GARY.—This is the new name of the Illinois, Iowa & Minnesota, which runs from Rockford, Ill., to Momence, 125 miles, and with which has been consolidated the Rockford Belt Railway, a small subsidiary. It is planned to extend the line north to Milwaukee and south to Gary, Ind.

CHICAGO RAILWAYS COMPANY.—The National City Bank and N. W. Harris & Co., of New York, who recently offered $2,500,000 first mortgage 5 per cent. bonds of this company at a price to yield 5½ per cent., have offered another $2,500,000 of these bonds, to yield 5⅜ per cent. The first offering was six times oversubscribed. (March 6, 1908, p. 329.)

CHICAGO, ROCK ISLAND & PACIFIC.—The Chicago, Rock Island & Pacific Railway has arranged with Speyer & Co. for extension of its $6,000,000 two-year 4½ per cent. collateral trust notes which mature April 1, 1908. The extension is for one year with interest at 6 per cent. The extended notes will be secured by $9,000,000 Rock Island, Arkansas & Louisiana first mortgage 4 per cent. bonds, a first lien on 308 miles of road and equipment and the entire amount outstanding. A cash payment of $5 is to be made on each $1,000 note extended, so that there will be a yield of 6¼ per cent. on the extended notes. Holders of the old notes who desire cash will receive it in exchange for their notes. Speyer & Co. are offering the extended notes at 99½ and interest, yielding 6½ per cent.

DETROIT, TOLEDO & IRONTON.—The lien of the receiver's certificates is junior to that of the Detroit Southern, Ohio Southern division, 4 per cent. bonds of 1941, which cover the middle part of the line and the Detroit, Toledo & Ironton general lien and divisional first mortgage 4 per cent. bonds of 1955, which cover the two ends of the line, from Detroit, Mich., south to Lima, Ohio, 125 miles, and from Ironton, Ohio, north 30 miles.

ERIE.—This company is reported to have sold about two weeks ago $1,000,000 Lehigh Valley stock, which it acquired in 1901. Some of its other Lehigh Valley holdings are also reported to have been sold several months ago. Lehigh Valley stock has recently been selling slightly above par.

Gross earnings for January decreased 11 per cent. and net earnings after taxes, decreased 77 per cent. Net earnings after taxes, were $210,000, against $922,000 in 1907.

GREAT NORTHERN.—Gross earnings for February were $2,841,000, an increase of $184,000, and for the eight months ended February 29, 1908, were $40,800,000, an increase of $5,100,000.

ILLINOIS CENTRAL.—There is to be a special stockholders' meeting on May 18 at which the directors will submit a plan for raising between $30,000,000 and $50,000,000; probably by a combined stock and mortgage bond issue.

See Central of Georgia.

ILLINOIS, IOWA & MINNESOTA.—See Chicago, Milwaukee & Gary.

INTERBOROUGH RAPID TRANSIT.—Plans for the proposed bond issue (*Railroad Gazette*, March 6, 1908, p. 330) have been changed. The special meeting of the stockholders will be held on March

28, and the new mortgage will secure $55,000,000 of 45-year bonds. The company has applied to the New York City Public Service Commission for authority to make this issue, also to issue $25,000,000 notes dated May 1, 1908, payable within three years with interest at not more than 6 per cent., these notes to be secured by not more than $30,000,000 of the new mortgage bonds.

INTERNATIONAL & GREAT NORTHERN.—Gross earnings for the week ended February 29, 1908, were $152,000, against $216,000 in 1907, a decrease of $64,000, or 30 per cent.

MOBILE & OHIO.—This company has issued $600,000 first mortgage three-year 5 per cent. notes dated February 15, 1908, secured by $603,000 first mortgage bonds of the Warrior Southern guaranteed by the Mobile & Ohio, and $145,000 equipment trust notes of the Warrior Southern, as well as real estate.

NEW YORK, NEW HAVEN & HARTFORD.—President Mellen, answering an inquiry of the New York City Public Service Commission, says that work is not being carried out on the New York, Westchester & Boston because of a cloud on the validity of this franchise, and is not being carried out on the New York & Port Chester because consent of the Board of Estimate and Apportionment to cross certain streets is lacking. The two companies together have all the necessary authority for building the line, but neither has complete authority separately. Mr. Mellen says that the New Haven will proceed without delay to finish the line as soon as the legal difficulties are settled.

NORFOLK & WESTERN.—Gross earnings for January decreased 25 per cent.; operating expenses decreased 20 per cent., and net earnings decreased 34 per cent. The operating ratio was 67 per cent., against 63 per cent. in 1907.

PORTLAND & SEATTLE.—See Spokane, Portland & Seattle.

SANDY RIVER & RANGELEY LAKES.—This company is a consolidation of the Sandy River Railroad, the Franklin & Megantic, and the Kingfield & Dead River, which together operate about 54 miles of narrow (2 ft.) gage line. The Phillips & Rangeley may also be taken over later. (February 14, 1908, p. 234.)

SOUTHERN PACIFIC.—Gross earnings for January were $9,300,000, against $10,800,000 in 1907, a decrease of $1,500,000, or 14 per cent. Net earnings after taxes were $2,000,000, against $3,500,000, a decrease of $1,500,000, or 43 per cent. The higher price of coal and fuel oil was responsible for $128,000 of the increase; taxes increased $108,000, and renewals of ties $197,000.

SPOKANE, PORTLAND & SEATTLE.—This is the new name of the Portland & Seattle, which is building a low grade cut-off from Spokane, Wash., via Pasco, to Portland, Ore., for the Great Northern and Northern Pacific. This new line is to be finished from Spokane to Portland this year.

TEXAS & PACIFIC.—Gross earnings for the two months of January and February were $2,500,000, against $3,100,000 in 1907, a decrease of $571,000, or 19 per cent.

UNION PACIFIC.—With 200 more miles operated than in the previous year, gross earnings for January, 1908, were $5,200,000, against $6,000,000 in 1907, a decrease of 13 per cent. Net earnings after taxes were $1,800,000, against $2,800,000 in the earlier year, a decrease of 35 per cent. There was an increase in expenditures for renewal of rails and of ties of $195,000; taxes increased $62,000.

WABASH-PITTSBURGH TERMINAL.—The following is the statement of earnings filed with the Interstate Commerce Commission for the month of January and for the seven months from July 1, 1907, to January 31, 1908, inclusive:

	January.	Seven months
Freight revenue	$49,369	$797,971
Passenger revenue	7,472	80,523
All other revenue from transportation	2,284	15,805
Revenue from operations other than transp.	201	3,396
Total operating revenues	$59,327	$897,700
Maintenance of way and structures	7,679	67,188
Maintenance of equipment	7,679	90,960
Traffic expenses	1,618	11,751
Transportation expenses	19,027	200,343
General expenses	3,554	22,114
Total operating expenses	$38,915	$392,969
Net operating revenues	20,411	506,738
Taxes	5,976	45,716
Operating income	$14,135	$461,021

WESTERN MARYLAND.—Judge Morris in the United States Circuit Court at Baltimore on March 5 appointed President B. F. Bush of this company its receiver. The company was embarrassed by lack of working capital. Its earnings were increasing, gross earnings for the week ended February 29, 1908, being $120,000, against $108,000 in the corresponding week of 1907, and from July 1, 1907, to February 29, 1908, having increased over $500,000, or 15 per cent. The management was also embarrassed by the uncertainty as to the proper procedure under the commodity clause of the Rate Law. The Western Maryland owns large bituminous coal workings.

ANNUAL CONSTRUCTION RECORD.

A

ABERDEEN & TOMBIGBEE.—Building from Okolona, Miss., southeast to Pickenville, Ala., 65 miles; surveyed. Grading finished between Okolona and Aberdeen 17.5 miles, also Columbus to Pickensville, 11.5 miles. W. T. McKee, Chief Engineer, Aberdeen, Miss.

ALASKA CENTRAL.—Building from Seward, north to Tanara river, 450 miles. Contract to Snow & Watson, for 23 miles. Surveyed to mile 183; also for branch from Kulk, mile 150, east to Matanuska, 40 miles.

ALASKA PACIFIC.—Building from Martin Island, near Katalla, Alaska, to Bering river coal fields. Surveyed to Copper river valley

AMERICAN RAILROAD OF PORTO RICO.—Cut-off from Hormigueros south to Lajas, 12 miles, to be finished this month.
——Branch to be built this year from San German, east to Sabana Grande, 9 miles. Includes one large bridge and several smaller structures.

ARIZONA & CALIFORNIA.—See Atchison, Topeka & Santa Fe.

ARKANSAS, LOUISIANA & GULF.—Building from Monroe, La., north to Pine Bluff, Ark., with a 7-mile branch to Crossett, Ark. in all 143 miles. Built from Monroe, La., north to Bastrop, 24 miles, and graded 38 miles further to Hamburg, Ark.; also on the branch to Crossett. Track-laying in progress. The 80-mile further extension from Hamburg to Pine Bluff has been surveyed, and grading is to be begun soon as line is finished to Hamburg. E. T. Bond, Chief Engineer, Bastrop, La.

ARKANSAS, OKLAHOMA & WESTERN.—Surveys being made for extensions from Rogers, Ark., northeast to Eureka Springs, 30 miles, and from Siloam Springs, Ark., west to Pryor Creek, Okla., 65 miles. Contract let for some of the work to the W. R. Felker Construction Co., of Rogers, Ark. Bonds offered in January, 1908, at par by Merriam Smith & Co., of New York.

ASHEVILLE & HENDERSON (Electric).—Surveys being made from Asheville to a point in Henderson county, about 20 miles. C. E. Van Bibber, 60 Wall street, New York, Chief Engineer.

ATCHISON, TOPEKA & SANTA FE.—Building new double-track tunnel through Raton Mountain, near Raton, N. Mex. To be 5,000 ft. long, through solid rock, 144 ft. below the existing tunnel. Work 70 per cent. finished. The Lantry Construction Co., Kansas City, Mo., contractors.
——Contracts let to A. Moore, of Newton, Kan., for reconstructing 14 miles of road from Shattuck, Okla., west towards Higgins, Tex.
——Contracts let for change of line and grades, Belle Plaine, Kan., southwest to Cimarron river, near Waynoka, Okla., to the C. H. Sharp Con. Co. and L. J. Smith, of Kansas City, Mo., S. Dolman & Son, Topeka, Kan., and Wood, Bancroft & Doty, Omaha, Neb.
——Contracts let to Wood, Bancroft & Doty, Omaha, Neb., and Dolman & Son, Topeka, Kan., for rebuilding the line from Cicero, Kan., to Mayfield, and for enlarging the yards at Wellington.
——The Southern Kansas of Texas, permitted to take up the track on the Panhandle Railway from a point 1.25 miles west of Panhandle, Tex., to Washburn, 14.3 miles, and to build a new line from the point 1.25 miles west of Panhandle to Amarillo, 25 miles. Work finished on 75 per cent. Wood, Bancroft & Doty, Omaha, Neb., contractors.
——Contract let to Ransom & Cook for grading new yards at Chanute, Kan.
——The Arizona & California projected from Wickenburg, Ariz., on Santa Fe, Prescott & Phoenix, west to Bengal, Cal., on main line, 205 miles. In operation from Wickenburg west 113 miles to the Colorado river. Work under way on bridge over Colorado river and northwest across the Mohave desert to Bengal.
Projected connecting line shown on map in 1907 annual report from Texico, N. Mex., the eastern end of the Belen cut off, southeast via Plainview, Tex., Floydada, Dickens, Aspermont, Hamlin, Anson and Abilene, to Brownwood, Tex., on San Angelo branch of Gulf, Colorado & Santa Fe, about 300 miles. This would give the Santa Fe a short through line from San Francisco to Galveston. Not likely to be built for some time.
See Gulf, Colorado & Santa Fe.

ATLANTA & ST. ANDREWS BAY.—Building an extension from Youngstown, Fla., south to Panama City, 25 miles.

ATLANTA, BIRMINGHAM & ATLANTIC.—Work under way on extension of main line from Talladega, Ala., west to Birmingham, 75 miles. Graded for about 65 miles, and on branch from Bessemer, Ala., to Mulgay, 14.5 miles. Lane Bros. Co., Atlanta, Ga., and C. D. Smith & Co., Birmingham, Ala., contractors.
——Surveys are being made from Atlanta, Ga., southwest to New Orleans, 500 miles.

ATLANTIC COAST LINE.—Contracts let to Wade & Bell, Trinity, Fla., Wade & Morrison, Washington, N. C., and Phillips & Allport, Richmond, Va., for building extension from Wilcox, Fla., northwest to Perry, 55 miles, for a change of line at Goldsboro, N. C., 4 miles, and a change of line at St. Mary's river, Fla., 1.5 miles. Surveys being made for a change of line 4 miles long at Inverness, Fla.

ATLANTIC, NORTHERN & SOUTHERN.—Built last year between Atlantic, Iowa, and Kimballton, 17 miles. Extensions to be built this year north from Kimballton to Manning, 20 miles, and south from Atlantic to V[illegible], 40 miles. C. B. Judd, Chief Engineer, Atlantic.

B

BAKERSFIELD & VENTURA (Electric).—Building from San Francisco, Cal., southeast via Santa Paula, thence southwest to Ventura, on the Pacific coast, with franchises from Sunset northeast to Bakersfield, and from Saticoy south to Hueneme, on the Pacific coast, a total of 270 miles. Branch also projected from Santa Paula southeast to Santa Monica, thence east to Los Angeles, 50 miles. The work will include several tunnels and eight or ten bridges; 20 miles finished. T. B. Blackburn, Ch. Engr., Los Angeles, Cal.

BALTIMORE & OHIO.—Plans for a freight line to be built under charter of the Patapsco & Susquehanna, around Baltimore, Md., 40 miles. The Maryland Court of Appeals has decided that the legislation enacted in 1906 to prohibit building this line is ineffective.

BANGOR & AROOSTOOK.—The annual report for year ended June 30, 1907, includes a map showing a line projected north from the main line at Sebools, Me., along the east bank of the Allagash river to St. Francis, 140 miles. Surveys made over the most difficult parts

BAY POINT & CLAYTON.—Building from Bay Point, Cal., southeast to Clayton. Finished to Cowell, 10 miles. W. H. George, Secretary and General Manager, San Francisco.

BEAUMONT & SARATOGA TRANSPORTATION.—Building extension from Sour Lake Junction, Tex., to Saratoga, 13 miles. Projected 15 miles further to Batson.

BESSEMER & LAKE ERIE.—Extension of the Western Allegheny located from Kaylor, Pa., northeast to Reidsburg, on the projected Franklin & Clearfield line of the Lake Shore & Michigan Southern.

About 12 miles of track to be laid, to finish double-tracking between Conneaut Harbor, Ohio, and North Bessemer, Pa.

BIG STONY.—See Norfolk & Western.

BILLINGS & NORTHERN.—See Great Northern.

BIRMINGHAM, COLUMBUS & ST. ANDREWS BAY.—Contract let to Lemuel E. Miller, Philadelphia, for building from Green Head, Fla., to St. Andrews Bay, 38 miles. Grading under way by J. M. Willis, from Sodom to Taylers, 10 miles.

Surveys for an extension from northern terminus at Chipley, Fla., to Enterprise, Ala., 100 miles. W. M. Gordon, Pres., Columbus, Ga.

BOSTON & ALBANY.—See New York Central & Hudson River.

BOSTON & MAINE.—Plans being made to abolish 19 grade crossings between Johnsonville, N. Y., and Troy.

BOSTON ELEVATED.—Work on the Cambridge subway postponed, awaiting a court decision on question raised by the Mayor of Cambridge. Plans approved and land bought on the East Cambridge elevated extension, including the section in Boston, the viaduct over Charles river and the connections with surface tracks in Cambridge.

Surveys under way for a subway from Sullivan square, Charleston, to Malden, about 3 miles.

——Permission granted by city and by property owners for subway from point near Park street station of present subway, west under Boston Common to south bank of Charles river, and under Charlesbank to beyond Harvard bridge. To be used by trolley cars for Newton, Brighton, Allston and other outlying points. Work not to be begun for some months yet.

BRINSON RAILWAY.—To build in 1908 from Springfield, Ga., northwest to Sylvania, 32 miles. Last year built 25 miles from Savannah, Ga., north to Springfield.

BROOKLYN RAPID TRANSIT.—Plans made for Flatbush avenue extension to the Manhattan bridge. This work, including third and fourth tracking of other lines, to cost $8,600,000.

BROOKVILLE & MAHONING.—See Pittsburgh, Shawmut & Northern.

BUFFALO & DEPEW (Electric).—See Buffalo, Genesee & Rochester.

BUFFALO & SUSQUEHANNA.—Plans made to rebuild parts of this road south from Juneau Junction southwest to Sagamore, 23 miles. Proposed extension from Sagamore southwest toward Pittsburgh. Surveyed to Southbend.

BUFFALO CREEK & GAULEY.—Extension surveyed from Cresmont, W. Va., to Camden-on-Gauley, 40 miles. Wm. D. Janney, Ch. Engr., Clay, W. Va.

BUFFALO, GENESEE & ROCHESTER (Electric).—Certificate of necessity granted for double track line from Depew, N. Y., to Rochester, 60 miles. Will also take over the Buffalo & Depew, now in operation. The road will run through the towns and villages of Lancaster, Crittenden, Corfu, Batavia, LeRoy and Chili. Henry H. Kingston, J. J. Collier, J. A. Harris, Jr., S. Welch and T. H. Dixon, of Philadelphia; W. B. Cutler, J. H. Baker and H. P. Bissell, of Buffalo, are interested.

BUFFALO, LOCKPORT & ROCHESTER (Electric).—Work under way from Rochester west to Lockport, 54 miles. Contract let to J. G. White & Co., New York. From Lockport the company expects to use the tracks of the International Traction Co. into Buffalo. Chas. B. Hill, President, Ellicott square, Buffalo, N. Y.

BUFFALO, ROCHESTER & PITTSBURGH.—Ten-mile section from Carman, Pa., south to Brockwayville, to be revised and a double-track tunnel about 1,000 ft. long, built. Contracts for grading let to Eyre-Shoemaker & Co., of Philadelphia.

BURRS FERRY, BROWNDEL & CHESTER.—Projected from Chester, Tex., east to Louisiana State line at Burr's Ferry, on Sabine river, 85 miles. Surveyed from Rockland to Burkville, 56 miles, graded for 29 miles, track laid on 11 miles. There will be a 200-ft. steel bridge over the Angelina river. Grading finished last year on 21 miles by the Wormack Construction Co., of Browndel. Work suspended. S. C. Omohundro, Ch. Engr., Beaumont.

C

CAIRO & KANAWHA VALLEY.—Proposed extension from Macfarlan, W. Va., to Smithville, 8 miles. Work to begin as soon as bonds can be sold.

CAIRO & THEBES.—Building from Cairo, Ill., northwest to Thebes, 25 miles. J. B. Magee, President. J. L. Armstrong, Ch. Engr., Cairo.

CAROLINA & TENNESSEE SOUTHERN.—See Southern.

CAROLINA VALLEY.—Building extension from Thomasville, N. C., to High Point, 6 miles, and from High Point to Greensboro, 16 miles; two miles built last year also from High Point to Winston-Salem, 21 miles.

CENTRAL CALIFORNIA.—See Southern Pacific.

CENTRALIA EASTERN.—Contract let to W. F. Nelson, of Seattle, Wash., to build from Centralia, Wash., northeast 9 miles. Grading to be begun at once. Contracts for 5 miles additional may soon be let. B. A. Johnson, Ch. Engr., Centralia.

CHARLESTON & SUMMERVILLE (Electric).—Contract let to the General Contracting & Engineering Co., New York, to build from Charleston, S. C., northwest to Summerville, 27 miles. Grading finished on 23 miles. Julius G. Hocke, President, New York. George Topper, Secretary-Treasurer, Summerville, S. C. W. O. Spriggs, Ch. Engr., 15 Whitehall street, New York.

CHARLESTON, PARKERSBURG & WESTERN.—Track laid for 30 miles on the line building from Charleston, W. Va., north to Parkersburg, 60 miles. Engineering work under way on the rest of the line, but undecided when grading will be begun. C. P. Peyton, Ch. Engr., Charleston.

CHARLOTTE HARBOR & NORTHERN.—Last year built 37 miles in Florida. Building with its own men a 3-mile line known as the Hull cut-off to Holst No. 7. Extension from Arcadia to Plant City, 60 miles, surveyed.

CHATTAHOOCHEE VALLEY.—Plans filed for extension from West Point, Ga., north through Troup county, Ga., to Standing Rock, in Chambers county, Ala., thence to a point near Texas in Heard county, Ga.

CHESAPEAKE & OHIO.—The Raleigh & Southwestern, building from the Piney branch at Raleigh, W. Va., up the Piney river and over the divide, thence down the tributaries of the Guyandotte river in Raleigh or Wyoming counties, also extension from Raleigh up Beaver creek into the Glade creek valley. Johnson & Briggs, Richmond, Va., contractors. Work suspended July 1, 1907, on all but 2 miles, which is now under construction on Piney creek above the mouth of Soak creek, Raleigh county.

—Contracts for extending the Coal River Railway let to Carpenter, Haley & Co., of Clifton Forge, Va., for work on Little Coal branch from Rock creek, W. Va., to mouth of Laurel Fork, 17 miles; Laurel to Seng Camp, 5 miles; Laurel to point 5 miles up Laurel Fork. On Big Coal branch to J. C. Carpenter & Co., Dartmouth, to Racine, 8.5 miles.

Double-tracking work on 67.8 miles at various points, and a change of line on 6.4 miles between Norge, Va., and Diascund, which had been temporarily abandoned, was resumed last fall on certain sections that were nearly finished.

—Extension of the Potts Creek branch, 25 miles; work stopped July 1, 1907.

CHESTERFIELD & LANCASTER.—Recently finished line from Ruby, S. C., to Croburk. Extension projected from Croburk north to Monroe or Charlotte, N. C., 20 to 40 miles.

CHICAGO & MILWAUKEE (Electric).—Grading under way by the MacArthur Bros. Co. on last 8 miles north to Milwaukee, Wis. The company is in the hands of receivers, but hopes to have 23.5 miles double track line from Chicago to Milwaukee finished by May. Republic Construction Co., contractors. F. J. Geraghty, Ch. Engr., Highwood, Ill.

CHICAGO & NORTH WESTERN.—Work under way on track elevation and a new passenger station in Chicago.

CHICAGO & WABASH VALLEY.—Building an extension from Dinwiddie, Ind., north to Gary, 20 miles.

CHICAGO, BURLINGTON & QUINCY.—Contracts let last year to the Kilpatrick Bros. & Collins Construction Co., of Beatrice, Neb., for new line to reduce grades from Lincoln, Neb., including new yard at that place west to Milford, 20 miles. Work suspended.

CHICAGO, INDIANAPOLIS & EVANSVILLE.—Contract let to the Carter Construction Co. to build from Indiana Harbor, Ind., south through Indianapolis to Evansville, 346 miles. Branch from Logansport, Ind., north to South Bend, 70 miles, projected. W. M. Kenefick & Co., of Kansas City, are the financial backers. William Kenefick, President; J. B. Carter, Vice-President; C. A. Dunnem, Secretary, and R. Zenkere, Treasurer, Indianapolis, Ind.

CHICAGO, LAKE SHORE & SOUTH BEND (Electric).—Building from South Bend, Ind., west to Chicago, Ill., 71 miles; track laid on 48 miles. Grading finished on 13 miles additional. Seven bridges finished and two being built. It is expected to have the entire line in operation by July. J. B. Hanna, President, South Bend.

CHICAGO, MILWAUKEE & ST. PAUL.—Extension from Glenham, S. Dak., west via Butte, Mont., to Seattle, Wash., 1,372 miles, with a branch from the main line at Black River Junction south to Tacoma, 20 miles. There will be 7 steel bridges aggregating 5,725 ft., with steel approaches 3,425 ft. long, 1,500 ft. of steel trestles, 4 tunnels with a total length of 15,630 ft., and later at Snoqualmie Pass a tunnel about 2 miles long. The line from Glenham to Butte is under contract to McIntosh Bros., of Milwaukee. The Bitter Root tunnel in Montana, and approaches for 2½ miles on each side, are being built by Nelson Bennett, of Tacoma, Wash. The line between the Bitter Root mountains and the coast is under contract to H. C. Henry, of Seattle. All steel bridges and trestles will be erected by the company's men. Track laid on Jan. 1 from Glenham west to Ives, N. Dak., 183 miles, and on 144 miles in Montana, out of 731 to finish the line to Butte. Much grading has been done in the Yellowstone and Musselshell valleys and all contracts have been let. It is expected that construction will be completed to Butte by May of this year, and to the coast by the end of 1909, except for the Bitter Root tunnel.

Work reported under way elevating tracks on the south side of Milwaukee at a cost of between $500,000 and $700,000.

CHICAGO, ROCK ISLAND & PACIFIC.—Work nearing completion on 33 miles of new yard tracks in the Kansas City terminals.

Projected line from Amarillo, Tex., west to Tucumcari, N. Mex., 110 miles. Grading under way from Amarillo west 20 miles, and track laying on this section is expected to be finished in May. Nothing to be done at present on the remaining 90 miles.

CHICAGO, SOUTH BEND & NORTHERN INDIANA (Electric).—Contracts to be let soon for extension from South Bend, Ind., west to Laporte, 25 miles.

CIMARRON & NORTHWESTERN.—See St. Louis, Rocky Mountain & Pacific.

CINCINNATI BELT LINE.—Surveys made and right of way being secured for a double-track belt line around Cincinnati, Ohio. J. F. Williamson, Union Trust building, Cincinnati, is interested.

CINCINNATI, BLUFFTON & CHICAGO.—Contracts for work on the southern extension from Portland, Ind., southeast to Versailles, Ohio, 35 miles, expected to be let early this year.

CLARK & ROCHEPORT COAL RAILWAY.—Right of way secured from Clark, Mo., south to Rocheport, 28 miles. Grading to be resumed in May, 15 miles graded last year. James D. Wade, Ch. Engr., St. Louis, Mo.

CLEAR LAKE & SOUTHERN (Electric).—Surveys under way and rights of way being secured for this proposed line from San Pablo bay, Cal., north via Napa, to Lakeport on Clear lake, 135 miles. Grading to be started this summer. LeGrand Brown, Chief Engineer, 34 Ellis street, San Francisco, Cal.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Surveys being made under charter of the Evansville, Mt. Carmel & Northern from Mt. Carmel, Ill., south to Evansville, Ind., 43 miles.

CLEVELAND SHORT LINE.—Building an 18-mile belt line around Cleveland, Ohio. Located from West Park, 7 miles west of Cleveland southeast to near the Cleveland city limits, thence east and northeast toward Collinwood. In southeast Cleveland the line passes under the main streets, also under the tracks of the Pennsylvania Lines, the Erie and the Wheeling & Lake Erie, through double-track tunnels 40 ft. below the surface. A viaduct 1,980 ft. long will carry it over the Cuyahoga river. There are no grade crossings. The line will furnish interchange facilities between 8 railroads. Work started in May, 1906. Contracts all let, to John Marsch, Cleveland, for grading and masonry, and the King Bridge Co. and the American Bridge Co. for bridges on the section from Rockport to the Cuyahoga river south of Cleveland. Graded for 5 miles and considerable work done on balance. Track laid for 4 miles. H. M. North, Engr. of Con., Cleveland.

COAL RIVER.—See Chesapeake & Ohio.

COAST LINE.—See Southern Pacific.

COLORADO & SOUTHERN.—Terminals being built by the Galveston Terminal Co. at Galveston, Tex., at a cost of $5,000,000; $850,000 has already been spent filling in and putting up a freight house. Over 40 miles of track have been laid.

COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—See St. Louis & San Francisco.

COLUMBUS, MAGNETIC SPRINGS & NORTHERN.—Consolidation of the Delaware & Magnetic Springs and the Richwood & Magnetic Springs, operating 18 miles from Delaware, Ohio, via Magnetic Springs to Richwood, of which 5 miles built last year. Extension to be built from Richwood north to La Rue, 12 miles. W. M. Galbraith, President; C. Magee, Vice-President and Treasurer, Pittsburgh, Pa.; H. E. Buck, Secretary, Delaware, Ohio.

COPPER RIVER & NORTHWESTERN.—Building from tidewater at Katalla, Alaska, through Copper river valley to the interior of Alaska, about 500 miles. A breakwater about 1 mile long will be built at Katalla. Contract let to M. J. Henry for some of the work. This road is one of the J. P. Morgan and Guggenheim projects in Alaska, and will be built by the Katalla Co. M. K. Rogers, President and General Manager, Seattle, Wash. John Krey, Ch. Engr., Katalla, Alaska.

CORVALLIS & ALSEA RIVER.—Building logging road from Corvallis, Ore., southwest to Alsea river, 25 miles; 13 miles graded, track being laid. Stephen Carver, President, Corvallis.

CUMBERLAND RAILROAD.—Contracts let to S. P. Condon, of Knoxville, Tenn., for extension from Artemus, Knox county, Ky., south to Jellico, Tenn., 32½ miles. Track laid from Artemus to Cumberland, 8.2 miles. B. C. Milner, Ch. Engr., Warren, Ky.

CUMBERLAND RIVER & NASHVILLE.—Contracts let to the Monticello Construction Co., of Monticello, Ky., to build from Burnside, Ky., southwest to Monticello, 20 miles; graded for 12 miles, and foundations being built for South Fork bridge. Projected from Corbin, Ky., west to Burnside, and thence southwest to the Tennessee State line, 100 miles, and from this point under the name of the Nashville & Northeastern to Clarksville, Tenn., 60 miles. S. Woodward, President, Carlisle building, Cincinnati, Ohio.

D

DANBURY & PORTCHESTER.—See New York, New Haven & Hartford.

DAYTON, LEBANON & CINCINNATI RAILROAD & TERMINAL CO. Work to be begun this year on an extension of the Dayton branch from Lambeth, Ohio, west to the union station in Dayton, 1.9 miles.

DEEPWATER.—See Virginian Railway.

DELAWARE & EASTERN.—Proposed northern extension to be built by the Schenectady & Margaretsville from Arkville, N. Y., to Schenectady, 70 miles.

——Proposed southern extension to be built by the Hancock & East Branch from East Branch, N. Y., southwest to Wilkesbarre, Pa., 160 miles.

DELAWARE & HUDSON.—Contract let to O'Brien & Mularkey, of Montreal, for extending the Quebec, Montreal & Southern from Pierreville, Que., to St. Jean des Chaillons, 48½ miles, toward Quebec. About three-fourths of the rails are on the ground and sub-structures of the bridges at Nicolet, Becancourt and East Gentilly and for several smaller structures are about finished. Contracts for 41 miles more soon to be let.

DELAWARE, LACKAWANNA & WESTERN.—Work under way on double track tunnel through Bergen Hill, N. J., to parallel the present tunnel at 51½ ft. between centers.

——Surveys made for a main line cut off from Port Morris, Morris county, N. J., west through Warren county to Slateford, Pa., on the Delaware river, 28.7 miles. Will save 11½ miles of distance, and have lighter grades and curves and no tunnels of which there are two on the present line. Will take three years to build. Contracts to be let in the near future.

DENVER & RIO GRANDE.—Double-tracking from Florence, Colo., west to Canyon City, 8 miles.

DENVER NORTH-WESTERN & PACIFIC.—Contract let to the Denver-Steamboat Springs Construction Co., recently incorporated in Colorado with capital of $1,500,000, to extend this line from Yarmony, Colo., west to Steamboat Springs, 68 miles. Col. D. C. Dodge is president of the construction company. The line is being built from Denver, Colo., west to Salt Lake City, Utah, 490 miles. In operation from Denver to Yarmony, 147 miles, leaving 343 miles to finish the line to Salt Lake City.

DETROIT RIVER TUNNEL.—See Michigan Central.

DULUTH & NORTHERN MINNESOTA.—Surveys being made in Minnesota for an extension from mile 50 north to mile 170.

E

EAST SIDE VIADUCT.—Incorporated to build an elevated railroad from the terminus of the Harlem river branch of the New York, New Haven & Hartford at Willis avenue in the borough of the Bronx, New York City, southward across the Harlem river and thence between First avenue and Avenue A to East 34th street, Manhattan. Proposed to build a six-track steel and concrete viaduct between Avenue A and First avenue and across Jefferson Park. "The only work has been topographical examinations, plans, profiles, maps, estimates of cost of lines of location and comparison of their totals." O. W. Barnes, Fishkill, N. Y.; C. H. Cooke, O. B. Mairs and William B. Dinsmore, Jr., of New York, and Thomas H. Loomis, of Steubenville, Ohio, directors.

ERIE.—Improvement work under way on Jersey City terminal. The plans provide for a four-track open cut 70 ft. deep and 4,500 ft. long through Bergen Hill for passenger trains. The tracks will run on an elevation in the city east of the tunnel to a new station. The present tunnel will be used for freight trains. The company has bought a large tract of land at the western end of the tunnel, and the city has vacated five blocks on the meadows. The work includes excavating about 120,000 cu. yds. of earth and 480,000 cu. yds. of rock, and building 15,000 cu. yds. of concrete masonry. The Penhorn Creek Railroad incorporated to build this line, 4.74 miles. Contract let to the Millard Construction Co., Philadelphia, Pa.

——Work under way on extension of Penhorn Creek Railroad to New York & Greenwood Lake Railway, 1.16 miles; also under the name of the Newark & Hudson Railroad, a connecting line from this extension to the Newark branch, 1.95 miles.

——Work under way on 34 miles of the Guymard cut-off (Erie & Jersey) building from Howells, N. Y., to Guymard, 42 miles. Contract let to Bennett & Talbot, of Greensburg, Pa., for building the first section of 12 miles, including a 5,300-ft. double-track tunnel through the Shawangunk mountains. Additional contracts let between Highland Mills and Guymard as follows: Newburg Junction to Woodbury, Sund strum & Stratton, New York. Woodbury to Moodna Creek, John F. Shields, Richmond Hill, Long Island; Moodna Creek viaduct, steel work is being done by the company's forces, masonry work by Smith McCormick Co., Belfast, N. Y.; Moodna Creek to Otterkill, Ferguson Contracting Co., New York City; Otterkill to Stony Ford, Lathrop, Shea & Henwood Co., Scranton, Pa.; Stony Ford to Howells, F. M. Clement & Co., Philadelphia, Pa. Four miles built last year.

——Contracts let and work under way on the Genesee River Railroad from Hunts, N. Y., south to Cuba, 33 miles, as follows: Hunts to Rossburg, Millard Construction Co., Philadelphia, Pa.; Rossburg to Black Creek, W. H. Coverdale & Co., New York; Black Creek to Cuba, Bennett & Smith, Wilkinsburg, Pa.

——Double-tracking from Carrollton, N. Y., to Cuba, 25 miles. Five miles finished; work suspended.

ERIE & JERSEY.—See Erie.

EVANSVILLE, MT. CARMEL & NORTHERN.—See Cleveland, Cincinnati, Chicago & St. Louis.

F

FAIRCHILD & NORTHEASTERN. Last year built 5 miles. Expects to finish extension to Owen by June, to complete line from Fairchild, Wis., via Greenwood to Owen, 38 miles.

——Building with its own men a yard about 1 mile long at Owen, Wis.

FLORIDA CENTRAL.—In operation from Thomasville, Ga., south to Roddenbery, 13 miles, and from Fanlew, Fla., south to Veren, 12 miles. Work under way from Roddenbery, Ga., south to Fanlew, 34 miles.

FLORIDA EAST COAST.—Building extension from Homestead, Fla., southwest along Florida keys to Key West, 156 miles. Opened for traffic to Knight's Key, 109 miles. From Key West north, track laid on about 15 miles.

FORT WAYNE & SPRINGFIELD (Electric).—Grading to begin in April on an extension from Decatur, Ind., south to Berne, 12 miles.

FRANKLIN & CLEARFIELD.—See Lake Shore & Michigan Southern.

FREEO VALLEY.—Contracts let last year to S. R. Neu, of Princeton, Ark., for extension in Arkansas from mile 22 to mile 26. E. Bower, Gen. Mgr., Eagle Mills, Ark.

G

GALVESTON TERMINAL.—See Colorado & Southern.

GENESEE RIVER.—See Erie.

GEORGIA & FLORIDA.—Projected connecting links aggregating 150 miles between existing lines to complete a through line from Augusta, Ga., to Madison, Fla. Contract let to Schofield & Sons, Philadelphia, for part of the work.

GREAT NORTHERN. The Billings & Northern building a connecting line between the Great Northern and Montana Central on the north and the Northern Pacific and Burlington on the south. Grading about two-thirds finished from Armington, Mont., to Laurel, 199 miles. Track laid last year on 32 miles.

——Contracts let to extend the Vancouver, Victoria & Eastern from Keremeos, B. C., west to Princeton, 45 miles. J. H. Stewart, of Grand Forks, B. C., reported to have grading contract for 40 miles, and F. P. Howard, of Maroon Valley, B. C., for work near Hedley. Work also under way from the Pacific coast east to meet the line building west from Keremeos and from Cloverdale, B. C., east to Abbotsford, 26.25 miles. The V., V. & E. and the Victoria Ferry & Railway Co. are building a low-grade line from New Westminster, B. C., south to Blaine, Wash. The part of the line from New Westminster to Olivers, 9.80 miles, is being built by the V., V. & E., and from that place to the international boundary north of Blaine, 11.32 miles, is being built by the V., F. & R.

——Work under way on the Crow's Nest Southern, building a 24-mile extension from Fernie, B. C., north to the mines of the Crow's Nest Pass Coal Co. at Michel, B. C.

——Proposed double-tracking of the mountain district to be begun as soon as surveys are made on the west slope of the Rockies from Summit, Mont., northwest to Whitefish, 68 miles. Much of the line will be rebuilt.

——See Spokane, Portland & Seattle, formerly Portland & Seattle.

GREENVILLE & KNOXVILLE.—Last year built 15 miles north to Marietta, S. C. Building extension from Marietta north to River Falls, 11 miles. Projected from River Falls to the North Carolina state line, 22 miles.

GULF, COLORADO & SANTA FE.—The Texas & Gulf is building from Center, Tex., via Tenaha to Zuber, 21.3 miles. John Scott & Sons, St. Louis, Mo., contractors. Work suspended Feb. 18, 1908.

GUYANDOTTE & TUG RIVER.—See Norfolk & Western.

H

HANCOCK & EAST BRANCH.—See Delaware & Eastern.

HOLSTON RIVER.—See Virginia & Southwestern.

HUDSON & MANHATTAN RAILROAD.—The two tubes of the south tunnel from Jersey City under Hudson river terminating between Cortland and Fulton streets in Manhattan have been driven from the New Jersey side to about the pier head line in New York. The terminal station at Cortland, Fulton and Church streets, New York, under which is the loop terminal of the south tunnel, is nearing completion and the building is to be opened May 1. The station is to be opened by the time the south tunnel is ready for operation. The station at the western terminus of the south tunnel at the Pennsylvania Railroad terminal in Jersey City is about finished. Work under way on the approach to the river tunnel on Railroad avenue and the connecting tunnel under Washington street in Jersey City. The north tunnel from the D., L. & W. station in Hoboken to Morton street, New York, thence northeast to Nineteenth street and Sixth avenue was opened to the public Feb. 25. Extension north to Twenty-third street to be opened shortly, and to the Thirty-third street terminal, later. Work under way in Manhattan on branch from Sixth avenue east under Ninth street to the subway at Astor place.

HUNTINGTON RAILROAD (Electric).—See Long Island.

I

IDAHO & WYOMING.—See Oregon Short Line.

ILLINOIS, IOWA & MINNESOTA.—Final surveys made for extension from Momence, Ill., northeast to Gary, Ind., 42 miles. Work to be begun this year.

ILLINOIS TRACTION SYSTEM.—This system comprises various lines from Danville, Ill., southwest to St. Louis, Mo., having a total of about 530 miles. The projected entrance to St. Louis includes an independent terminal in Venice, also a new bridge over the Mississippi river from Venice to the foot of Salisbury street, St. Louis. Ground secured for yards, terminals and stations at Salisbury street in St. Louis and adjacent to the stock yards at Venice. Work on the bridge piers soon to be begun.

ILWACO RAILWAY & NAVIGATION COMPANY.—See Oregon Railroad & Navigation Company.

INDIANAPOLIS, LOGANSPORT & CHICAGO.—Projected from Logansport, Ind., south to Indianapolis, 66 miles. Surveys made and rights of way for 25 miles and franchises for entering Indianapolis secured. Graded for 2½ miles at Indianapolis. Walter Osmer, Ch. Engr., Logansport, Ind.

INDIAN CREEK VALLEY.—Location surveys made for 10-mile extension from Jones Mills, Pa. C. F. Hood, President, Normalville, Pa.

INTERBOROUGH RAPID TRANSIT (New York City).—Building an elevated line from 230th street on the Broadway division of the subway (on this section an elevated line) to Van Cortland Park, 1 mile; and a subway from Borough Hall, Brooklyn, to Atlantic avenue, .89 mile. The work is being done by the Rapid Transit Subway Construction Co.

——Plans for additional subway tracks north from 96th street and Broadway to 102d street. Work to be begun soon.

INTER CALIFORNIA.—See Southern Pacific.

INTERIOR & WEST VIRGINIA.—See Norfolk & Western.

INTERSTATE RAILWAY (Electric).—Grading to be begun this spring from St. Joseph, Mo., to Kansas City, 47 miles. Right of way secured. Address Smith H. Braney, 1606 Tribune building, Chicago.

J

JOPLIN & PITTSBURG (Electric).—General contract let to A. L. Register & Co., of Philadelphia, Pa., to build extension from Pittsburg, Kan., southeast to Joplin, Mo., 25 miles. Track being laid. Another extension building from Scammon west to Mineral, 5½ miles, also one from Joplin for 12 miles. H. F. Coleman, Ch. Engr., Joplin.

JOLIET & SOUTHERN TRACTION.—Built last year 3 miles in Joliet, Ill., and 7 miles from Joliet to New Lenox. Expects to finish work on the Blue Island division this year; also south from Joliet through Elwood to Wilmington, 16 miles.

K

KANSAS CITY, MEXICO & ORIENT.—Building from Kansas City, Mo., via Wichita, Kan.; Fairview, Okla. T.; Sweetwater and Presidio, Tex., and Chihuahua, Minaca and El Fuerte, Mex., to Topolobampo, on the Pacific coast, in the state of Sinaloa, 1,661 miles. In operation for 714 miles. Track laid in Kansas, 91.45 miles; Oklahoma, 173.86 miles; Texas, 101.87 miles, and Mexico, 357.49 miles, a total of 724.67, leaving 940 miles still to be built. Track is being laid in the United States northeast from Eldorado, Kan., northeast from Benjamin, Tex., southwest from Sweetwater, Tex.; in Mexico west of Falonier on the Chihuahua division, west of Sanchez in the Sierra Madre mountains and east of Hornillos on the Pacific coast division. Contract let to the International Construction Co., of Kansas City, for building 152 miles.

——Rights of way being secured for a branch from Sentinel, Washita county, Okla., southeast to Lawton, 70 miles. Extension from Lawton east to Sulphur, about 100 miles, also projected. Some grading done at Lawton.

——Surveys made to Kerrville for a branch from San Angelo, Tex., southeast to San Antonio.

——Branch projected from San Antonio, Tex., south to Del Rio, 180 miles.

——The Kansas City Outer Belt & Electric, which is to be the Kansas City (Mo.) terminal of the K. C. M. & O., building double-track line. Grading, masonry and bridge work finished, except bridge over Missouri river. L. J. Smith, contractor.

KANSAS CITY OUTER BELT & ELECTRIC.—See Kansas City, Mexico & Orient.

KANSAS CITY SOUTHERN.—Building 3-mile cut-off south of Howe, Okla., to reduce grades. Some bridge work. Extensive surveys made last year for other similar work.

KANSAS SOUTHERN & GULF.—Expects to build extension this year from Westmoreland, Kan., to Manhattan, 22 miles, including a 300 ft. bridge over the Blue river. Surveys made for extension from Blaine, Kan., to Falls City, Neb., 65 miles. Grading to be begun about May 1. O. J. Collman, Gen. Mgr., Lincoln, Neb., and J. E. Williams, Ch. Engr., Westmoreland, Kan.

KENTUCKY MIDLAND.—Last year built 8 miles in Kentucky. Contract let to A. B. Wood, of Cottage Grove, Ore., for an extension from Cypress Creek, Ky., to Midland, 5 miles, including 800 ft. tunnel near Midland. Surveys under way from Midland to Madisonville, 13 miles. M. M. Wheeler, Ch. Engr., Central City.

KEWEENAW CENTRAL.—Building branch from Phoenix, Mich., to Eagle River, 2 miles.

L

LAKE ERIE & PITTSBURG.—See Lake Shore & Michigan Southern.

LAKE SHORE & MICHIGAN SOUTHERN.—Projected extension of the Pittsburg & Lake Erie from Youngstown, Ohio, to Lake Erie. Contract let last year by the Lake Erie & Pitts-ing to Carter Construction Co. from Mill Creek Junction, near Cleveland, southeast to Kent, 26 miles.

The Franklin & Clearfield projected from Franklin, Penn., southeast to Brookville, 56 miles. Contracts let last year to the Crary Construction Co., McNally Co., Ferguson Contracting Co., Mills Construction Co., King Bridge Co., and American Bridge Co.

LAKE SUPERIOR & ISHPEMING.—Surveys being made for change of main line through Negaunee, Mich., about 3 miles, also for reducing the grade on a 5-mile branch and to extend this branch 3 miles. The work will be heavy and includes several steel bridges.

LARAMIE, HAHN'S PEAK & PACIFIC.—Contracts about to be let for work on extension from Centennial, Wyo., south to Hebron, Colo., 77 miles. Part of the work is being done by J. F. White and part by the company's men.

LAS VEGAS & TONOPAH.—Preliminary surveys made from Goldfield, Nev., to Tonopah, 16 miles. Last year 74 miles built on extension from Rhyolite to Goldfield.

LIMA & TOLEDO TRACTION.—See Ohio Electric Railway.

LINCOLN NORTHERN.—See Southern Pacific.

LITTLE RIVER.—Contract let to J. W. Anderson & Co., of Townsend, Tenn., for extension from Forks, Tenn., to Trenthams, 15 miles. Six miles finished and 4 miles in operation.

LITTLE ROCK, MAUMELLE & WESTERN.—Surveys being made for 12-mile extension from Douglas, Ark. Last year built 16 miles in Arkansas.

LONG ISLAND.—Final details not yet settled with the city officials about change of line of the Manhattan Beach line, which is part of the Bay Ridge improvement. It will remove, altogether, about 80 grade crossings between Bay Ridge and East New York and between Manhattan Beach Junction and Manhattan Beach. Contract let to Walter H. Gahagan. Work suspended.

Plans made to eliminate grade crossings at Old West road, Westbury, and New York avenue, Huntington.

—Work started last year on following: Huntington Railroad (electric) from Huntington, N. Y., south to Amityville, 15.75 miles. Includes 3 bridges. Track laid on 7 miles. Surveys on the Babylon extension (electric) from Babylon west to Amityville, 5.82 miles. Jamaica & South Shore branch from Springfield Junction south to Cedarhurst, 3½ miles. All of this work suspended.

—For other work in connection with the Pennsylvania's tunnel extension to Long Island City and the New York Connecting Railroad, see Pennsylvania.

LOUISIANA & PINE BLUFF.—Contracts let to S. R. Neel, of Huttig, Ark., for extension from Dollar Junction, Ark., to New London, 15 miles. Further extension projected from New London to Wilmington, 15 miles.

LOUISVILLE & ATLANTIC.—Contracts let to Mason, Hanger & Coleman, of Richmond, Ky., and to the Canton Bridge Co., of Canton, Ohio, for building 3 miles from Heidelberg, Ky., to Elk City. C. W. Moorman, Engineer Maintenance of Way, Richmond, Ky.

LOUISVILLE & NASHVILLE.—During 1908 second track to be laid from Perth, Ky., to East Bernstadt, 9 miles, and a new double-track line to be built between Pittsburgh and Little Laurel river, 6.80 miles. Also between Frantz and Lynn Camp Creek, 6.50 miles.

Work under way on the South & North Alabama between Graces, Ala., and Hardy, 17 miles, reducing grades and revising the line. Second track to be added.

Work under way extending the Pine Mountain Railroad between Clear Fork river, Ky., and Catliff coal mines, 17 miles; also branch diverging from Yost to Mahan, 2.30 miles.

The Swan Creek Railway is to be finished to Flanigan, Tenn., this year. Track laid from Mount Pleasant, Tenn., 4 miles, leaving 13½ miles yet to be built.

LOUISIANA WESTERN.—See Southern Pacific.

M

MANILA RAILROAD.—Grading started about a year ago on lines on the Island of Luzon, P. I., aggregating 428 miles, to be built by a syndicate formed by Speyer & Co., New York. No contracts to be let for any of the work.

MASSILLON, WOOSTER & MANSFIELD TRACTION.—Contracts let to the Northern Engineering & Construction Co., Cleveland, Ohio, to build from Massillon, Ohio, west to Mansfield, 50 miles. Graded for 4 miles between Smithville and Madisonburg. G. A. Bartholomew, Ch. Engr., 1123 Williamson building, Cleveland.

MEMPHIS & CHATTANOOGA.—See Southern.

MEMPHIS, PARIS & GULF.—Projected from Memphis, Tenn., via Little Rock, Ark., to Paris, Texas, 400 miles. In operation from Nashville, Ark., southwest to Ashdown, 26.9 miles. Extension to be built this summer.

MEXICO, SANTA FE & PERRY TRACTION.—Grading under way from Mexico, Mo., northeast to Perry, 27 miles. J. M. Wolfe, Collinsville, Ill., contractor. About 3 miles graded. Expected that whole line will be in operation about September. Contracts soon to be let for bridges. Extension from Mexico southwest to Columbia projected. S. L. Robison, President and General Manager, Mexico, and C. O. Thon, Ch. Engr.

MICHIGAN CENTRAL.—Detroit River Tunnel Co., building the Michigan Central's new railroad tunnel under the Detroit river between Windsor, Ont., and Detroit, Mich. The length of the underground part of the tunnel will be 1.5 miles, and the distance from surface to surface about 2½ miles. Contract let to the Butler Brothers, Hoff Co., of New York. Contract calls for the completion of the work by June 1, 1909.

MINNEAPOLIS & RAINY RIVER.—Building with its own forces extension from Big Fork, Minn., north to Second Crossing, 11½ miles. Graded for 10 miles.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Work under way by Foley, Welch & Stewart, St. Paul, on extension from Brooten, Minn., northeast to Duluth, 189 miles. 49.6 miles built last year.

MISSISSIPPI CENTRAL.—Contract reported let to O. A. Gibson to build 14 miles from Roxie, Miss., east toward Brookhaven.

MISSISSIPPI VALLEY INTERURBAN.—Organized to build from Springfield, Ill., south to Hillsboro, 53 miles, absorbing as part of the line the Springfield Clear Lake & Rochester, building from Springfield to Rochester, 10 miles; also the Sangamon Valley, building from Hillsboro, north 8 miles. J. E. Melick, President, Springfield.

MISSOURI & NORTH ARKANSAS.—Operates 130 miles from Seligman, Mo., southeast to Leslie, Ark. Track laying just finished on 31½ miles from Woodruff, 9 miles north of Seligman, northwest to Neosho, on the Kansas City Southern, over which the Missouri & North Arkansas has trackage rights to Joplin. The roadbed for 100 miles south of Leslie is being graded by M. C. Burke and L. S. Joseph. 26 miles of track laid and grade ready for 20 miles more. It is expected to finish tracklaying on this section by July. From Kensett, Ark., for 30 miles southeast toward Helena grading contracts let for 11 miles to the Dalhoff Construction Co., of Little Rock, Ark., and the next 15 miles, one-half to the Alabama Construction Co. and one-half to James Dishman. These firms are putting up the embankment across the White and Cache river bottoms. From Cotton Plant to Helena, 55 miles, grading is 80 per cent. done and track material being received. It is the intention to finish the through line from Joplin, Mo., to Helena, Ark., 361 miles, about Oct. 1, 1908.

MISSOURI, OKLAHOMA & GULF.—Building extension from Wagoner, Okla., north to Joplin, Mo., 120 miles, and another from Rose, Okla., south to Denison, Tex., 102 miles.

MISSOURI PACIFIC.—Work under way extending the Springfield Southwestern, from Gulf street through Springfield, Mo., 1.33 miles.

—Track-laying and ballasting under way on 11 miles of yard tracks at Dupo, Ill.; 27 miles finished last year.

—Grading under way for passenger yard west of the new Union station at Little Rock, Ark., which is nearly finished.

MISSOURI SOUTHERN.—Built 4 miles in 1907. Contracts let to the S. H. R. Robinson & Son Contracting Co., of St. Louis, Mo., for extension from Ohlman, Mo., to Bunker, 8 miles. A further extension projected from Bunker to Salem, 20 miles.

MONTANA RAILROAD.—Contract let to Dittner, Bradbury & Co., of Lombard, Mont., for rebuilding from Lombard, Mont., east to Minden, 36 miles. Surveys made from Minden north to Summit, 14 miles.

MOREHEAD & NORTH FORK.—Building with its own men extension from Paragon, Ky., southeast to Redwine, 10 miles.

MORGAN'S LOUISIANA & TEXAS.—See Southern Pacific.

MORGANTOWN & DUNKARD VALLEY (Electric).—The Morgantown Interstate is grading from Morgantown, W. Va., to Star City, 4 miles. The work includes a 600-ft. bridge. W. W. Smith, Secretary and Treasurer, Morgantown.

MORGANTOWN INTERSTATE.—See Morgantown & Dunkard Valley.

MOUNT VERNON & EASTERN.—See New York, New Haven & Hartford.

N

NASHVILLE & NORTHEASTERN.—See Cumberland River and Nashville.

NEBRASKA, KANSAS & SOUTHERN.—Bids are to be asked about May 1 for building this proposed line from Stockton, Kan., southwest to Garden City, 167 miles. Rights of way partly secured. J. C. Hopper, President, Ness City, Kan. Baxter L. Brown, Ch. Engr., St. Louis, Mo.

NEVADA-CALIFORNIA-OREGON.—Building with its own men extension from Likely, Cal., to Alturas, 20 miles. Projected extension from Alturas north to Lakeview, Ore., 60 miles.

NEVADA COUNTY NARROW GAGE.—Work begun last year on cut-off between Colman Station, Cal., and Long Ravine, 3½ miles. Work is being done by the company's men, and includes a steel bridge 190 ft. high and about 800 ft. long, which is to be begun April 1. Graded for 1½ miles and track laid for about three-quarters of a mile.

NEVADA NORTHERN.—Reported plans for extension from Ely, Nev., southwest to Goldfield, about 170 miles.

NEWARK & HUDSON.—See Erie.

NEW ORLEANS GREAT NORTHERN.—Contracts let last year to W. J. Oliver, of Knoxville, Tenn.; Smith & Scott, Memphis, Tenn.; the Worthington Construction Co., of Alabama; E. W. Hanson, of New Orleans, La., and Shea & Ford, Buffalo, N. Y., for building various sections of this line as follows: May's Creek, Miss., to Jackson, 84 miles; Lawrence Creek, La., to Tylertown, Miss., 23 miles, and Slidell, La., via Mandeville to Abita Springs, 26 miles. Last year 53 miles built in Mississippi and 42 miles in Louisiana.

NEW YORK & PORTCHESTER.—See New York, New Haven & Hartford.

NEW YORK, AUBURN & LANSING (Electric).—Building from Auburn, N. Y., to Ithaca, 37 miles. All graded and track laid on 30 miles, and on branches 2 miles. Work under way by the Auburn Construction Co. from South Lansing to McKinneys, 4.1 miles. Projected as steam road, but changed to third-rail. H. A. Clarke, Ch. Engr., Auburn, N. Y.

NEW YORK CENTRAL & HUDSON RIVER.—Excavation and masonry work under way by company's men on second section of reconstructed Grand Central terminal in New York. Steel work being erected by Terry & Trench.

—Buffalo grade crossing elimination work; contract let to the Eyre-Shoemaker Co., Inc., of Philadelphia, for grading the middle section, about one-third of the whole. The city of Buffalo has given contract to John Johnson for changes in streets and street construction.

—Large new yard at Gardenville, near Buffalo, N. Y. Work under way. 10 miles of track laid in 1907.

—Tracks in Tenth and Eleventh avenues, New York, to be removed from the surface of the streets. Not yet determined whether they will be elevated or depressed in a subway.

—Elimination of grade crossings on Harlem division in Mount Vernon, N. Y. Grading for new line in progress.

—Proposed elimination of grade crossings on Harlem division at Tuckahoe, N. Y. Plans being considered by village authorities.

—Proposed elimination of grade crossings on Hudson division through Yonkers, Tarrytown and Ossining, N. Y. Necessary before electrification can be extended to South Croton. Some work done, but now suspended.

—Work under way on the Boston & Albany on 14½ miles of third track between Pittsfield, Mass., and Albany, N. Y.

NEW YORK, NEW HAVEN & HARTFORD.—Harlem river branch from Harlem river to New Rochelle, N. Y., now double track, is being six tracked. Daly & Holbrook, contractors. Four tracks will be equipped electrically with the third-rail system. Estimated cost of entire work, $7,101,891; $4,825,891 for roadway and stations, and $2,286,000 for electrical equipment and apparatus.

—The Providence Terminal Co. building a double track connecting line from the main line station at Providence, R. I., under the river to East Providence, 2.70 miles, including a tunnel under the city. The tunnel is being driven from both ends; about 2,100 ft. have been driven, leaving 2,900 ft. yet to be bored.

—Double-tracking on the Highland division between Waterbury, Conn., and Bristol. Work under way from Waterbury to Terryville Summit, 9 miles, which is expected to be finished early this year, and the rest at the close of the year. This work involves the re-location of much of the line and a 3,500-ft. tunnel at Pequabuck, Litchfield county.

—Widening cut through the city of New Haven for 4 tracks, 1.65 miles. C. R. Blakeslee & Sons, of New Haven, have the contract. Nearly finished.

—Building electric roads from Waterbury, Conn., to Woodbury, 13 miles, and from Waterbury to Thomaston, 6 miles. Work under way.

—Elimination of nine highway crossings at New Bedford, Mass., under way and to be finished in about a year. New engine house and freight yard also to be built.

—Building an extension of the Springfield & Eastern (electric) from Monson, Mass., to Fiskdale, 12 miles; and to South Monson, one-half mile. Palmer to Fiskdale, 11 miles, finished.

—The Danbury & Port Chester is to build a new double track cut-off from the New York division near Greenwich, Conn., via Ridgefield, to Highland division west of Danbury, 30 miles; will shorten distance between New York and Danbury 15 miles. Postponed.

—Negotiations with city of Springfield, Mass., whereby the lands on which the railroad enters Springfield on the east side of the Connecticut river will be sold to the city of Springfield, the tracks transferred to the west side of the river and a new line built from Warehouse Point northward to Springfield, 12 miles. When the change is made trains will run all the way from Hartford to Springfield on the west side of the river. The railroad will build a new bridge over the Connecticut river at Springfield. Under investigation.

—Proposed line from present southern terminus of main line at Woodlawn, 12 miles north of New York, south along the east bank of the Bronx river, 4 miles, to connection with Harlem River & Portchester branch near West Farms, 4 miles north of Harlem river terminus. Investigated only.

—Proposed cut-off from Plantsville, on the Northampton division, southeast to Yalesville on the Hartford division, 8 miles. Investigated only.

—Some work done over a year ago by the New York, Westchester & Boston (electric) from 177th street, New York, north to the city boundary, 4¼ miles. The proposed line is from Harlem river at 129th street, north through West Farms, Westchester, Bay Chester, Pelham Manor, Pelham, New Rochelle, Larchmont, Mamaroneck, Harrison and Rye to Port Chester to the Connecticut line, with branch from Pelham through Mount Vernon, Alameda Park, Fairview Park, Tuckahoe, Arthur Manor and Scarsdale to White Plains, N. Y., in all 38 miles. The New York & Port Chester, which has franchises over nearly same route, is also controlled by the New Haven. No new construction in last year. Mace Moulton, Ch. Engr., 37 Wall street, New York.

——The Mount Vernon & Eastern (Electric) has been incorporated in the interest of the New Haven through the New York, Westchester & Boston, to build from Mount Vernon, N. Y., northeast to Lewisboro, near the Connecticut State line, 35 miles. Preliminary surveys in progress.

——See East Side Viaduct.

NEW YORK CONNECTING.—See Pennsylvania.

NEW YORK, PITTSBURG & CHICAGO AIR LINE.—Surveys being revised for this line. Projected from Pittsburg, Pa., east via Indiana, Cherry Tree, Irvona, Sandy Ridge, Loveville, Tusseyville, New Berlin, Sunbury, Mahanoy City and Tamaqua to Allentown, 298 miles. Joseph Ramsey, Jr., Orange, N. J., is interested. No connection with electric line projected under similar name.

NEW YORK SUBWAYS.—Work under way on a four-track subway loop to connect the Brooklyn and Williamsburg bridges in the Borough of Manhattan. Contracts let on five sections, aggregating $9,094,606 as follows: Bradley Contracting Co., in Centre street between Pearl street and Park Row; Degnon Contracting Co., in Centre street between Pearl and Canal streets, including a spur from Centre street to the Manhattan bridge approach; Cranford Co., in Centre street between Canal and Broome streets; Bradley Contracting Co., in the new extension of Delancey street between Centre street and the Bowery; same company in Centre street between Bowery and Norfolk street. No work has been done on the Brooklyn side.

——The New York State Public Service Commission, First district, has approved the route for the Fourth avenue subway in Brooklyn. It is to be a four-track subway through Flatbush avenue to Fourth avenue, from where a two-track subway will run to Coney Island; also one to Fort Hamilton. Bids will soon be asked for. The estimated cost is $20,000,000.

——The Public Service Commission, First district, has approved plans for the Broadway-Lexington avenue subway from the Battery at the south end of Manhattan Island, north under Church and Vesey streets to Broadway, thence under Broadway and Lexington avenue to the Bronx side of the Harlem river, where it will branch into two spurs, one to Woodlawn Cemetery and the other to Pelham Bay Park. The estimated cost of the work with a line across the island at Canal street, is $67,000,000. The Commission passed a resolution asking the Board of Estimate to assent to the scheme. It is expected that bids will be asked shortly after contracts are let for the Fourth avenue subway.

NEW YORK, WESTCHESTER & BOSTON.—See New York, New Haven & Hartford.

NORFOLK & SOUTHERN.—Contracts let and work under way in North Carolina as follows: Between Farmville and Snow Hill, 10.10 miles; Bayboro and Oriental, 9.80 miles; Mackay's Ferry and Edenton, 9.37 miles; Mackay's Ferry and Columbia, 22.40 miles, and Bishop Cross and Pine Town, 10.95 miles.

NORFOLK & WESTERN.—Work is to be carried out by this company as follows: Extension of the Tug Fork branch, 2.13 miles up the right fork of Sand Lick, in West Virginia; also an extension above Pageton, 4.03 miles. Work under way.

——The Pocahontas & Western to be extended 4 miles in Virginia to the Pocahontas Consolidated collieries.

——The Interior & West Virginia, building from the terminus of extension of Big Stony through Monroe county, W. Va., to Virginia State line, 17½ miles.

——The Virginia & Potts Creek, to be built from the terminus of the Interior & West Virginia to Potts Creek, Va., 11 miles. Work under way to Paint Bank, 4.2 miles.

——The Big Stony started work last year on extension from Interior, Va., to West Virginia State line, 6 miles.

——The Guyandotte & Tug River has secured nearly all the right of way for main line between Clarks Gap, W. Va., and Wharncliffe, 62.27 miles; also located the Barker Creek branch, 10.7 miles, from the mouth of Pinnacle Creek up Guyandotte river, and secured most of the right of way. Extension located to a point on Guyandotte river above the mouth of Slab Fork, 3.03 miles. Branches also located as follows: Pinnacle Creek branch, 7.35 miles, and Still Run branch, 3.56 miles.

NORTHERN DAKOTA.—Grading to be begun in April or May on line from Edinburg, N. Dak., west to a terminal not yet named, about 21 miles. Work expected to be finished by August. Contracts shortly to be let for 60,000 ties. Thomas D. Campbell, President; E. Thorwaldson, Vice-President, and D. F. Bull, Secretary and Treasurer, Edinburg.

NORTHERN OF MAINE.—Grading to be begun about May 1 from Van Buren, Me., west along the northern boundary of Maine via Grand Isle, Madawaska, Frenchville, Fort Kent and St. John to St. Francis, 62 miles. Contracts soon to be let. One bridge. Edson E. Goodrich, President, Waterville, and Henry F. Hill, Ch. Engr.

NORTHERN PACIFIC.—Rebuilding and double-tracking main line from Lake Park, Minn., west to Glyndon, 25 miles. Work 80 per cent. completed and to be finished this spring.

——New alternative line being built from Alta, N. Dak., to Berea, 9.4 miles north of Valley City

——New track on revised grade being built for westbound trains from Wheatland, N. Dak., to Buffalo, 11.2 miles; the present line will be used for eastbound trains.

——Double track work between Casselton, N. D., and Wheatland, to be finished this year.

——Second track under construction from west end of Bozeman tunnel to Bozeman, Mont., 11.8 miles. This is expected to be put in operation in 1908.

——Work under way changing the line and grades in connection with new second track between Garrison, Mont., and Missoula, 69.1 miles.

——Alternate line to eliminate mountain grades from St. Regis, Mont., to Paradise, 21.8 miles; this in connection with the proposed line and grade revision between De Smeth and St. Regis, now operated as a branch line, will reduce the eastbound grade to 0.3 per cent. and westbound grade to level between Tunah and Paradise. It is expected to have this finished in 1908.

——On the White Pine Hill line, 28.4 miles, in Montana, work is under way on a change of line to reduce grades.

——In Washington between Kalama and Vancouver second main track work and improving line and grades on 29.9 miles is under way, and is expected to be finished in the fall of 1908.

——See Oregon, Washington & Idaho under Oregon Railroad & Navigation.

——See Spokane, Portland & Seattle, formerly the Portland & Seattle.

NORTHWESTERN.—See Oregon Short Line.

NORTHWESTERN PACIFIC.—Contracts let to Warren Improvement Co., of San Francisco, for surveys made from Willits, Cal., north 3 miles. Surveys made from Willits north to Shively, 108 miles, on the main line, and from Eledgate south 63 miles, on the branch from Albion to a junction with the main line at Healdsburg.

O

OCEAN SHORE (Electric).—Building double-track line from San Francisco, Cal., south to Santa Cruz, 79.5 miles. Grading 85 per cent. finished. Track laid for 36 miles. J. Downey Harvey, President; Burke Corbet, Secretary; J. B. Rogers, Ch. Engr., San Francisco. In operation from San Francisco to Pedro Valley, 17 miles.

——The Ocean Shore & Eastern to build a branch from Santa Cruz, Cal., southeast to Watsonville, 19 miles. Surveyed.

——The San Joaquin Valley Western to build from Hollister, Cal., to Coalinga, 200 miles. Surveyed.

——The San Juan Pacific to build from Watsonville, Cal., to Hollister, 25 miles. Surveyed. In operation for one-third of the distance.

OCEAN SHORE & EASTERN.—See Ocean Shore.

OHIO ELECTRIC RAILWAY.—The Lima & Toledo Traction, building extension from Deshler, Ohio, northeast to Toledo, 30 miles. Reinforced concrete bridge 1,220 ft. long over the Maumee river near Waterville finished. Graded to Toledo city line. Work suspended, to be resumed this spring and finished this summer.

OPELOUSAS, GULF & NORTHEASTERN.—See Texas & Pacific.

OREGON & WASHINGTON.—See Oregon Railroad & Navigation.

OREGON EASTERN.—See Southern Pacific.

OREGON ELECTRIC.—Work finished from Portland, Ore., via Tualitin and Wilsonville to Salem, 50 miles, except ballasting, which is under way. Extension projected from Portland to Forest Grove, 25 miles. Surveyed. Guy W. Talbert, Manager, Portland.

OREGON RAILROAD & NAVIGATION.—Work under way finishing extensions as follows:

——Between Elgin, Ore., and Joseph, on remaining 56½ miles. Contract for 47 miles let to Erickson & Peterson, of Portland.

——Between St. John and Woodlawn, 1.80 miles.

——On the Oregon, Washington & Idaho, between Riparia, Wash., and Lewiston, Idaho, 37 miles.

——On the Ilwaco Railway & Navigation, between Ilwaco, Wash., and Knappton, 9.40 miles. Erickson & Peterson, Portland, Ore., contractors.

——The Oregon & Washington, projected from Portland, Ore., north to Tacoma and Seattle, 230 miles. At Tacoma there is to be a 8,700-ft. tunnel. Surveyed to Tacoma.

OREGON SHORT LINE.—The Northwestern Railroad projected from Huntington, Ore., north along the Oregon-Idaho State line following the Snake river to Lewiston, Idaho. Contracts let last year to Utah Construction Co., Ogden, Utah, from Blakes Spur north to Homestead, 58 miles; includes 2,200-ft. tunnel east of Huntington. Graded for 25 miles. Work suspended.

——Location surveys made for the Idaho & Wyoming from Elva, Idaho, east to Jackson, Wyo., 105½ miles. Work not yet started.

OREGON WESTERN.—See Southern Pacific.

OWENSBORO & ROCKPORT BRIDGE & TERMINAL CO.—Work expected to be started this year from Owensboro, Ky., north to Rockport, Ind., 12 miles, including a bridge over the Ohio river. A. H. Kennedy, President; G. H. Cox, Secretary, Owensboro.

P

PACIFIC & EASTERN.—Surveys being made for extension from Eagle Point, Ore., to Butte Falls, 21 miles.

PACIFIC & IDAHO NORTHERN.—Surveys being made for extensions from Evergreen, Idaho, east to Roseberry, 35 miles.

PANHANDLE SHORT LINE.—Projected from Dalhart, Tex., south via Hereford and Midland to San Antonio, with a branch from Midland to Rockport on the Gulf. Grading contract let to Miller & Jefferson from Dimmitt south to Lamb county, 60 miles. Grading finished from Hereford to Dimmitt, 32 miles. There will be a number of bridges. Other contracts soon to be let. W. G. Ross, President, and A. D. Goodenough, General Manager, Hereford, Tex.

PATAPSCO & SUSQUEHANNA.—See Baltimore & Ohio.

PAYETTE VALLEY.—Surveys being made for extension from New Plymouth, Idaho, southeast to Falk's Store, 7 miles.

PENHORN CREEK.—See Erie.

PENINSULA RAILWAY (Electric).—Built 8 miles from Bartow, Fla., west to Mulberry, last year. Rights of way secured and 1,000 tons of rails on hand. Expects to begin work soon on remaining 37 miles to Tampa. The Florida Engineering Co. in charge, and W. H. Evers, Bartow, is Ch. Engr.

PENINSULAR RAILROAD.—See Southern Pacific.

PENNSYLVANIA.—Terminal improvements at New York being carried out by the Pennsylvania Tunnel & Terminal Railroad as follows:

——New line from Harrison, N. J., the point east of Newark where the tunnel line leaves the present main line, to the Weehawken shaft of the Hudson river tunnel. Much of the masonry, superstructure and embankment work finished.

——Work being carried on from both ends and from a shaft in the center on two single-track tunnels under Bergen Hill. William Bradley & Sons, contractors. Excavation on tunnels finished, except on 700 ft., and concrete lining being put in.

——Two single-track tube tunnels from Weehawken under Hudson river to 11th avenue shafts; tubes completed and concrete lining being put in. O'Rourke Engineering Construction Co., contractors.

——Western approach to passenger station between 11th avenue and Ninth avenue. New York Contracting Co., contractors. All excavated and work from Ninth and Tenth avenues half finished.

——Contract for construction of the station building and all electrical equipment for the entire terminal and approaches let to Westinghouse, Church, Kerr & Co. Steel work under way on station building.

——Tunnels under 32d and 33d streets, Manhattan, from terminal station at Seventh avenue to East river. United Engineering & Contracting Co., contractors. All excavated except between Fifth and Sixth avenues, and about one-half lining and other work finished.

——Four single-track tubes under the East river, from Manhattan shaft to Long Island. Three of the iron tubes have been joined, and it is expected to connect the fourth by March 20, or earlier. S. Pearson & Son, Ltd., contractors.

——Tube tunnels from river shaft east under Long Island City to East avenue shaft. Excavated, iron lined and two-thirds of concrete lining in place. S. Pearson & Son, Ltd., contractors.

——Tunneling under streets in Long Island City from East avenue shaft to western end of Sunnyside yard, near Thompson avenue; about two thirds finished.

——Large terminal to be known as the Sunnyside yard, between Jackson and Thompson avenues, Long Island City. To be 5,500 ft. long, 1,550 ft. wide at widest point and include about 400 acres. Work on viaducts, embankments, and bridge masonry under way.

——Franchise granted to the Long Island Railroad for Glendale cut-off between Glendale Junction and Woodside, at the entrance to Sunnyside yard. The cut-off is to be a four-track line. All grade crossings between Jamaica and Woodside will be eliminated.

——Franchise granted the New York Connecting Railroad for line through Brooklyn and Queens boroughs, New York City, and over the East river on a bridge to connection with the New York, New Haven & Hartford at Port Morris on the Harlem river. New line to be built from Manhattan Junction, on Long Island Railroad, to the East river and bridge over the East river and Ward's and Randall's islands, with a connection at Long Island City to the Sunnyside yard. The line is to include on its south end through Brooklyn the Bay Ridge line of the Long Island Railroad from East New York to Bay Ridge, on which improvements are under way to eliminate 115 grade crossings, at a cost of about $7,000,000.

——Work to be started soon on large freight terminal at the Bay Ridge waterfront, Brooklyn. This is to be the western terminus of the New York Connecting Railroad, where cars will be put on boats to be sent to the Pennsylvania yard at Greenville, N. J. Contracts for piers and float bridges let. There is to be a pier 600 ft. long with four tracks. The yard will have a frontage on the upper bay of 565 ft., extending to Fifth avenue between 64th and 65th streets. About 40 tracks, with a capacity of 1,800 cars, are to be laid west of First avenue.

——Terminal yard at Pacific street, Brooklyn, N. Y. Work under way.

——Work under way by the Pennsylvania Railroad on the four-track system on the Middle division, between Vineyard, Pa., and Newton Hamilton. To be finished in May. Revision of line on the Conemaugh division, between Blairsville and Tunnelton, 8 miles, and elimination of grade crossings in Blairsville. Under way and to be finished this summer.

——Eastbound classification yard, at Pitcairn, Pa. Work under way.

——Track elevation on the New Jersey division through Camden, N. J., to eliminate grade crossings between the Delaware river and Cooper's creek. Work under way.

——Track elevation begun on the Kensington branch in the northeastern part of Philadelphia. Contract let to the James McGraw Co.

——On the Monongahela division the Ten Mile Run branch, from Ellsworth, Pa., to Millsboro, 15.5 miles, has been finished from Ellsworth south 8 miles, and from Millsboro north 1.6 miles.

——Connecting line from Newberry, Pa., along Lycoming creek, from the Erie division to the Elmira division of the Northern Central. Under construction.

——Improvement of grades and curvature between Jersey Shore, Pa., and McElhattan. Under way.

——Proposed relief freight line, to be built under the name of the Pennsylvania & Newark, from West Morrisville, Pa., to Newark, N. J., 50 miles. With its completion, the six track system will extend from Trenton to Jersey City. Includes new bridge across the Delaware river from Trenton, N. J., to Morrisville.

PENNSYLVANIA ROADS.—The Blair Lumber Co. has given a contract to Vito Greco, of Ligonier, Pa., to build from Laurel Summit, Pa., to Indian Creek, 4 miles. Address J. W. Baker, Ligonier.

PENNSYLVANIA TUNNEL & TERMINAL RAILROAD.—See Pennsylvania.

PHILADELPHIA & READING.—Agreement made with the city of Philadelphia to elevate tracks. Some of the grade elimination work on the Philadelphia, Germantown & Norristown recently let.

PHILADELPHIA RAPID TRANSIT.—Work under way on extension of Market street subway. Contract let to E. E. Smith Contracting Co. from Fifteenth street around the City Hall and east to Juniper street, and to the Millard Construction Co. for eastern section from City Hall loop to Front street. Work from the Delaware river west to City Hall may be finished by July.

PHILIPPINE RAILWAY.—Work under way by the Philippine Railway Construction Co., which has let contract to J. G. White & Co., New York, to build 300 miles of road on the islands of Negros, Panay and Cebu, P. I. William Salomon, Chairman, and Charles M. Swift, President, New York.

PINE MOUNTAIN.—See Louisville & Nashville.

PITTSBURGH & LAKE ERIE.—See Lake Shore & Michigan Southern.

PITTSBURGH, BINGHAMTON & EASTERN.—Building from Binghamton, N. Y., southwest to Clearfield, Pa., 232.5 miles. Grading under way from Renova, Pa., to beyond Westport. Contract let to the Holbrook, Cabot & Rollins Corporation, Boston, Mass. About 21 miles built from Cedar Ledge, Pa., to Powell last year. Other contracts will probably soon be let.

——Branch located and most of the rights of way secured from Cedar Ledge, Pa., to Oregon Hill, 32 miles.

PITTSBURGH, SHAWMUT & NORTHERN.—Work is to be begun in April on extension of the Brookville & Mahoning from Freeport, Pa., to Mahoning, 20 miles.

PITTSBURGH, SUMMERVILLE & CLARION.—Millcreek branch being extended from Millcreek, Pa., 10 miles, by A. Cook's Sons Co., to connect with lumber properties. Four miles built.

POCAHONTAS & WESTERN.—See Norfolk & Western.

PORTLAND & SEATTLE.—The name of this company has been changed to Spokane, Portland & Seattle, which see.

PORT O'CONNOR, RIO GRANDE & NORTHERN.—Projected from Port O'Connor, Tex., north to San Antonio, 190 miles, with branches from Gonzales north to Smithville, 50 miles; Yoakum north to La Grange, 61 miles, and Seguin northwest to New Braunfels, 15 miles. At Port O'Connor, the Gulf terminus, it is planned to develop a deepwater port. Graded for 100 miles and track laying soon to be begun. W. S. Hipps & Co., Houston, contractors. L. A. Gueringer, Ch. Engr., Victoria, Tex.

PORTLAND, EUGENE & EASTERN (Electric).—Projected from Portland, Ore., via Eugene to a point in eastern Oregon, about 182 miles. Grading under way from Eugene to Springfield, 6 miles, and track laid in Eugene for 3 miles. The project is financed by A. Welch, of Portland.

——The Salem-Mehama Railway projected from Salem, Ore., southeast to Mehama, 24 miles. Surveys and rights of way secured by Walters Bros., of Salem.

PUBLIC BELT RAILROAD.—Contract let to the Orleans Engineering Co., of New Orleans, for building part of this double-track line around New Orleans, La. Proposed route is from the upper Parish line along the river front to Kentucky street, around the city to upper Parish line, thence along the protection levee to starting point, 22 miles. One track laid from Parish line to Montegut street, 10 miles. W. J. Hardee, City Engineer, is Ch. Engr.; Hampton Reynolds is Assistant Engineer in charge. Work under way on storage tracks and bridges at various points.

Q

QUEBEC, MONTREAL & SOUTHERN.—See Delaware & Hudson.

R

RANDOLPH & CUMBERLAND.—Work temporarily stopped on extension from Hallison, N. C., northeast to Tillman, $3\frac{1}{2}$ miles. Grading finished.

RALEIGH & SOUTHWESTERN.—See Chesapeake & Ohio.

ROBERT LEE, FORT CHADBOURNE & EASTERN.—Building from Robert Lee, Tex., north east to Winters, 35 miles. Work under way from Robert Lee to Rawlings, $13\frac{1}{2}$ miles. Graded for $2\frac{1}{2}$ miles. J. L. Hoover, Robert Lee, contractor. Additional contracts to be let during first half of 1908. J. Austin Spencer, President, and S. J. Bross, Ch. Engr., Robert Lee.

ROGERS SOUTHWESTERN (Electric).—Building from Siloam Springs, Ark., northeast via Rogers to Eureka Springs, 50 miles. First 27 miles from Siloam Springs finished. Surveys being made on the northern end. Later a line is to be built from a point 7 miles southwest of Eureka Springs south to Huntsville, 22 miles. W. R. Felker, President, Rogers, Ark.

S

ST. JOSEPH, SAVANNAH & NORTHERN.—Located from St. Joseph, Mo., north to Savannah, 15 miles. Work to be begun this spring. T. B. Campbell, M. Tootle and E. J. Wheeler, of St. Joseph, interested.

ST. JOSEPH VALLEY TRACTION.—Building from Middlebury, Ind., east via Shipshewana to La Grange, and, under the name of the St. Joseph Valley Railway, from that point to Angola, 43.7 miles. About finished except some grading, on which work will be resumed this spring. Preliminary surveys made from Middlebury west to South Bend; also from Angola east to Pioneer, Ohio, and Montpelier. G. T. Moore, General Manager.

ST. LOUIS & SAN FRANCISCO.—The Colorado Southern, New Orleans & Pacific, which last year built 121 miles in Louisiana, is putting up a bridge over the Atchafalaya river. This will complete this new line from the Mississippi river to Houston, Tex.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—Surveys reported made for the Cimarron & Northwestern from Cimarron, N. Mex., northwest up the Ponil river to Ponil Park, 22 miles. Grading finished on 15 miles, and 3 miles of track laid. General contract to the Whitescarver Construction Co., Trinidad, Colo., and sub-contracts to Maney Bros., of Oklahoma City, Okla.

ST. LOUIS SOUTHWESTERN.—Three-mile extension under construction at Argenta, Ark.

——Similar terminal extension about 2.75 miles long projected to Fort Worth, Texas.

SACRAMENTO VALLEY & EASTERN.—Building with its own men from Pitt, Cal., to Delamar, 16 miles. Contract for bridge work let to the Globe Construction Co., of San Francisco. Address T. J. Dearborn, Winthrop, Cal.

SALEM-MEHAMA.—See Portland, Eugene & Eastern.

SALT LAKE & OGDEN.—Building extension from Ogden, Utah, city limits to Canyon, 5.60 miles.

SAN ANTONIO & ARANSAS PASS.—Heavier rails being laid from San Antonio, Tex., east to Yoakum, 120 miles; also from Houston west, where 9 miles laid.

SAN DIEGO & ARIZONA.—Location surveys partly made from San Diego, Cal., east to Yuma, Ariz., 200 miles. Small amount of grading done between San Diego and National City; also in the mountains. Over $1,000,000 spent in securing rights of way and terminals in San Diego and National City. The company has taken over the franchises and property of the San Diego Eastern, projected over the same route. John D. Spreckels, San Francisco, is the principal promoter; W. Clayton is Vice-President.

SAN DIEGO EASTERN.—See San Diego & Arizona.

SAN FRANCISCO, IDAHO & MONTANA.—Building, from Caldwell, Idaho, to Homedale, 16.2 miles. Contract let to the Canyon Construction Co., of Caldwell. Graded for 12 miles, track-laying to be begun in April. Surveys from Homedale, Idaho, to Winnemucca, Nev., 275 miles. F. H. Richardson, Ch. Engr., Caldwell.

SANGAMON VALLEY.—See Mississippi Valley Interurban.

SAN JOAQUIN VALLEY WESTERN.—See Ocean Shore (Electric).

SAN JUAN PACIFIC.—See Ocean Shore (Electric).

SANTA FE, LIBERAL & ENGLEWOOD.—See Santa Fe, Raton & Eastern.

SANTA FE, RATON & EASTERN.—Work resumed in Oklahoma on the Santa Fe, Liberal & Englewood, projected from Des Moines, N. Mex., east via Hooker, Okla., to Woodward, Okla.

SARATOGA & ENCAMPMENT.—Building from Walcott, Wyo., south to Encampment, 45 miles. All graded except yards. Track laid from Walcott to Cow Creek, 34 miles. In operation from Walcott to Saratoga, 21 miles.

SAVANNAH, AUGUSTA & NORTHERN.—Surveys being made from Savannah, Ga., northwest to Chattanooga, Tenn., and east to Augusta, Ga., in all 425 miles. Graded for 58 miles and track laid on 30 miles between Statesboro, Ga., and Garfield. Contracts let to W. J. Oliver, of Knoxville, Tenn. W. H. Lynn, 111 Broadway, New York, interested.

SCHENECTADY & MARGARETSVILLE.—See Delaware & Eastern.

SOUTH & NORTH ALABAMA.—See Louisville & Nashville.

SOUTH & WESTERN.—Building from Elkhorn, Ky., south via St. Paul and Clinchport, Va., Kingsport and Johnson City, Tenn., Spruce Pine, Marion and Bostic, N. C., to Spartanburg, S. C. Work under way from Dante, Va., to Bostic, 211 miles. The Meadows Co., of Johnson City, Tenn., general contractors. Work at various points is being done by Walton, Witten & Graham, of Graham, Va.; Carpenter & Boxley Bros., Clinchport, Va., and Jonesboro, Tenn.; Rinehart & Dennis Co., Washington, D. C.; A. H. Jaudy Co., [illegible]; Walton Contracting Co., Falls Mills, Va.; Walton, Wilson, Rodes & Co., Knoxville; Kreis & French Construction Co., Knoxville; J. C. Carpenter & Co., Falls Branch, Tenn.; Carpenter & Boxley, Johnson City; MacArthur Bros. Co., Altapass, N. C.; Patton, [illegible]hardson & Co., Marion, N. C.; Parsons, Aiken, Sheehan & Co., Thermal City, N. C., and Millard-Quigg Construction Co., Marion. Graded and track laid from Dante, Va., to Boltown, 16 miles; Johnson City, Tenn., to Blue Ridge Summit, 69 miles; North Cove, N. C., to Marion, 14 miles, and grading 75 per cent. finished on 67 miles more; 75 miles in operation. Heavy work being done to secure a grade of 1.2 per cent. [illegible] the east slope of Blue Ridge mountains. There are to be 54 bridges and 33 tunnels. Contracts will probably be let this year from Elkhorn to Dante, [illegible] miles, and from Bostic to Spartanburg, 53 miles.

SOUTH OMAHA & WESTERN.—See Union Pacific.

SOUTHERN.—Second-track work under way on 33 miles between Monroe, Va., and Greystone, expected to be finished by June. About 25 miles in operation between Knoxville, Tenn., and Morristown, and 15 more will be finished by April.

——Similar work between Whitethorn and Durmid, including a line through the city of Lynchburg, 6.9 miles, is heavy and includes a tunnel 1,300 ft. long. Now suspended.

——Second-track work between Flowery Branch, Ga., and Austell, 11.56 miles, finished with the exception of bridge over Chattahoochee river.

——On the Knoxville division double-track work is nearing completion between Mascot, Tenn., and Jefferson City, 14.3 miles, including a new double-track bridge over the Holston river, and it is expected to have the entire line between Knoxville and New Line ready for operation in May.

——About half the double-track work between Ooltewah Junction, Tenn., and Citico, 13.75 miles, was finished last year; work suspended.

——The Carolina & Tennessee Southern, projected from Bushnell, N. C., west along the northern bank of the Little Tennessee river to the North Carolina-Tennessee State line, 26 miles, is finished from Bushnell for 14.5 miles; work suspended. From the State line further extension under the name of the Tennessee & Carolina Southern to Maryville, Tenn., 38.8 miles; on the latter grading has been finished for 37.4 miles. Track laid on 4.5 miles. About 25 miles will be ready for operation by July.

——About 150 miles of second track has been finished between Washington and Atlanta, 650 miles; 32 miles more will be put in operation by June.

——The Memphis & Chattanooga projected from Chattanooga, Tenn., to Stevenson, Ala., 42 miles, on which grading and masonry from point near Chattanooga to east portal of Lookout mountain tunnel, about 90 per cent. finished. Work suspended. Work under way lining the double-track tunnel through Lookout mountain, 3,500 ft. long. This is to be finished by July.

——The Louisiana Western building extension from Eunice, La., to Mamou. Graded for 10 miles and work under way on remaining 7 miles.

SOUTHERN KANSAS OF TEXAS.—See Atchison, Topeka & Santa Fe.

SOUTHERN PACIFIC.—Morgan's Louisiana & Texas building extension from Lafayette, La., to Port Allen (opposite Baton Rouge), 21 miles finished, and work on the remaining 32 miles in progress. Extension graded from Bayou Sale to South Bend, 11 miles.

——The Coast Line Railway building north from Santa Cruz, Cal., 12 miles; 9 miles finished and work under way on the remaining 3 miles.

——The Central California, building from Niles, Cal., to Redwood City, 16 miles. Graded for 3 miles and work in progress on rest.

——The Peninsular Railroad building from Mayfield, Cal., to Vasona, 16 miles; 9 miles graded and grading work under way on rest.

——The Inter-California building an extension east from Calexico, Cal., through the northern part of Mexico to Yuma, Ariz., 55 miles. Track laid on 19 miles and 3 miles more graded. Work under way on remaining 33 miles.

——On the 152 miles projected by the Oregon Eastern, surveys between Natron, Ore., and Klamath Falls, and between the eastern side of the Cascade mountains and Ontario have been finished and considerable right of way secured.

——Oregon Western projected, 82 miles. Surveys made from Drain, Ore., via Marshfield to Ward and considerable right of way secured. Grading and tunneling under way and a large part of steel bridges, rails, ties and other track material bought.

——The Lincoln Northern organized to build from Lincoln, Cal., to Dairy Farm Mine, 11 miles.

——For Mexican Pacific Coast and Cananea, Yaqui River & Pacific see Southern Pacific under Mexico.

SPOKANE, PORTLAND & SEATTLE.—This road, formerly the Portland & Seattle, is a joint project of the Northern Pacific and Great Northern, to give them a direct low grade line to Portland, Ore. Building from Portland up the north bank of Columbia river and to Spokane, Wash., with branch east along the Snake river to Texas Ferry, Wash., a total of 415 miles. From Vancouver, Wash., to Kennewick, opposite Pasco, 220 miles, finished in 1907. Work under way on double-track steel bridges over the Columbia and Willamette rivers. The line between Pasco and Spokane, 145 miles, and the branch to Texas Ferry, 41 miles, also the 10 miles from Vancouver south to Portland is expected to be finished by August. Contract let to Siems & Shields, St. Paul, Minn., from Portland east to Kennewick, 230 miles. N. D. Miller, Ch. Engr., Vancouver, Wash.

SPOKANE & INLAND EMPIRE (Electric).—Last year built 50.5 miles in Washington. Contract let to Grant Smith & Co., of St. Paul, Minn., for extension on the eastern division from Palouse, Wash., south to Moscow, Idaho, 15.5 miles; graded for 14 miles and track laid on one-half mile.

SPRINGFIELD, CLEAR LAKE & ROCHESTER (Electric).—See Mississippi Valley Interurban.

STEPHENVILLE NORTH & SOUTH TEXAS.—Last year built 43 miles from Stephenville, Tex., south to Hamilton. Projected extension from Hamilton, south 60 miles, and from Stephenville, north 38 miles.

SUGAR CREEK & NORTHERN.—See Wheeling & Lake Erie.

SWAN CREEK.—See Louisville & Nashville.

T

TAMPA NORTHERN.—Built 39 miles in Florida last year. Contract let to B. H. Hardaway, of Columbus, Ga., for 9 miles from Envill Junction, Fla., to Brooksville. Surveying from Brooksville north to Thomasville, Ga.

TENNESSEE & CAROLINA SOUTHERN.—See Southern.

TENNESSEE RAILWAY.—Grading recently finished by Walton, Wilson, Rodes & Co. on 17 miles, from a point 2 miles below Smokey creek, Tenn., to Beech fork, on New river, 8½ miles; also on spur along Smokey creek to Asher fork, 8½ miles. Track laid for 7 miles and in progress on remaining 10 miles. A 3-mile spur to be built at once up Straight fork of Smokey creek. The line is being built to develop the coal and timber lands along New river and is eventually to be 75 or 80 miles long. W. O. Dyer, Ch. Engr., Oneida, Tenn.

TEXAS & GULF.—See Gulf, Colorado & Santa Fe.

TEXAS & NEW MEXICO.—Projected from McKinney, Tex., west via Denton, Krum, Bridgeport and Jacksboro, 175 miles. Surveyed for 80 miles, and grading finished on 4 miles. W. J. Healy, Vice-President, McKinney.

TEXAS & PACIFIC.—The Opelousas, Gulf & Northeastern, building from Opelousas, La., northeast to point on the Mississippi and southwest to Gulf. Finished from Melville, La., to Crowley, 58 miles. Myrick & Andrews, Opelousas, contractors.

TEXAS STATE.—In operation from Rusk, Tex. west 10 miles. Building extension west 18 miles to Palestine; extension also projected from Rusk east 6 miles. Plans reported to extend from Palestine northwest to Dallas, Tex., 100 miles, and on the southern end southeast to Sabine Pass, about 160 miles from Rusk.

TOPEKA & NORTHWESTERN.—See Union Pacific.

TOPEKA-SOUTHWESTERN.—Contracts let last year to the Southwestern Construction Co., of Topeka, Kan., from Topeka, Kan., southwest to Council Grove, with a branch west of Topeka north to the Kansas river, 60 miles. Steel bridge at Dover. W. L. Taylor, President; V. R. Parkhurst, Ch. Engr., Topeka.

TREMONT & GULF.—Building branch from Menefee, La., southeast to Rochelle, 18 miles.

TUSCALOOSA BELT.—Contract let to the Birmingham & Gulf Construction Co., Birmingham, Ala., from Tuscaloosa, Ala., northeast to Gadsden, 120 miles. Eleven miles in operation. Geo. H. Ross, Superintendent, Tuscaloosa.

TWIN CITY & LAKE SUPERIOR (Electric).—Building double track third rail line from Minneapolis and St. Paul, Minn., via Superior, Wis., to Duluth, Minn., 130 miles. Grading contract let from Belt Line, Minneapolis, to St. Croix river, 38.5 miles; graded for 30 miles. Additional contracts for 60 miles to be let April 1. Number of bridges. E. W. Farnham, President; W. H. Crossland, Vice-President. J. H. Thomas, Ch. Engr., Minneapolis.

U

UNION PACIFIC.—The South Omaha & Western is now building a double-track line from South Omaha, Neb., to Lane, 11.60 miles. Four miles finished last year. The Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb., contractors.

Contract let to Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb., to build branch from Rock Springs, Wyo., north to coal fields, 8 miles.

——Contract let to the Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb., from Luther, Neb., northwest to Northport, 51 miles, on the line from Hershey, Neb., to Northport, 115 miles.

——Extension of the Topeka & Northwestern from Onaga, Kan., to Marysville, 32.44 miles. Kilpatrick Bros. & Collins Contracting Co., contractors. Expected to finish the line by May 1, 1908. To be used in connection with part of the St. Joseph & Grand Island as a through line from Kansas City to main line in Nebraska.

Contract let to the Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb., for the Athol Hill cut-off south of Cheyenne, Wyo., from Carr, Colo., northeast to Borie, Wyo., on the main line; also on branch on the main line between Carr and Borie 3 miles south of Corlett, connecting with the Wyoming division 4½ miles west of Cheyenne. Total length of the new lines 17 miles.

UNITED TRACTION CO.—Contract let to A. W. Sykes, of Sykesville, Pa., to build from Sykesville, Pa., to Big Run, 7.5 miles. Grading finished and track laid on 6.5 miles. E. W. Hess, Ch. Engr., Du Bois, Pa.

V

VALLEY RIVER.—Projected from Mill Creek, W. Va., south to Clover Lick, 43 miles, surveys. Work under way from Mill Creek south to Valleyhead. John Alden, Ch. Engr., Elkins, W. Va.

VANDALIA.—Second track and grade reduction work under way from Harmony, Ind., west to East Yard at Terre Haute, 15 miles, including a better line between Seelyville and Brazil, 8 miles. Will be 9 reinforced concrete subways and 2 reinforced concrete bridges for highway traffic, eliminating 11 grade crossings; also 8 reinforced concrete culverts. Contracts let last year to Jones Bros., of Columbus, Ohio. To be finished in April.

About one mile of second-track being laid between the west end of the Wabash river bridge at Terre Haute and Macksville. To be finished by April.

VIRGINIA & POTTS CREEK.—See Norfolk & Western.

VIRGINIA & SOUTHWESTERN.—Contract let to Callahan Construction Co., of Knoxville, Tenn., for extension from Moccasin Gap, Va., south to the Tennessee State line, 6 miles, thence under the name of the Holston River Railway, southwest to Persia, Tenn., 38 miles. Work started in 1906, partly suspended in October, 1907, and now under way by small forces "at ruling points." All grading and structures 80 per cent. finished.

VIRGINIA AIR LINE.—Building from Lindsay, Va., south to Upper Bremo, 30 miles. Graded for 27 miles, and track laid on 8 miles. Expects to begin operation in July. J. N. H. Cornell & Co., contractors. W. Washabaugh, Ch. Engr., Charlottesville, Va.

VIRGINIAN RAILWAY.—Consolidation of the Tidewater and the Deepwater roads. Building from Norfolk, Va., west through Virginia, 332 miles, and north through West Virginia to Deepwater, 118 miles. Grading finished, except on few cuts between mile 215 near Leesville, Va., and mile 235, east of Roanoke. Track laid on 306 miles. Work under way on large viaducts prevents finishing track-laying. In operation from Norfolk west to Victoria, 125 miles, and from Deepwater south to Matoaka, 80 miles.

W

WALCOTTVILLE & COLDWATER.—Is to build from Walcottville, Mo., to Coldwater, 30 miles, during 1908. O. G. Wales, Kansas City, Mo., interested.

WARREN, JOHNSVILLE & SALINE.—Projected from Warren, Ark., southeast to Longview, 25 miles, with branch southwest to Hermitage. Built from Warren to Fullerton 6 miles, also from Fullerton on the branch 7 miles. Grading under way on 1 mile. Grading to be begun in May on 5 miles from Fullerton south. J. F. Forsyth, General Manager; C. W. Holderbaum, Ch. Engr., Warren.

WASHINGTON, WESTMINSTER & GETTYSBURG.—Projected from Washington, D. C., northeast to Gettysburg, Pa., 90 miles. Built 25 miles last year. Surveys under way on 3 miles in District of Columbia. Grading soon to be resumed. Ira Taylor, New York, contractor.

——Branch projected west to Frederick, Md. Contract for grading and materials agreed upon. Will probably be operated by gasolene motor cars. J. B. Colegrove, President, Washington, D. C. Walter Atlee, Ch. Engr., Baltimore, Md.

WATERLOO, PELLA & SOUTHWESTERN.—Projected from Waterloo, Iowa, southwest to Chariton, 120 miles. Contracts will probably be let this spring. E. A. Harris, Vice-President and General Manager, Pella, Iowa.

WEST CHESTER & WILMINGTON (Electric).—Projected from West Chester, Pa., south to Wilmington, Del., 17 miles. Work to be begun in March. Two bridges. Thomas E. O'Connell, President; C. P. Faucett, Secretary and Treasurer, Delaware Trust building, Wilmington.

WESTERN ALLEGHENY.—See Bessemer & Lake Erie.

WESTERN PACIFIC.—Building from Salt Lake City, Utah, west to Oakland, Cal., 929 miles, of which 122 miles are in Utah, 427 in Nevada and 380 in California. Contracts let to the Utah Construction Co., of Ogden; E. B. & A. L. Stone, of Oakland, Cal., and Maney Bros. & Co., of Winnemucca, Nev. Up to Feb. 20, 1908, grading finished on 620 miles and track laid on 275 miles, including the section from Salt Lake City west to the crossing of the Nevada Northern at Shafter, Nev., and in California from Stockton east 35 miles, and from Marysville east 34 miles. There will be 43 tunnels aggregating 15,342 lineal ft., three of which are to be over a mile long and a fourth over 4,287 ft. Tunnel work about 55 per cent. finished. There are to be 75 steel bridges, a total of 15,535 ft. long; 7 of these have been finished.

WEST TEXAS & NORTHERN.—The West Texas Construction Co. organized to build this line from Stanton on the Texas & Pacific to Lubbock, 110 miles. Fourteen miles graded north from Stanton.

WHEELING & LAKE ERIE.—Considerable amount of double tracking and minor grade and curvature reduction work contemplated, also the completion of the Sugar Creek & Northern, a new cut off from Bolivar, Ohio, northwest to Orrville, 22 miles, now three-fourths finished. All work suspended.

WICHITA FALLS & NORTHWESTERN SYSTEM.—Building with its own men extension from Olney, Tex., south to Belknap, 14 miles.

WISCONSIN & NORTHERN.—Projected from Menasha, Wis., north 153 miles. In operation for 43 miles. Projected extensions from Menasha to Shawano, 45 miles; Van Ostrand to Crandon, 32 miles, and from junction with the Minneapolis, St. Paul & Sault Ste. Marie, to the northern boundary of Wisconsin, 33 miles. All but 12 miles surveyed. Three miles partly graded from Crandon south.

WISCONSIN CENTRAL.—About 28 miles to be built to finish the line from Ladysmith, Wis., north to Superior. In Duluth, Minn., building about 4½ miles. Contracts let to H. P. Basch, of Rice Lake, Wis., and to Lantry Construction Co., of Duluth.

WOLCOTTVILLE & COLDWATER.—Projected from Wolcottville, Ind., northeast to Coldwater, Mich., 30 miles. Contract let to Panama Construction Co. Grading to be begun in June. O. G. Wales, President, 541 Frisco building, St. Louis, Mo.

Y

YELLOWSTONE PARK.—To build from Bridger, Mont., southwest to Cook, 125 miles, including branches. Thirty miles in operation. Contracts let last year to Western Development Co., of Belfry, Mont. "Arrangements pending to continue construction." No connection with recently built Oregon Short Line road of same name.

CANADA.

ATLANTIC, QUEBEC & WESTERN.—Built last year from New Carlisle, Que., north to Port Daniel, 20 miles. Contract let to the New Canadian Co., Ltd., of Paspebiac, and work under way from mile 20 to mile 102.

CANADIAN NORTHERN.—Grading finished by Cowan Construction Co. and track laid from Etoimami, Sask., northeast to Pas Mission, Keewatin, 100 miles. The first section of projected line to Fort Churchill on Hudson bay, 425 miles.

Branch from Dalmeny, Sask., to Coulter, Man., 45 miles, graded from Dalmeny north 21 miles.

—Extension of Rossburn Junction Rossburn branch, from Rossburn, Man., northwest to western boundary of Manitoba. Track laid from Rossburn to Russell, 25 miles. Further extensions projected, one northwest to Buchanan, Sask., on main line, the other west via Dundurn, on the Q., L. L. & S. to point near western boundary of Saskatchewan.

——Branch projected from Edmonton, Alb., north to Athabasca Landing, 100 miles. In operation to Morinville, 23 miles. Only surveys beyond that point.

Proposed extension of Thunder Hill branch from Benito, near western boundary of Manitoba, west to proposed Aberdeen-Fenton connecting line. Nothing done in 1907.

Proposed connecting line from Prince Albert, Sask., southwest to main line at North Battleford. Bridge being built over North Saskatchewan river.

Projected line from Saskatoon, Sask., southwest to Calgary, 300 miles. Graded for 30 miles. This is to form part of through line between Calgary and Fort Churchill on Hudson bay by connection with the line north from Etiomami, Sask.

——Contract let for rebuilding 8.4 miles of the Qu'Appelle, Long Lake & Saskatchewan, between Lumsden, Sask., and Disley.

Plans approved for the joint terminals to be built at Main street and Broadway, Winnipeg, by the Canadian Northern and the Grand Trunk Pacific at estimated cost of $3,000,000.

Improvements reported will be made this year on line between Port Arthur and Winnipeg. About 30 miles of present rails between Atikokan, Ont., and Rainy river to be replaced with 80-lb. rails, and extensive improvements at Fort Frances.

CANADIAN NORTHERN ONTARIO.—Building a 6-mile line to Key Harbor on Georgian Bay to carry iron ore from the Moose mountain deposits.

Extension from Parry Sound, Ont., northwest to Sudbury and beyond; 111 miles built in 1907 and in operation for freight service to Sudbury. Projected west to the Canadian Northern at Port Arthur, 600 miles from Sudbury.

Projected line from Key Inlet, near Sudbury, Ont., east to Ottawa, 350 miles.

Grading nearly finished last year from Ottawa east to junction with Canadian Northern Quebec at Hawkesbury, 50 miles.

—Contract let last year to Central Contracting Co., Toronto, to build from Nepigon, Ont., north to Lake Nepigon.

CANADIAN NORTHERN QUEBEC.—About 65 miles graded and track laid for 20 miles on extension from Gatineau Junction, Que., to Quebec, 84 miles. Work is being pushed to completion. O'Brien & Mullarkey of Montreal, contractors.

Charter granted last year for proposed line from Quebec bridge east to Moncton, N. B.

Proposed line from Moncton, N. B., to Pugwash, N. S., with branch in New Brunswick south to St. John.

CANADIAN PACIFIC.—Work under way on 196 miles to complete the double-tracking from Winnipeg, Man., east to Fort William, 426 miles. Foley, Welch & Stewart, Winnipeg, general contractors. A 100-ft. tunnel at Kilmar.

——Work started last year on the St. Mary's & Western Ontario from Woodstock, Ont., west to Sarnia, 95 miles. Contract let to John F. Webb, of Toronto, from St. Mary's to Embro, 15 miles, including a reinforced concrete subway under the Grand Trunk at St. Mary's; grading finished and track laid on 3 miles. Surveys being made on 71 miles toward Sarnia. J. G. Macklin, Ch. Engr., St. Mary's.

——Second track laid on about 50 miles between Ste. Annes, Que., and Smiths Falls, Ont.; the remaining 58 miles to be finished this year.

——Line from Saskatoon, Sask., west to Wetaskiwin, Alb., 325 miles. Contract let last year to Foley, Welch & Stewart, from Wataskiwin, Alb., east to Battleford, 250 miles. Grading 95 per cent. finished and 97 miles built from Wetaskiwin east and 26 miles west from Saskatoon. Sub-contract reported let to J. D. MacArthur, of Winnipeg.

——Work under way on 37-mile extension of the Yorkton branch from Sheho, Sask., northwest. Projected to Lanigan, 82 miles. Grading 50 per cent. finished.

——Contract let last year to J. T. Hargrave, of Winnipeg, for grading 30 miles on branch from Stoughton, Sask., west to Weyburn, 37 miles. All graded and 12 miles built last year. Projected from Weyburn, Sask., west 100 miles to Range 30, west of the second meridian.

——Building branch from Reston, Man., northwest to Wolseley, Sask., 122 miles, 98 miles built to Kaiser in 1907.

——Reconnoissance for proposed line from Killam, Alb., northwest to Strathcona, 80 miles.

——Extension of Kootenay Central from Golden, B. C., southeast to Fort Steel or Jaffray, about 180 miles. Contract for grading 10 miles from Golden south let last year to the British Columbia General Contract Co., of Vancouver. Track to be laid by the railroad.

——Projected branch from Moose Jaw, Sask., northwest to Lacombe, Alb., 375 miles. Grading contract from mile 50 to mile 123 let to J. D. MacArthur, Winnipeg, for work from Moose Jaw north via Tuxford to point 30 miles beyond Rutland, 50 miles. Track being laid by the railroad on first 50 miles; finished to Tuxford, 15 miles. Work also under way from Lacombe east 100 miles toward Moose Jaw. Surveyed, and 51 miles in operation to east Stettler, Alb. Foley, Welch & Stewart, contractors.

——Contract let last year to Foley, Welch & Stewart for work on Toronto-Sudbury line from Bolton, Ont., north to Romford, 226 miles; 160 miles built; whole to be finished in June. Ross & Harris, contractors for 40 miles.

——Agreement made with the Northern Colonization Railway to build extension from Nominingue, Que., west to Rapide de L'Original, in Wright district, 34 miles.

——The Walkerton & Lucknow building from Walkerton, Ont., to Proton, 37.5 miles. About 25 miles built.

——On the branch of the Guelph & Goderich from Linwood, Ont., to Listowel, 16 miles, there are 3 miles still to be built. B. Gibson, Toronto, contractor, and P. A. Peterson, Goderich, Ch. Engr.

——Contract reported let to McDonnell & Gzowski, of Vancouver, B. C., for improving the main line grades near Field, B. C. The work includes two new tunnels aggregating about a mile and a half, one on each side of the Kicking Horse river, and two bridges. To cost about $1,500,000. Preliminary work begun.

——Additional work to be carried out this year as follows: Line to Hardisty, Alb., and extension of the Winnipeg Beach line north to Icelandic river. A large amount of bridge work is also to be done in British Columbia; many wooden bridges will be replaced by permanent structures.

——Extension of 4 years granted to complete the Esquimalt & Nanaimo branch from Nanaimo, B. C., west to Alberni, 50 miles. Location work finished. Contract let to John Bright, of Nanaimo, for grading from Wellington to Nanoose bay, 12 miles, and to A. Carmichael for clearing right of way from Nanoose bay to Alberni, 46 miles.

CAPE BRETON.—Surveys under way for extension to be built this spring from St. Peters, N. S., northeast to Louisburg, 31 miles.

CENTRAL ONTARIO.—Contracts let to build extension from Maynooth, Ont., to Lake St. Peter, 8 miles; also from Lake St. Peter to Whitney, 19½ miles.

CROW'S NEST SOUTHERN.—See Great Northern under United States.

ESQUIMAULT & NANAIMO.—See Canadian Pacific.

GRAND TRUNK PACIFIC.—To extend from Moncton, N. B., 3,550 miles across Canada to Prince Rupert, B. C., a new port on Kai En Island, about 25 miles south of Port Simpson. The total length of all the projected lines is 7,000 miles.

——Moncton to Winnipeg, Man., 1,807 miles, called the National Transcontinental, to be built by the Canadian government. Contracts let for 859 miles and bids asked for 365 miles more. Total expenditure to Jan. 28, 1908, $21,364,364. Contracts let last year as follows:

——To Grand Trunk Pacific Construction Co., from Moncton, N. B., west to point near Chipman, N. B., 50 miles.

——To Lyons & White, of Ottawa, from Grand Falls, N. B., west to New Brunswick-Quebec boundary line, 62 miles.

——To M. P. & J. T. Davis, of Ottawa, from point 52.4 miles west of the New Brunswick-Quebec boundary west to southern end of the Quebec bridge, 150 miles.

——To Hogan & McDonald, Montreal, for 150 miles from north end of Quebec bridge west to La Tuque. Thirty-four miles of track laid in short sections. Over 6,000,000 yds. of earth and 1,000,000 yds. of rock excavation on this stretch, of which part is finished. Sub-contract for 50 miles from Quebec bridge west let to M. T. Davis, Ottawa. Work under way on Cape Rouge viaduct, 3,000 ft. long.

——To Grand Trunk Pacific Construction Co., from La Tuque, Que., west to Weymontachene, 45 miles.

——To Grand Trunk Pacific Construction Co., from point 8 miles west of Abitibi river, east 150 miles. Some of this sublet to J. H. Reynolds Construction Co. Work to be started on this section this spring.

——To J. D. MacArthur, Winnipeg, from junction to Lake Superior branch with main line, west to point a few miles east of Winnipeg, 244 miles. Sub-contracts let to A. Herbert, 20 miles; W. Wardrup, 15 miles; F. W. Smith, 2 miles of rock work; Guy Campbell, Ottawa, rock work, and W. T. Parsons, of Kenora, Ont., 15 miles, including about 1,000,000 yds. of rock excavation. Excavation on this section amounts to over 11,000,000 yds. of earth and 3,500,000 yds. of rock.

——Bids asked up to March 11 for the following sections: District A.—From about 58 miles west of Moncton, N. B., to the crossing of the Intercolonial, at mileage 97.7, a distance of 39.7 miles. From the latter point to the Tobique river, at mileage 165.7, less one mile, 67 miles. From the Tobique river to about 2½ miles west of Grand Falls, N. B., 31.5 miles. District B.—From the Quebec-New Brunswick boundary westerly for 52.4 miles. District D.—From a point about 8 miles west of the Abitibi river crossing in Ontario, west about 100 miles. District E.—From a point 19½ miles west of the crossing of Mud river, near Lake Nepigon, easterly 75 miles.

——The western line, Winnipeg, Man., via Saskatoon, Sask., Edmonton, Alb., and Yellow Head pass to Prince Rupert, 1,750 miles, and the Lake Superior branch east of Winnipeg to Fort William, to be built by Grand Trunk Pacific. All located. Contracts let for 1,108 miles from Winnipeg, Man., west to 120 miles west of Edmonton. Track laid from Portage la Prairie, Man., via Brandon and Touchwood Hills to Saskatoon, 415 miles. Grading finished from Winnipeg to Portage La Prairie. Contracts let last year as follows:

Lake Superior branch, from Lake Superior Junction southeast to Fort William, 210 miles, to Foley Bros., Larsen & Co. (now Foley, Welch & Stewart), Winnipeg, Man.; 100 miles of track laid.

——To MacDonald-McMillan Construction Co., Winnipeg, from Winnipeg west to Portage la Prairie, 56 miles. Work under way.

——To MacDonald-McMillan Construction Co., Winnipeg, for grading from Portage la Prairie, Man., west to Touchwood Hills, Sask., 275 miles. Finished.

——To Canadian White Co. (J. G. White & Co.), Montreal, from Touchwood Hills to Saskatoon, Sask., 140 miles. Sub-contracts let to M. C. Cance, Rainy River, Ont., J. H. Armstrong, and S. D. Lake. Finished.

——To Foley Bros., Larsen & Co., Winnipeg, Man., from Saskatoon to Edmonton, Alb., 328 miles. Sub-contracts let to Cash Bros. for work in Alberta near Battle river. Work under way and to be finished this year.

——To Foley Bros., Larsen & Co., Winnipeg, from a point 6 miles east of Edmonton, Alb., to Wolf Creek, 120 miles west. The section will be the most expensive of any of the western lines yet under contract. Work under way. Contracts let for ties to H. A. Calder, $200,000; Carruthers, Round & Co., and McPhee Bros. & Hislop, each $100,000.

——Work under way on 100 miles of main line east from Prince Rupert, B. C., to Kitselas canyon, which is the junction point between located direct line eastward and located loop line which is to run north along the Skeena river to Hazelton, then southeast to junction with main line again at point 350 miles east of Prince Rupert. The 100-mile section directly east of Prince Rupert includes much rock work, and it is expected will take two years to build, and cost $7,000,000.

——The Grand Trunk Pacific Branch Lines Co., authorized to build branches from the main line as follows:

——From Moncton, N. B., south to St. John; New Brunswick-Quebec boundary west to the St. Lawrence river, near Riviere du Loup, Que., south to Montreal; from a point further west southeast to Montreal; to Ottawa; to North Bay; from point northeast of Fort William, Ont., southeast to Orilli, Ont.; Winnipeg south to international boundary; Brandon south to international boundary with a west line from Brandon to Regina, and from point on the international boundary in southeastern corner of Saskatchewan northwest to Regina, thence northeast across main line south of Springside, Sask., to Fort Churchill, on Hudson bay; point east of Saskatoon, north to Prince Albert; point near western boundary of Saskatchewan, north to North Battleford; point near eastern boundary of Alberta, southwest to Calgary, thence southeast to international boundary; Fort George, B. C., south to Vancouver; point near Hazelton, B. C., northwest to Dawson, Yukon. Also line from the southeast end to the northwest end of Vancouver Island.

GREAT NORTHERN.—See Great Northern under United States.

GUELPH & GODERICH.—See Canadian Pacific.

INTERCOLONIAL.—Double-tracking under way between Moncton and Halifax. Contract from Moncton to Painsec Junction, 7 miles, let to J. B. McManus Co., Ltd., of Memramcook, N. B.

——Contract let to Willard Kitchen Co., of Fredericton, N. B., for Cotton Factory branch from Richmond, N. S., to Kempt Road, Halifax, 1.69 miles. Work under way.

NORTHERN COLONIZATION.—See Canadian Pacific.

ORFORD MOUNTAIN.—Building extension from Mansonville, Que., to North Troy, Vt., 4.5 miles, and from Windsor Mills, Que., to Brompton-ville, 9 miles. Both to be finished early this year.

QUEBEC, MONTREAL & SOUTHERN.—See Delaware & Hudson under United States.

ST. MARY'S & WESTERN ONTARIO.—See Canadian Pacific.

TEMISKAMING & NORTHERN ONTARIO.—Extension of main line from mile post 2[illegible] at the Watabeag river to mile post 2[illegible]1 near Transcontinental Junction, 4[illegible] miles. A. R. McDonald, New Liskeard, Ont., and McRae, Chandler & McNeil, Driftwood City, Ont., contractors.

——Branch from Englehart to Charlton, 8 miles. Canadian Construction Co., Montreal, contractors.

——Branch from Cobalt to Kerr Lake, 4 miles. McQuigge & Hunt, Cobalt, Ont., contractors.

——Surveys for branch from Cobalt to Sudbury, 110 miles.

VANCOUVER, VICTORIA & EASTERN.—See Great Northern, under United States.

VICTORIA FERRY & RAILWAY.—See Great Northern, under United States.

WALKERTON & LUCKNOW.—See Canadian Pacific.

MEXICO.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific, under Mexico.

KANSAS CITY, MEXICO & ORIENT.—See this company under United States.

MEXICAN CENTRAL.—On the Tampico cut-off about 101 miles remain to be built, 54 miles of which (from the Panuco river south) is under contract. The line as located from the city of Mexico to Tampico will be 364 miles long, as against 1,000 miles by the present route. The 142 miles from Tampico to the foot of the plateau, will have a .5 per cent. grade, and on 54 miles the maximum will be 2.5 per cent. with 8 deg. curves.

——Building Manzanillo extension from Tuxpan, Jalisco, to Colima, capital of Colima, 45 miles. Hampson & Smith, Mexico City, contractors. Number of important bridges and 12 tunnels. Much heavy work to be done between Colima and the port of Manzanillo. Connection at Colima with reconstructed line of Mexican National Construction Co. to Manzanillo. Whole extension to be finished this summer.

——Large terminal to be built at Manzanillo. About 1,000 acres of land bought.

MEXICAN PACIFIC COAST.—See Southern Pacific, under Mexico.

MEXICAN WESTERN.—Grading soon to be begun from Gutierrez, Zacatecas, west to Sombrerete, 100 miles. Final surveys made. R. S. Towne, President of the Mexican Western Construction Co., interested. Vinton P. Safford, Gutierrez, Ch. Engr.

MINERAL BELT OF GUANAJUATO.—Contract let to E. J. White, of Guanajuato, to build 40 miles to mines in state of Guanajuato. Heavy work. Graded from Tepetapa, 2 miles. The Guanajuato Development Co., is building the line.

PAN AMERICAN.—Contract let to H. L. Heintz of San Geronimo, Oaxaca, to build from Huixtla, Chiapas, to the Guatamala line, 30 miles, including 3 large bridges. Track laid from Tapachula, Chiapas, to San Bineto, 20 miles.

——This company has concessions for main line to Panama through San Salvador and Nicaragua.

——The Pacific, Gulf & Yucatan is a projected branch from Jallaco, Chiapas, to point in state of Yucatan, 660 miles.

PACIFIC GULF & YUCATAN.—See Pan American.

PARRAL & DURANGO.—Last year built 3 miles south of Mesa de Sandia, Durango. Work under way on 12 miles from kilometer 75 to Paraje Seco. Contract let to R. M. Dudley, of Mesa de Sandia.

SOUTHERN PACIFIC.—The Cananea, Yaqui River & Pacific is building a branch from Corral, Sonora, north along the Yaqui river. Projected to international boundary, 388 miles. Built to Cumuripa, 41 miles. Grant Bros. Construction Co., Los Angeles, Cal., has contract to Tonichi, 63 miles.

——Work under way on branch from Rio Yaqui, Sonora, north to Nacozari, 108 miles.

——Work under way from Del Rio Sonora, on the Naco-Cananea line, northwest to Nogales, 75 miles.

——The Mexican Pacific Coast building from Navojoa, Sonora, south of Corral on the Cananea, Yaqui River & Pacific, southeast to Guadalajara, Jalisco, 780 miles. About 84 miles finished last year from Navojoa south, and work progressing. The Grant Bros. Construction Co., Los Angeles, Cal., has contracts for some of the work.

ZACATECAS & EASTERN.—Projected from Camacho, Zacatecas, via Tesolate and Cedros to Bonanza, Coahuila, with a branch from Cedros to Salverna, a total of 80 miles. Concessions granted to John Cooper through J. P. Taylor, of Mexico City. Contracts soon to be let and grading started within 6 months.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 12. FRIDAY, MARCH 20, 1908

Bion J. Arnold, who was some time ago engaged by the Public Service Commission for New York City to report improvements which might be made to the present Interborough Rapid Transit subway, has made a further report to the Commission dealing with improvements which can be made to the express stations and to the signal system of the subway. Mr. Arnold's report on the Subway Car was published in the *Railroad Gazette* of February 28 and March 6, 1908. Mr. Arnold declares that the existing signal system, when it was put in in 1904, was as complete as it was possible to make it, but that the art of signaling has made rapid strides since that time. Besides advocating a change in the signal system on the express tracks, which will provide an automatic stop for trains entering stations and the extension of the signal system used on the express tracks to the local tracks, Mr. Arnold's most novel recommendation is that the express stations should be double decked, so as to make it possible for two express trains to lie in a station at the same time, alternating on one and the other side of the express platform, the local trains running underneath the express level. This he believes would increase the capacity of the subway by fully 50 per cent., because the great delays in the subway come in unloading and loading passengers. There is said to be room for double decking the express stations without additional excavation, with a possible exception at Ninety-sixth street. At present during the rush hours each express train usually has to wait just short of each express station while the train in advance is discharging and taking passengers at that station platform. With capacity for receiving two express trains at the same time at each platform, a second train could pull into the platform and begin unloading while the first train was finishing its loading and about to pull out. Mr. Arnold's recommendations in regard to the signal system are summed up in another column.

We print this week in pretty full detail a very noteworthy document: the report of the commissioners appointed to investigate the Quebec bridge failure. The finding that the professional knowledge of the present day concerning the action of steel columns under load is not sufficient to enable engineers to design economically such structures as the Quebec bridge is immensely important, but it tells only part of the story, for the commissioners specifically deny that there was any improper desire of economy or any neglect of duty. The bridge fell because its design was fundamentally wrong, insufficient provision having been made for unit stresses higher than any established by past practice. The dead load upon which the calculations were based was assumed at too low a value and the error got past all the engineers who should have detected it. But this error, great as it was, might have been detected early or might at least have been prevented from working terrible harm had it not been for the fact that "the greatest bridge in the world was being built without there being a single man within reach who by experience, knowledge and ability was competent to deal with the crisis." The bridge company had the services of an excellent consulting bridge engineer, but, owing to Mr. Cooper's advancing years and ill health, they were absentee services. The correspondence quoted from the report shows perfectly clearly the instant apprehension of the consulting engineer at the first sign of danger; but he was ill, he was a long distance from the work, and there was nobody on the ground possessing either the experience to grasp the full meaning of the desperate situation which had arisen or the combined experience and authority needed to deal with it. The commissioners say, "the impression left with us is that throughout the work Mr. Cooper was in a position of a man forced in the interests of the work to take responsibility which did not fully belong to his position and which he was not authorized to take, and that he avoided the assumption of authority whenever possible." So here we have the two great causes of the disaster, defective design, and a defective organization for doing the work. No further comment need be made. The rewards which compensate the engineer who has succeeded are not great, apart from the joy and pride of conquering quietly and progressively all the difficulties, old and new, which nature provides with such abundance and of realizing that there are a few who know and appreciate: the penalties and the sorrow of failure are perhaps greater than in any other profession.

The announcement by the Georgia Railway Commission that Mr. Harriman and his associates bought the Central Railroad of Georgia last summer through their agents, Oakleigh Thorne and Marsden J. Perry, is of unusual interest, for several reasons. First of all because a transcontinental system has been created within the boundaries of the United States under common control. Details of Mr. Harriman's exact holdings in the Georgia Central are lacking, just as they are in the case of the Illinois Central, but it is clear that the Harriman party commands the policy and resources of both these roads, which together afford a through route from Omaha, Neb., to

Savannah, Ga., by way of the new Illinois Central extension to Birmingham, Ala., described on another page last week. The Gould interests have been measurably close to a transcontinental line for some years, and when the Western Pacific is completed the only gap between Oakland and the terminus of the Western Maryland at Baltimore will be a stretch of 100 miles or so (of exceedingly difficult country) in the West Virginia mountains between the West Virginia Central & Pittsburgh and the Wheeling & Lake Erie. But Mr. Harriman has a good deal better through route than this could have been. The grades on the Denver & Rio Grande and on the West Virginia Central & Pittsburgh are not adapted to a heavy through haul, and the difficulties in connection with the West Virginia mountain strip of intervening territory are so great that no active attempt to close the gap is being made. On the other hand, the Harriman route from the Pacific coast right through to Birmingham, Ala., is thoroughly well adapted for heavy traffic, and the Georgia mileage, although not yet developed for that purpose, ought to be capable of development at comparatively small expense. To what actual use this combination of roads will be put in its capacity as a transcontinental line, is another question. The Illinois Central has a most excellent, substantial, capacious line from Chicago to New Orleans, with easy grades favoring southbound traffic. The Southern Pacific has a line of freight and passenger steamers from Galveston and New Orleans to New York which can handle through business with the greatest advantage and economy, and it is not clear that it would benefit the system to haul transcontinental traffic over the Central of Georgia to Savannah, thereby competing with the Illinois Central gulf lines and with the great fleet of Southern Pacific coastwise steamers. The Central of Georgia also has an excellent fleet running between Savannah and New York. This steamship property has been carried upon the Georgia Central balance sheet at an absurdly small figure, in view of the fact that all the steamers now in commission are large, new boats, none of them except the "Kansas City" being more than six years old and all being excellently adapted to the traffic, and the inference is a fair one that this service has been so profitable that much of the actual cost of this fleet has been met out of surplus earnings. It is not clear how the Harriman system will derive any advantage from using this Savannah fleet to compete with the New Orleans fleet for through traffic. It seems more likely that the best use of the Georgia Central will be as a large and very important local railroad, fully able to take care of itself, with its sphere of usefulness extended by the additional traffic which the western connections will be able to give it. But, after all, the greatest value of this property to the Harriman system probably lies in the fact that it is thereby kept out of the hands of the Rock Island.

RIFTS IN THE RAILROAD CLOUDLAND.

The president of a great railroad system, itself not so severely visited by adverse legislation as some other systems, recently in a semi-private talk expressed his fears that the present general onset upon the railroads presaged ultimately one of two things—compulsory and arbitrary scaling down of their values by state action or a smaller scaling down under federal ownership. Such words were the language of pessimism albeit they represent in these strange times what too many people who are always looking toward the sunset rather than to the dawn, are saying or thinking. It is one of the evils of hard times that their ills are not merely concrete. They also tend to create a kind of atmosphere which, breathed in, infects overmuch the vision and distorts the perspective. In such atmospheric conditions it is well now and then to take a draught of ozone and readjust vision to its true focus. Nor, somber as the general outlook may be, is such a search for rifts in the railroad cloudland in vain, nor like an attempt to draw rays from the cucumber, nor to demonstrate the much-disputed canals of Mars. The bright rifts in the railroad situation are really there and likely to widen rather than narrow—especially after election.

Let us take, for one example, that valuation idea which rises every few days like an uneasy ghost and has but lately assumed somewhat clearer apparent outlines, while not more tangible really, in the Nebraska platform which is known to be Mr. Bryan's own, and which may be rebuilt at Denver along the same lines. It scares somewhat conservative railroad investors already made nervous by previous events. But how many of them remember in that connection the "due process" clause of the federal constitution relating to property and how it stands right athwart anything that savors of confiscation? "Valuation" of railroad properties means a process of such intricacy, such an excursion into an infinity of varying values, such an unraveling of tangled and snarled skeins of interests complicated by time and change as would defy the labors of the economic gods. But even were it practical, how much have the railroads actually to fear? Not a few of them if extinction of old investment by reorganization is reckoned in, are under-capitalized rather than over-capitalized by a fair valuation test. Others have been solidified by the immense increase of their realty values, especially when they include terminals in great cities. Under constitutional limitations and checks the very worst that valuation could do in the case of the steam roads, would be the clipping of the edges of speculative securities. Even in the case of speculative issues, which morally deserve small pity, most of them are protected behind state law though that does not prevent them, perhaps, from being reached by legislative reduction of rates. This would apply, however, to street railways rather than to the steam roads, honest investors in which can afford to treat valuation as a bogy and rely pretty confidentially on the courts to resist confiscation by statutory rate-making.

Another rift in the clouds is descried when one studies the present phase of railroad contraction. We have now begun to reach the after-panic period when the procession of receiverships has started. But no great railroad system has yet joined it. What is of more importance, unlike the after-panic periods of the seventies and early nineties, the recent receiverships have come, usually not as the sequel of basic railroad weakness but of credit contraction. There has, of course, been contraction of earnings, but this has been a minor factor; there has been a malign influence reaching somewhat further in the form of state and federal action, but the main cause has been stagnated credit at a time when only the highest security commands funds. Though the distinction may seem a fine one, the recent receiverships in railroads have been fiscal rather than physical, as they were after 1873 and 1893. Then they were the result of an undue mass of debt in ratio to physical capacity and earning power; now they come when physical capacity is good and indeed so good that it has been seeking extension, but has been met by sudden and unlooked for collapse of borrowing power. The distinction seems obvious, as also its corollary that the railroad receiverships of 1908, unless hard times greatly deepen and lengthen, will perhaps not involve any great railroad system, and will many of them be transitory without root and branch reorganizations—in this respect not unlike the suspension of certain New York banking institutions.

In this connection another rift to be watched for hopefully is the market for railroad bonds, the real financial criterion of railroad credit. Through that fissure in the gloom there gleamed a cheering light in January. The normal reaction from panic conditions seemed then to have set in. Capital, made timid by panic, had begun to seek actively senior classes of good railroad bonds for investment, and the demand had even begun to reach the junior bonds of the stronger roads, and promised to extend downward still further and alleviate the strain on railroad credit. Why the upward movement of railroad credit ceased within three weeks is partly conjectural. Those who attribute it to the exhaustion of dividend investments may possibly be as near to the truth as those who charge it to the untimely utterances of the President. But whatever the cause, the normal drift of capital into railroad bonds has probably suffered a pause, not a check. That the free capital exists to renew it is at least suggested by the great over-subscription to the New York City loan and the success and high premium of the new $39,000,000 loan of the New York, New Haven & Hartford. Upon the future of railroad bonds during 1908 the solution of the railroad situation very largely depends and, on the whole, the outlook is not unpromising save for "politics" and unnatural interference by high officialdom with the national law of post-panic recovery.

We have referred to certain breaks in the railroad obscurity which are secondary in character and remote from others which are primary and more visible, such as the underlying strength of the nation's industries, the powers of common law as a check on demagogism, the final triumph of common sense and of the axioms of political economy and the bracing fact that a presidential campaign cannot last forever. But while optimism still has the vantage of pessimism the deeper must be the regret that the rifts in the railroad cloudland are not broader, that they do not open faster and that in the commercial quarter the horizon still remains so thick. The curt phrase, "net earnings" of the railroads are the final test words, and those in time rest on general trade conditions. How far and how long they, in their turn, are to be distempered by policies external, hasty and rash, only time will inform us. If they could only be let alone prophecy would be both more definite and more reassuring.

THE ENGINEERING DIFFICULTIES OF THE HUDSON & MANHATTAN TUNNEL.

The shield method has now been used so often for subaqueous tunneling that from the engineering standpoint there is nothing new or particularly interesting about its general principles. The striking features of such work are the means devised to meet unique difficulties. It is here that the duties of the engineer in overcoming natural forces branch out into the romance of achievement. The twin Hudson & Manhattan tunnels recently opened for traffic under the Hudson river between New York and Hoboken, had their full share of such critical situations, which were successfully handled by new methods. In an address before the Yale Club in New York City recently, Charles M. Jacobs, chief engineer of the Hudson & Manhattan, spoke of a few of the most striking of these problems. They are worth special mention as illustrating the highest type of engineering achievement.

At the beginning of the work on the south tube of the uptown tunnel, the shield from the Hoboken side through the silt was being advanced with the shield doors closed so as to save the cost of excavation. While the heading was still under the Lackawanna coal dock the night superintendent, thinking that the shield was moving very slowly, determined, contrary to orders, to open one of the center doors so as to let the mud come in and so let the shield go ahead faster. The silt shot in under such pressure that it buried some of the men before they could escape; the rest of the shift got away through the upper emergency lock which was then 115 ft. from the shield face. The heading was lost and, the tunnel between the shield and the lock being filled solid with mud, there was no space for air pressure in which men could be put to work digging out the mud. The coal dock was crowded with shipping and, furthermore, the Lackawanna at that time was not particularly favorable to the tunnel enterprise, so it would have been almost impossible to get permission to dredge out the bed of the river in front of the shield so that a diver could go down and timber up the exterior opening to the doorway. The problem was solved as follows: Two heavy mainsails (one being an old one of the cup defender Reliance) were procured and a double canvas cover, about 60 ft. by 40 ft., made of them. Around the edges were secured small weights of pig iron. The canvas was spread on a flat barge and lines carried to fixed points to hold the mainsail in the position; the barge was withdrawn and the mainsail allowed to drop to the bed of the river, 30 ft. of it covering the shield and the remaining 30 ft. extending out beyond the face toward the middle of the river. One of the pipe valves in the lock was then opened and the mud, under the direct pressure of the river, shot into the tunnel westward of the lock for 40 ft. It came in a solid stream for eight days and nights. Finally it let up for a few minutes, began again and then stopped. A cavity had formed in the bed of the river outside the cutting edge of the shield until the canvas dropped with the cavity and was eventually drawn into the opening of the doorway through which the mud was pouring. A small cavity was excavated in the mud-filled tube ahead of the lock and air pressure being put on, it immediately relieved much of the strain on the temporary canvas cover. Miners were then able to get into the tunnel and dig out the mud. In about nine days the heading was recovered and the door on the inside closed.

The north tube is an extension of an old tunnel abandoned some years ago. Within 100 ft. from the point where the shield stopped in the previous attempt, was a reef of rock, standing from 1 to 16 ft. above the intended grade of the tunnel. Before the shield arrived at this point, it was necessary to build a temporary workshop in the river ahead of the shield, so as to build on the front of it a steel apron under which men could work in drilling the rock and blasting it out of the path of the shield. Above the rock was soft silt and, above that, from 60 to 65 ft. of water. It was expected that, in blasting the rock with so slight a cover and with such heavy water pressure, the heading would probably be blown out. Clay loaded on barges was, therefore, always held in readiness to be dumped into any such blowout. After a few weeks the expected blowout occurred and the 900-ft. of tunnel from lock to heading was flooded. The men at work escaped. The clay scows were immediately brought over the blowout and dumped, thus blocking the hole. The water was pumped out into the western workings, and within 11 hours men were able to reach the heading on a small raft. No damage was found and work was soon under way again. In all, only 21 hours time were lost. There were two more blowouts while the tunnel was being built across the 700 ft. of reef, and in each case they were similarly dealt with. Finally, however, there arose a problem which could not be dealt with by dropping these clay blankets. At the extreme eastern end of the reef the rock rises about 16 ft. above the bottom of the cutting edge of the shield. The tunnel at this point is so near the bottom of the river that the clay was almost fluid and continually slipped into the pockets of the shield, so that the men could not get out underneath the apron to drill the rock. Scow after scow was dumped, but the clay would not hold. Finally blow pipe flames, fed from two tanks of kerosene, were directed against the exposed clay until it was indurated, so as to hold its position while the men drilled the rock. The blow pipe process took eight hours, during which time streams of water were continually played on the shield structure to prevent its being damaged by the high temperature. This is probably the first time that man has made brick in the bed of a river.

There was a serious problem on the New Jersey side in regard to the transverse tunnel running from the river tubes north to the Lackawanna terminal and south to the Erie and Pennsylvania terminals, and thence to the downtown tunnel of the Hudson & Manhattan. The problem was to eliminate, as far as practicable, all crossings of the tubes at grade and still give each track a connection with all the terminals mentioned. The south tube of the uptown tunnel was, accordingly, carried under the north tube at the Fifteenth street shaft, Jersey City. About 200 ft. west of this shaft a reinforced concrete caisson (known as caisson No. 1) was sunk from the surface; the caisson is a two-story structure, carrying two tracks on each level. The south tube enters on the lower level, and trains are switched in the caisson to the north or to the south. The north tube comes on the upper level, and branches similarly north and south. The caisson is 105 ft. long, 23 ft. wide at the easterly end, and 46 ft. wide at the westerly end; it is 51 ft. high, is sunk 85 ft. below tide level, and the total weight is about 10,000 tons. There is a similar caisson (No. 2) about 700 ft. west of the first one. In caisson No. 2 trains from Hoboken may be switched over to New York or to the Erie and Pennsylvania stations in Jersey City. Caisson No. 3 is south of caisson No. 2, the three caissons making a triangle. In caisson No. 3 trains from the Erie and Pennsylvania stations are switched either to Hoboken or to New York. It was originally intended to use steel caissons, but the high cost of steel and uncertainty as to the delivery of material resulted in the decision to make them of reinforced concrete with steel cutting edges, being the first of their kind. They were sunk to position and the shields then run into them, making in a unique way underground switch yards, and saving a large amount in cost and in time, the latter being of the utmost importance. It would probably have taken about nine months and cost $75,000 to make one steel caisson. All the caissons were sunk under air pressure.

Perhaps the greatest, though not the most spectacular, feat in all the construction thus far completed was the building of the tunnels at the intersection of Christopher street, Ninth street and Sixth avenue, in Manhattan. From this point two tunnels go east under Ninth street and two north up Sixth avenue. Here there was the elevated railroad overhead, the Metropolitan Street Railway lines on the street surface, and buildings on each side of the street. It was a problem similar to the intersections in Hoboken, just described, but in this case, of course, sinking a caisson was out of the question. To accommodate the two tubes coming up from the south and the four diverging to the east and north it was necessary to build an arch whose maximum width was 68 ft. The work was all in running sand and was done under air pressure. Two iron-lined tunnels were run through this intersection first, and the side-walls then built in. Openings were then made at the tops of the tunnels and timbering for strutting was carried up so that sufficiently heavy false work could be put in for springing the arch. After the arch was completed the two temporary tunnels were taken out. This work required the greatest ingenuity and care for at least eight weeks. Any accident to the timbering, any loss of the necessary air pressure, or any carelessness of the men, would have undoubtedly caused a cave-in, and the elevated structure and the surface lines, together with the streets and the buildings on each side, would have fallen into the excavation. Every square inch of the treacherous ground had to be protected by wooden sheathing the moment it was exposed, otherwise the vibration of the passing trains above would start the sand running. This part of the work was the last of the excavation necessary for opening the railroad to traffic, and although it was early in last December when the spring of this large arch was under way, it was finished so that trains could be operated on February 10, 1908.

Committee Reports at the Maintenance of Way Convention.

Following are brief synopses of the committee reports presented at the convention of the American Railway Engineering and Maintenance of Way Association, held in Chicago this week. An abstract of the discussion of these reports will be given next week.

ROADWAY

The report on Roadway deals with the subjects of "Track Elevation and Depression in Cities," and "The General Practical Work of Grade and Curve Improvement Work Outside Cities."

Under the first heading, the committee presents, in tabular form a summary of replies received in answer to a circular of inquiry. The roads reporting are the Chicago & Western Indiana; the Burlington; the Rock Island; the Chicago Terminal Transfer; the Delaware, Lackawanna & Western; the Illinois Central; the Long Island; the Michigan Central; the New York, Chicago & St. Louis, and the Pennsylvania. The information included the extent of the work; how it was handled; how it was organized; where the material for filling was obtained; how unloaded; number of cubic yards a day, and the equipment for unloading; method of handling the bridge work, and the methods of handling water, sewer and gas pipes, electric conduits and wires, street cars and general traffic.

The second subject has been confined to the practical work of grade and curve improvement, with particular reference to the consideration of practical methods and organization.

The committee reports progress on the "Determination of Waterway for Culverts," and presents a list of references to articles published on this subject.

The committee recommends the adoption of the following conclusions:

GRADE AND CURVE IMPROVEMENT WORK INSIDE OF CITIES, SUCH AS TRACK ELEVATION AND DEPRESSION.

(1) Organization.—There should be a superintendent of construction in complete charge of the work. To him should report the following officers in charge of the various branches of the work: The engineers having charge of the contract work and giving lines and grades; the roadmaster in charge of earthwork and track work; the engineer in charge of masonry and bridges; the yardmaster in charge of engines and switching; the trainmaster, with a despatcher in charge of the operation of traffic over the territory covered by the work in hand. If the proportions of the work allow, every person connected with this organization should be relieved from all other duties relating to the operation of the road.

(2) The railroad company should handle with its own force all work which may interfere with the operation of the road, such as track raising or lowering, filling and excavating, handling and laying tracks, moving switches and putting in bridges under traffic. All other work which can be done without any interference with the operation of the railroad should be let by contract, both for economical and political reasons; this consisting of street work and concrete work where practicable.

(3) As far as practicable, all earthwork should be handled by machinery; that is, loaded by steam shovels and unloaded by plows, handled by cable unloaders and moved by spreaders.

(4) The best material to use for filling is sand.

(5) Bridge work, both railroad and highway, must ordinarily consist of temporary bridges, to be replaced by permanent bridges after tracks are elevated or depressed.

(6) Water, sewer and gas pipes, electrical conduits and wires should be taken care of and the work of moving them should be done by the companies owning them, whether or not the work is paid for by the railroad company.

GRADE AND CURVE IMPROVEMENT WORK OUTSIDE OF CITIES.

The following rules of practice are recommended:

(1) Establish the lowest gradient and lightest curvature which physical conditions and the present and prospective business of the road will admit.

(2) Complete the location entirely before entering on work of construction.

(3) Attend, first of all, to surface and waterway drainage, and last to the roadway drainage in excavations.

(4) Separate grades of railroads and highways, wherever practicable.

(5) Eliminate temporary bridges, etc., by the substitution of permanent structures in concrete and steel, wherever it can be done, having in view the formation of a continuous roadway on ballast.

(6) Do all light, short haul and preparatory work with teams or other light working plant.

(7) Provide separate tracks for work and traffic, wherever it can be done.

(8) Have a well defined plan for conducting heavy excavation before starting work.

(9) The simplest organization is the best. Some one man should be in responsible charge of the work, with a staff of engineers under him, and enough supervisors to cover the work, who have full control of men, material and means for each section, with foremen and gangs everywhere needed.

The report is signed by H. J. Slifer, Chairman, G. H. Bremner, Vice-Chairman, John C. Beye, D. J. Brumley, F. R. Coates, W. M. Dawley, Paul Didier, C. Dougherty, S. B. Fisher, D. MacPherson, W. D. Pence, J. G. Sullivan, J. E. Willoughby and R. C. Young.

BALLASTING.

The committee presents a revision of the ballast sections for crushed rock and slag, Classes A and B, with a slope of 2 to 1. The 1907 convention adopted a rock slope of $1\frac{1}{2}$ to 1, but the committee believed that this was passed under a misapprehension and therefore submitted the question to letter-ballot. The result of the letter-ballot showed 79 votes in favor of the slope recommended by the committee, and 21 votes against.

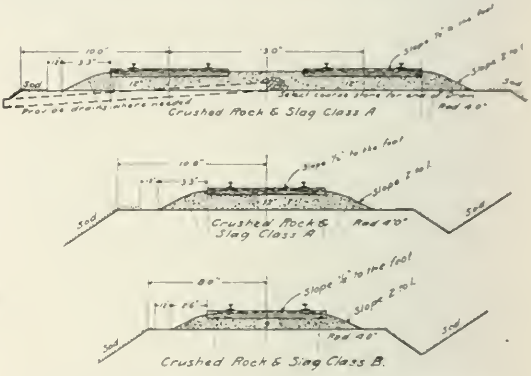
CONCLUSION.

The committee recommends the adoption of the ballast sections for crushed rock and slag, shown herewith, as being good practice.

The report is signed by John V. Hanna, Chairman; C. A. Paquette, Vice-Chairman; Willard Beahan, W. B. Causey, G. D. Hicks, B. C. Milner, F. J. Stimson, G. M. Walker, Jr., W. J. Bergen, J. B. Dickson, Alfred Jackson and A. F. Rust.

TIES.

The report on ties contains a compilation of answers received in reply to a circular of inquiry as to causes of crosstie failure



NOTE: The Slag which should be dressed to section shown for Crushed Rock and Slag is broken slag, similar in its character to Crushed Rock. Granulated Slag should be dressed to section shown for Gravel, Cinders, Chats, etc.

Crushed Rock and Slag Ballast; Recommended Practice.

whether due to decay, rail cutting or spike cutting, a suggested method for analyzing coal-tar creosote, and determining the amount of zinc in wood treated with that material; a discussion of the future policy of railroads with reference to tie supply, and a list of wood preserving plants in the United States and Mexico.

Conclusions.

The committee recommends the adoption of the following conclusions:

(1) That the method for analysis of coal-tar creosote shown on pp. 98-101 of Bulletin 96 be approved as good practice.

(2) That the method for determination of zinc in treated timbers shown on pp. 102-105 of Bulletin 96 be approved as good practice.

The report is signed by E. B. Cushing, Chairman; W. W. Curtis, Vice-Chairman; E. G. Erickson, W. F. H. Finke, E. O. Faulkner, E. E. Hart, H. C. Landon, J. D. Isaacs, A. S. More, Dr. H. Von Schrenk, J. C. Nelson and H. J. Simmons.

RAIL.

The committee reviews the report of the American Railway Association committee on Standard Rail and Wheel Sections, and points out the desirability of all railroad companies uniting on a single rail section. The American Railway Association committee submitted two series of proposed rail sections, which are shown in the body of the report. (*Railroad Gazette*, Nov. 22, 1907.)

A form for reporting rail failures is submitted for adoption by the railroads represented in the association. The arguments advanced for the approval of the proposed blank are the following:

(1) The desirability of keeping the size of the form to that of a letter-size sheet.

(2) The majority of the railroads of the country require reports of rail failures to be made out by a track foreman, as he is generally the first on the ground after a rail failure, and they will have to depend very largely on him for the information; therefore it seems desirable to put the questions in such a way that men of ordinary intelligence can answer them.

(3) Certain questions were asked by the blank submitted by the American Railway Association committee which were to be answered by reference to diagrams. We believe it better to have

written replies as far as possible to all questions. We have, however, made use of the diagrams showing rail failures suggested by the American Railway Association committee in connection with the instructions on the back of the blank recommended.

Conclusion.

The committee recommends the adoption of form M. W. 1200 for reporting rail failures by the railroads represented in the association.

The report is signed by Wm. R. Webster, Chairman; R. Montfort, Vice-Chairman; F. E. Abbott, J. W. Kendrick, E. F. Kenney, J. Kruttschnit, E. B. Ashby, A. S. Baldwin, D. D. Carothers, J. A. Colby, C. H. Ewing, S. M. Felton, J. F. Hinckley, Robert W. Hunt, D. W. Lum, F. H. McGuigan, H. T. Porter, J. T. Richards, R. Trimble, G. W. Vaughan, H. U. Wallace and G. B. Woodworth.

TRACK.

The report on Track embodies formulas and tables for computing the elements of the split switch (straight points) from a tangent. A diagram showing a 15-ft. reinforced split switch was presented. For main track, the committee recommends split switches in accordance with the diagram, with distant switch signal interlocked with switch-stand and pipe-connected derail. The bolted type of frog is recommended, the length to be such that the standard angle bars can bo applied; flangeway to be 1⅞ in.; rails to be of open-hearth steel, fillers to be made of rolled steel and to fit snug; bolts of fine B. B. iron, round and true to size, with U. S. standard ends and threads; bolt holes to be accurately drilled, holes to be made 1/16 in. less in diameter than bolts to be used; parts of frogs to be then assembled and holes reamed in order to be straight and of such size as to give the bolts a driving fit. Bottom plates to be made of rolled steel. A plan of the proposed frog was shown on the diagram.

The guard rail recommended is 15 ft. long, with flangeway 1⅞ in. where track is maintained to standard gage. If turnouts are located on curve, it is recommended that flangeway be widened to maintain a distance of 4 ft. 6⅝ in. from the gage of frog to the gage of the guard rail.

The diagrams and formulas for the widening of gage were prepared for the standard spacing of wheels of consolidation engines. The tables given are for consolidation engines having 18 ft. wheel base, consolidation engines having 19 ft. wheel base, and decapod engines having wheel base of 19½ ft. In making the calculations, the distance from back to back of tires for forward and rear drivers is assumed to be 53½ in., and for middle drivers 54¼ in. The clearance between the hubs of the wheels and the driving boxes is taken as 1¼ in. The committee recommends to the American Railway Master Mechanics' Association that the present clearance between wheels and driving boxes for new and repair work be increased from ⅛ to ¼ in.

Conclusions.

The committee recommends the adoption of the following conclusions as representing good practice:

(1) That the elements of the split switch turnout from a tangent be computed according to the formulas given and as indicated by Table No. 1.

(2) The adoption of the reinforced split switch shown.

(3) The adoption of the frog and specifications for same, outlined in the body of the report.

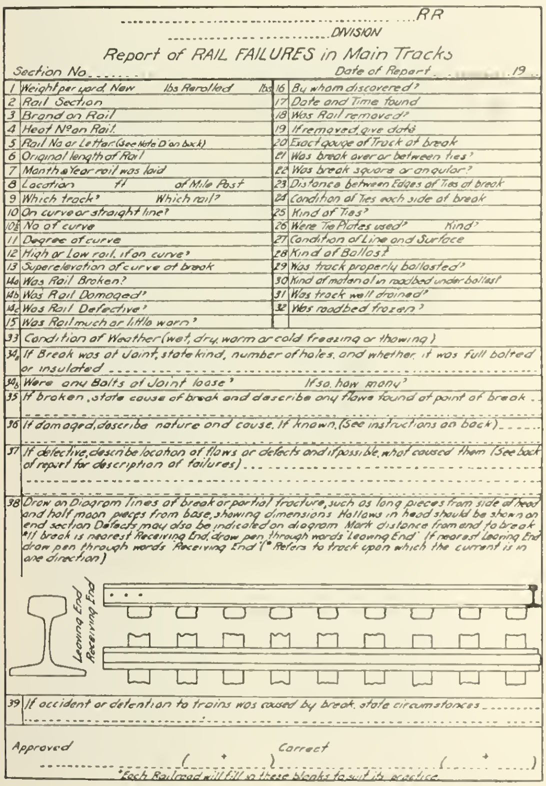
(4) The adoption of the guard rail and throat clearance, shown with the 15 ft. reinforced split switch.

(5) That tie-plates be used on all ties throughout the leads.

(6) That glazed sewer pipe with bell ends be used for the drainage of wet cuts, pipe to be laid without cemented joints, and to be covered with hay or straw and cinders, and laid below frost line where possible. French or pillar drains to be used for the curing of slides.

(7) That the widening of gage on curves be calculated according to formula on diagram A in the report, like tables B, C and D.

The report is signed by L. S. Rose, Chairman; T. H. Hickey, Vice-Chairman; Wm. Ashton, R. K. Brown, G. C. Cleveland, A. L. Davis, Garrett Davis, R. L. Huntley, W. S. Kinnear, C. E. Kinkerbocker, R. K. Rochester, F. A. Smith, Earl Stimson, R. A. Van Houten and A. A. Wirth.



..................RR

..................DIVISION

Report of RAIL FAILURES in Main Tracks

Section No........ Date of Report.......19..

1	Weight per yard, New lbs Rerolled lbs	16	By whom discovered?
2	Rail Section	17	Date and Time found
3	Brand on Rail	18	Was Rail removed?
4	Heat No. on Rail	19	If removed, give date
5	Rail No or Letter (See Note D on back)	20	Exact gauge of Track at break
6	Original length of Rail	21	Was break over or between ties?
7	Month & Year rail was laid	22	Was break square or angular?
8	Location ft of Mile Post	23	Distance between Edges of Ties at break
9	Which track? Which rail?	24	Condition of Ties each side of break
10	On curve or straight line?	25	Kind of Ties?
10½	No of curve	26	Were Tie Plates used? Kind?
11	Degree of curve	27	Condition of Line and Surface
12	High or Low rail, if on curve?	28	Kind of Ballast?
13	Superelevation of curve at break	29	Was track properly ballasted?
14a	Was Rail Broken?	30	Kind of material in roadbed under ballast
14b	Was Rail Damaged?	31	Was track well drained?
14c	Was Rail Defective?	32	Was roadbed frozen?
15	Was Rail much or little worn?		

33 Condition of Weather (wet, dry, warm or cold freezing or thawing)

34a If Break was at Joint, state kind, number of holes, and whether it was full bolted or insulated..........

34b Were any Bolts at Joint loose? If so, how many?

35 If broken, state cause of break and describe any flaws found at point of break..........

36 If damaged, describe nature and cause, if known. (See instructions on back)..........

37 If defective, describe location of flaws or defects and if possible, what caused them (See back of report for description of failures)..........

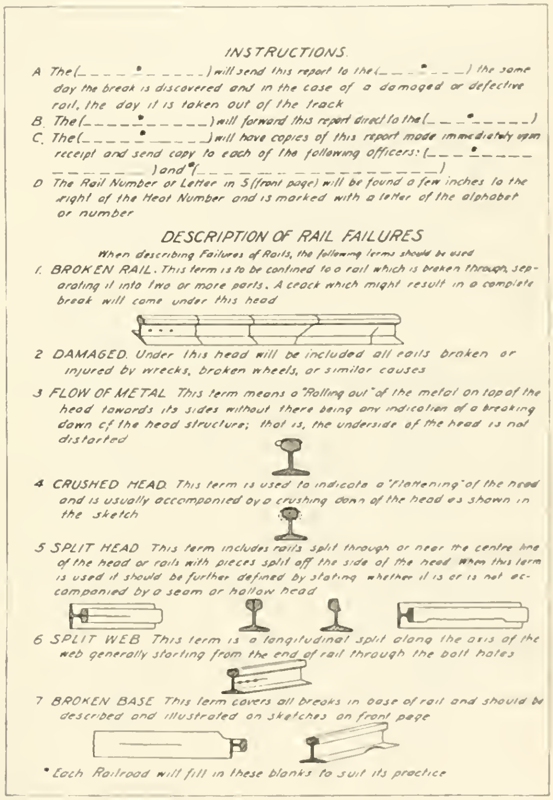
38 Draw on Diagram lines of break or partial fracture, such as long pieces from side of head and half moon pieces from base, showing dimensions. Hollows in head should be shown on end section. Defects may also be indicated on diagram. Mark distance from end to break. *If break is nearest Receiving End, draw pen through words "Leaving End." If nearest Leaving End draw pen through words "Receiving End" (* Refers to track upon which the current is in one direction)

39 If accident or detention to trains was caused by break, state circumstances..........

Approved Correct

..........(....*....)..........(....*....)

*Each Railroad will fill in these blanks to suit its practice.



INSTRUCTIONS.

A The (....*....) will send this report to the (....*....) the same day the break is discovered and in the case of a damaged or defective rail, the day it is taken out of the track

B. The (....*....) will forward this report direct to the (....*....)

C. The (....*....) will have copies of this report made immediately upon receipt and send copy to each of the following officers: (....*....) and *(..........)

D The Rail Number or Letter in 5 (front page) will be found a few inches to the right of the Heat Number and is marked with a letter of the alphabet or number

DESCRIPTION OF RAIL FAILURES

When describing Failures of Rails, the following terms should be used

1. BROKEN RAIL. This term is to be confined to a rail which is broken through, separating it into two or more parts. A crack which might result in a complete break will come under this head

2 DAMAGED. Under this head will be included all rails broken or injured by wrecks, broken wheels, or similar causes

3 FLOW OF METAL This term means a "Rolling out" of the metal on top of the head towards its sides without there being any indication of a breaking down of the head structure; that is, the underside of the head is not distorted

4 CRUSHED HEAD. This term is used to indicate a "Flattening" of the head and is usually accompanied by a crushing down of the head as shown in the sketch

5 SPLIT HEAD This term includes rails split through or near the centre line of the head or rails with pieces split off the side of the head. When this term is used it should be further defined by stating whether it is or is not accompanied by a seam or hollow head

6 SPLIT WEB This term is a longitudinal split along the axis of the web generally starting from the end of rail through the bolt holes

7 BROKEN BASE This term covers all breaks in base of rail and should be described and illustrated on sketches on front page

* Each Railroad will fill in these blanks to suit its practice

Recommended Form for Reports of Rail Failures.

BUILDINGS.

The subjects assigned the committee were as follows:

(1) Report and present recommendations relative to best type of locomotive coaling station to adopt for various conditions.

(2) Report on use of reinforced concrete for roundhouses.

(3) Report on best method for smoke removal, ventilation and heating of roundhouses.

(4) Report on use of movable or fixed cranes for facilitating locomotive repairs in roundhouses.

(5) Report on best arrangements of windows and roof lights and proper ratio of light area to floor surface in roundhouses.

Under the first heading, the committee submits its conclusions.

as follows (conclusions 1 to 4 were adopted in 1907, but are reproduced for convenience in discussion)

(1) The cost items should include charges for interest and depreciation, charges for maintenance and operation (the cost of switching cars onto trestles should be included), and a charge for the use of cars for storage purposes.

(2) Provision should be made for fire protection, the avoidance of damage to the coal, and its delivery in the best possible condition.

(3) The use of self-clearing cars should be made possible, and ordinarily it should also be possible to shovel from flat-bottomed cars.

(4) Storage for emergency purposes and fireproof construction are, in general, to be recommended, and in some cases duplicate machinery is desirable.

(5) It is not possible to give absolute limits between which different types of coaling arrangements are to be used. Each installation must be considered as an individual problem. Prices of materials, cost and character of labor, the possible track arrangements, the amount of storage desired, the power and attendance, and shifting service available, all are to be considered.

(6) Where the quantity of coal handled is small, particularly at terminal points where locomotives lie over night, it is recommended that the locomotives be coaled, either directly from cars by the hostler, or by handling from cars to an elevated platform provided with a jib crane and one-ton buckets, and from these buckets to the locomotive.

(7) At terminals where the daily consumption of coal does not exceed 75 tons, a locomotive crane with clam-shell bucket is desirable, provided that there is at such terminal other work that can be economically performed by the locomotive crane.

(8) At terminals where the requirements are from 75 to 200 tons per day and a deep foundation is practicable, a "balanced two-bucket hoist type" of coaling station is recommended.

(9) For terminals larger than those previously considered, the type of coaling station which should be selected as most desirable is dependent entirely upon local conditions. Where it is required that coal be delivered to not more than two tracks, and where the necessary ground space is available, a coaling station of the "trestle type," with incline approach, is recommended. In yards where delivering locomotives are constantly in attendance a plant with a 5 per cent. incline is preferable to one with a 20 per cent. grade operated by a hoisting engine. Where it is required to deliver coal to more than two tracks, or where the ground space for a "trestle type" is not available, a "mechanical conveyor type" is recommended.

(The following substitute for conclusions 8 and 9 is submitted by a member of the committee as a minority report.)

(8) At terminals where the requirements do not exceed 200 tons a day, when the desired storage is not so great that auxiliary buckets are necessary, and where a deep foundation is practicable, a two-bucket hoist is recommended.

(9) At points where the requirements are greater than this a mechanical conveyor plant is recommended, except that when the track arrangement and the ground space available permit, especially where it is difficult to obtain proper care of a mechanical plant, the use of a trestle should also be considered.

Under the second heading, "Use of Reinforced Concrete for Roundhouses," the following conclusions are submitted:

(1) Reinforced concrete should be used below the floor when it is cheaper than plain concrete.

(2) The additional security against interruption to traffic warrants the construction of a roundhouse with a reinforced concrete roof.

(3) When the roof is of reinforced concrete the columns should be of the same material.

(4) Reinforced concrete should be used for the walls only where special conditions reduce its cost below that of brick or plain concrete and where plaster is not considered satisfactory.

Subject No. 3 "Best method for smoke removal, ventilation and heating of roundhouses" no definite recommendation is made

Subject No. 4 "The use of movable or fixed cranes for facilitating locomotive repairs in roundhouses" the conclusion of the committee is that:

Jib cranes attached to the posts alongside of a number of pits in roundhouses, or, in the case of large roundhouses, a small traveler working around the outer circle, capable of handling two tons should be installed, in such roundhouses as may be designated by the motive power department as requiring such appliances for light locomotive repairs.

Subject No. 5—"Best arrangement of windows and roof lights, and proper ratio of light area to floor space" the committee concludes that:

(1) The disadvantages of roof or skylights in roundhouses are so much greater than their advantages as to make them undesirable.

(2) Windows in the outer walls of roundhouses should be made as large as practicable and contain the largest glass or light area consistent with the requisite strength. In general, the lower sill should be not more than 4 ft. from the floor and only sufficient space left between pilasters and sides of window frames, and girders and window heads to properly secure the window frames. Windows or transoms as large as practicable should be provided over all doors where locomotives enter.

The report is signed by O. P. Chamberlain, Chairman, Maurice Coburn, Vice-Chairman, J. W. Cowper, H. M. Cryder, C. H. Fake, J. S. Metcalf, A. G. Norton, L. D. Smith, Wm. Graham, E. W. Wiggin, C. H. Stengel, S. D. Brady, M. J. Caples and W. H. Sellew.

WOODEN BRIDGES AND TRESTLES.

The report on Wooden Bridges and Trestles contains standard specifications for bridge and trestle timber, revised specification for piling; a discussion of wooden trestle bridges with ballast floors, including plans typical of the two general designs for ballast floor trestles in use on the Santa Fe, Illinois Central, Mobile & Ohio, and Union Pacific railroads; safe unit stresses for timbers used in wooden bridges and trestles, with a graphical comparison and tables of unit stresses; a discussion of preservation of structural timber, its effect on the strength of timber, cost of treatment, method of treatment, etc.; specifications of the Santa Fe for creosoting Pacific coast piling and timber; standard names for structural timbers and classification of southern yellow pine.

Conclusions.

The adoption of the following conclusions is recommended:

(1) That the standard specifications for bridge and trestle timbers be approved as good practice.

(2) That the revised specifications for piling be approved.

(3) That there be added to the definitions of standard defects of structural timber the following:

16. *Ring Shake.*—An opening between annual rings.

17. *Through Shake.*—A shake which extends between two faces of a timber.

The report is signed by Henry S. Jacoby, Chairman; James Keys, Vice-Chairman; F. H. Bainbridge, A. L. Bowman, R. D. Coombs, R. T. Darrow, H. G. Fleming, Hans Ibsen, S. S. Roberts, W. F. Steffens, I. O. Walker, C. C. Wentworth and B. A. Wood.

MASONRY.

The specifications for stone masonry, presented in 1907, have been revised and are submitted for final approval.

The committee was instructed to report on the most economical size or combination of sizes of stone to be used in stone concrete, as applied to the different classes of work. A circular of inquiry was issued, requesting an expression from the members of the association as to their preferences, and a summary of the replies is given in the report. From the answers received the committee draws the following conclusions:

"Considering plain concrete only, and assuming that the aggregate will range in size from ¼ in. to the maximum named, a preference is shown for the following maximum sizes:

"For foundations, 2½ in.; for abutments, 2 in., for arch rings, 1½ in.; for coping, bridge seats and thin walls, 1 in."

The committee reports progress on the subject of waterproofing masonry, and on the subject of failures of concrete structures.

A comparison of standard plans in use on a number of railroads for masonry culverts is in preparation, and will appear in a bulletin after the convention.

The report is signed by A. O. Cunningham, Chairman; C. W. Boynton, Vice-Chairman, W. B. Hanlon, W. K. Hatt, H. H. Knowlton, C. H. Moore, W. H. Petersen, Job Tuthill, J. W. Schaub, Richard L. Humphrey, F. B. Scheetz, G. F. Swain and G. H. Tinker.

SIGNS, FENCES AND CATTLE GUARDS.

The committee reports progress on the subject of "snow fences, snow sheds and other means of preventing snow accumulating and the best methods of clearing tracks and snow removal." A large amount of valuable information has been obtained in response to a circular of inquiry, and a report will be made on the subject during the coming year.

The report is signed by W. D. Williams, Chairman; F. P. Gutelius, Vice-Chairman; L. G. Curtis, Ole Davidson, A. E. Doucet, Paul Hamilton, C. W. Pifer, W. A. Wallace and H. F. White.

SIGNALING AND INTERLOCKING.

The report contains an historical review of the efforts made by various railroad companies towards formulating an ideal system of signaling, and the committee briefly summarizes the requirements thus far adopted by the association and published in the Manual of Recommended Practice.

The committee has developed and presents the indications deemed requisite, with their application, shown by means of a diagram, and from which it has deduced the necessary requisites of installation and adjuncts.

Requisites of installation for telegraph block, controlled manual, automatic block and other systems are given. The requisites of installation recommended depart from the Standard Code of the American Railway Association in six important features:

(1) A distinctive position is recommended for the caution indication of the distant signal, in lieu of a special form of arm displayed in stop position of other signals.

(2) Two lights are recommended on every signal in lieu of one, two, three, four or even five lights under present practice.

(3) The requisite use of two lights is taken advantage of in distinguishing between the different types of signals.

(4) A differentiation is made between signals requiring stop until authorized to proceed, stop and proceed, and stop and investigate, because the first two have been provided properly and necessarily by the standard code, and the third one is recognized in universal practice and should be embodied in the rules laid down for the proper conduct of transportation.

(5) A differentiation is made between the indication regulating the approach to another signal and the indication permitting a train to enter a manual block that is not clear.

(6) Adequate approach indications are provided for all high-speed signals.

The following arguments are advanced for the adoption of the committee's plan:

(1) The advantages resulting from uniformity of signaling on the different systems of the country are:

(a) A considerable mileage of track in the country is operated jointly by two or more roads, and at present if the signal practices of the parties to the joint use of tracks are at variance, as frequently occurs, the same crews may have to run under different systems of signaling on a single run. Under a uniform system these crews would have but one system of indications to learn.

(b) Men leaving the employment of one road will not have to unlearn one system of signaling and learn another in order to qualify to work upon another road.

(c) Uniformity of indications will tend to uniformity in a considerable portion of the apparatus used, resulting in a decrease in various manufacturing expenses, and amount of stock to be carried by manufacturers and railroads, especially at jointly operated plants, and will result in quicker delivery of material.

(d) The expense for damage claims should be reduced and a better legal status secured to the railroad companies on account of less liability to confusion of indications, and on account of the system of signaling proposed having the endorsement of general adoption.

(2) Quicker and more accurate interpretation of signals by enginemen.

(3) Indication of diverse functions by the signals themselves, instead of by general orders, special orders, etc., thus relieving the enginemen's minds of a burden of detail.

(4) Classification of indications of the same general meaning, thus avoiding misunderstanding.

(5) Information by the aspect of the signal of the improper display of an indication.

The report also contains three papers by members of the committee, on "Signal Indications and Aspects," and "Suggestions as to the Selection or Development of a Basis for a Correct System of Signaling."

Conclusions.

(1) The committee recommends that the "requisite indications," as shown on page 12 of Bulletin 94, are adequate and embody all essential and proper indications and that they be recommended to the American Railway Association for adoption.

(2) That the "requisites of installation" set forth on pages 11-17 of Bulletin 94 are practicable and form an adequate and proper basis for the design of a system of aspects required for the display of the requisite indications and are essential for a uniform, universal system of signaling, and that they be referred to the American Railway Association for adoption as proper for new work and renewals.

The report is signed by A. H. Rudd, Chairman; L. R. Clausen, Vice-Chairman; Azel Ames, Jr., C. C. Anthony, H. S. Balliet, Chas. A. Dunham, G. E. Ellis, M. H. Hovey, J. C. Mock, F. P. Patenall, J. A. Peabody, Frank Rhea, W. B. Scott, Thos. S. Stevens, J. E. Taussig, H. H. Temple, H. M. Waite and Edwin F. Wendt.

RECORDS, REPORTS AND ACCOUNTS.

The report on Records, Reports and Accounts contains a review of the subjects of Right-of-Way and Track Maps and Individual Ledger Accounts. Three blank forms are submitted—Form M. W. 1,020, Monthly Progress Statement of Expenditures; Form M. W. 1,014, Standard Method for Recording the Cost of Individual Pieces of Work; and Form M. W. 1,017, a suggested substitute for the Estimate Form shown in the Manual of 1907.

The following conclusions are submitted for adoption:

RIGHT-OF-WAY MAPS.

Definition: "Right-of-Way Map.—A plat representing the actual location and dimensions of all property, rights or franchises that are owned or controlled by a railroad company."

(1) Right-of-way maps should show the state, county, township, town or city; the right-of-way alinement complete; the station plusses of the crossing of all important land or property lines and streets, with the distance to all permanent land or street corners. The angle which the center line of the road makes with property lines; the number of the right-of-way sheet; the points of the compass; the scale and date of the map; the boundaries of the several parts of the land owned by the company, and the width of the right-of-way, particularly at those points where the widths change; any additions, or subdivisions of towns or cities, with numbers and sizes of lots and blocks, and names of streets. It should also show all main tracks, sidetracks and structures that were built in connection with the original construction of the road; the exact location of all crossings of steam, electric or other roads.

(2) On or near each part of the land on the right-hand side of each map should be shown the deed custodian's number; the date of grantor and grantee, mileposts, kind of instrument, date and book and page where recorded. This also includes reference to leases, franchises, ordinances and grants concerning the use of land.

(3) The original right-of-way map should be traced, and the tracing filed away for a permanent record of the conditions existing at the time the railroad was completed. The map from which this tracing is made should be corrected from time to time as changes are made in important tracks and structures, which are of value as reference to the right-of-way boundaries, as well as any transfers of property made to and from the railroad company, and any important tracks or structures.

(4) The property of adjacent railroads or of subsidiary and associated companies should be shown in different colors for the purpose of ready distinction.

(5) It is important to show on the original right-of-way map a profile of the same horizontal scale and of the same station numbers as the map and of suitable vertical scale, which profile should show the original subgrade, the location, character and size of opening of each bridge, waterway or under-crossings, and the original surface of the ground, the necessity for this being the knowledge of physical conditions at the time the road was built, often needed in defending litigation and settling questions arising from time to time.

(6) In regard to the scale, size and methods of filing maps, it is not considered advisable to make a definite recommendation as to the scale of such maps, because of the different conditions that require greater or less detail. It is suggested, however, that a range of from 50 ft. to the inch to 400 ft. to the inch should cover all possible conditions, except, possibly, in undeveloped portions of the country, where a smaller scale could be used.

TRACK MAPS.

Definition: "Track Map.—A map used primarily for showing physical conditions, including tracks, bridges, buildings, water service and mains, leases, station facilities and all of the physical and operating features."

(1) Track maps should show all physical conditions pertaining to the construction and operation of the railroad and the limits of the right of way without reference to title or ownership. They should show all main and sidetracks and their alinement, distance between them, capacity and car lengths; all buildings upon the right of way and adjacent thereto, dimensions and character thereof and location with reference to main or sidetracks, bridges, culverts, water stations, coaling plants, turntables, shop buildings, water mains, electric light wires, fences, street car and other railroad crossings, and the angle they make with the railroad track, sewers, signals of all kinds and all physical conditions on the property. All structures on such maps should be located by chainage numbers and plusses.

(2) They should be corrected whenever any changes are made in any of the features shown thereon and a corrected copy sent to the general office for record.

(3) It is recommended that a scale of 100 ft. to the inch be used for such maps except in territories and cities of large industrial development, where varying scales may be used to suit the local conditions.

(4) The map should show very plainly the north point, scale, original date and date corrected.

(5) The conventional signs adopted by the association should always be used where it is possible and convenient to do so.

INDIVIDUAL LEDGER ACCOUNTS.

(1) The adoption of form M. W. 1020, to be used for a monthly progress statement of expenditures (p. 55, Bulletin 97).

(2) The adoption of form M. W. 1014 as a standard method for recording the cost of individual pieces of work, such form to be used in making a report to the officer in charge of the department doing the work (p. 54, Bulletin 97).

(3) Your committee recommends for consideration and, if possible, approval, a suggested change for form M. W. 1017 (pp. 56, 57, Bulletin 97).

The report is signed by H. R. Safford, Chairman; J. B. Austin, Jr., Vice-Chairman; W. Archer, Edward Gray, Henry Lehn, A. W. Newton, J. E. Schwitzer, V. D. Simar, R. C. St. John, J. E. Turk and E. K. Woodward.

UNIFORM RULES.

The committee submits for adoption the following rules pertaining to supervisors of signals:

(1) They shall report to and receive instructions from the (To be filled in by each road).

(2) They shall be responsible for the safe condition and proper maintenance of all signals and interlocking plants in their districts. They must inform themselves of the condition of signals and interlocking plants, make necessary repairs of such defects as

may endanger or delay the movement of trains and promptly report defective condition to (Title).

(3) They shall employ in the discharge of their work, such men as are necessary for carrying out the duties for which they are responsible.

(4) They must know that all foremen are provided with all rules, circulars, forms and special instructions pertaining to their duties, and that they fully understand and comply with the same.

(5) They must see that all foremen are familiar with the rules in regard to train signals and flagging, and that they fully understand and comply with the same.

(6) They must know that all foremen are supplied with tools and material necessary for the efficient performance of their duties and must see that they are properly cared for and used.

(7) They shall conform to the prescribed standards and plans in the execution of the work under their charge.

(8) They shall not permit experimental trials of appliances or devices not standard with the company, nor give out information of the results of any trial, except by proper authority.

(9) They shall keep general oversight of all work performed in their districts by contractors or others who do not come under their direct charge, and see that nothing is done by them that will interfere with the safety of track or movement of trains.

(10) They must make frequent inspections of all signals and interlocking plants in their districts and have necessary repairs made as promptly as conditions require.

The report is signed by R. C. Barnard, Chairman; J. H. Abbott, Vice-Chairman; C. C. Anthony, Robert Bell, C. N. Kalk, F. L. Nicholson, J. O. Osgood, J. C. Mock, J. A. Peabody, G. H. Webb, and C. A. Wilson.

WATER SERVICE.

This committee took for the subject of its report a revision of the conclusions previously adopted by the association on the "Quality of Water, with Methods of Treatment and Results Obtained Therefrom." The matter appearing in the Manual of 1907 under the above heading has been rearranged, condensed and a portion eliminated.

Conclusions.

The committee recommends that the material in the "Manual of Recommended Practice," edition of 1907, be revised to read as follows:

QUALITY OF WATER, WITH METHODS OF TREATMENT AND RESULTS OBTAINED THEREFROM—CONCLUSIONS AND RECOMMENDED PRINCIPLES OF PRACTICE.

(1) In locating water stations along a railroad, an investigation should be made of all the available water supplies, and care should be taken to avoid the use of poor water, or to curtail its use as much as possible.

(2) Most water used in locomotive boilers contains scale-forming matter in solution or suspension, causing much trouble and expense in operating and maintaining locomotives.

(3) Hard water can be softened before it is put into locomotive boilers by treating it with chemicals.

(4) Water whose hardness is due to carbonates of lime and magnesia can be softened at a moderate expense for chemicals by the use of lime alone, without adding any soluble salts to the softened water.

(5) Water whose hardness is due to sulphates of lime and magnesia can be softened, but at a greater expense, by the use of soda ash, a more expensive chemical. In this case soluble sulphate of soda will be added to the softened water, increasing the tendency to foam.

(6) The mechanical methods of modern water-softeners are new and differ widely, but consist of two general types, the continuous and the intermittent.

(7) At stations where hard water is used, special study should be made relative to the economical value of treating the water, and the method best adapted to meet the conditions.

(8) The cost of installing a water-softening plant varies according to the capacity of the plant, its type, cost of material and labor in its locality, and other local conditions.

(9) The cost of operating a water-softening plant varies according to the efficiency of the water-softening apparatus and the cost of lime and soda ash or other chemicals available for softening water in its locality.

(10) The cost of chemicals required to soften water varies according to the quantity of hardening matter in the water, and also its composition.

(11) The benefits derived from water-softening plants are: Fewer boiler failures due to leaking; longer life of flues and firebox sheets; reduced cost of labor for repairing and washing boilers; increased locomotive mileage between shoppings; decreased number of locomotives required to perform the same service; less expense in cost of overtime and delayed time.

(12) The removal of the sulphates of lime and magnesia is of greater value than the removal of the carbonates alone, as the carbonates of magnesia, without the presence of the sulphates of lime or magnesia, do not form hard scale but are precipitated in the boiler as soft scale and mud.

(13) The greatest disadvantage in treating water is the increased tendency to foam, due to the reaction of soda ash on the sulphates of lime and magnesia.

The report is signed by A. K. Shurtleff, Chairman; W. P. Bonright, J. L. Campbell, John P. Congdon, J. P. Hanahan, E. N. Layfield, C. A. Morse, John P. Ramsey, C. L. Ransom, G. J. Ray, O. E. Selby and M. H. Wickhorst.

YARDS AND TERMINALS.

The report on Yards and Terminals deals with the subjects of Freight Yards for Hump Switching; Track Scales; Conveying Car Riders in Hump Yards; Yard Lighting; Freight Transfer Station, Railway Freight Houses and Warehouses and Freight Handling Machinery.

Plans and profiles of a number of gravity switching yards are shown, also plan of entrance to classification yard with double ladders, plans of freight transfer stations, illustrations of freight conveying machinery in use at ocean terminals, tables giving car capacities of freight yards on the Pennsylvania Lines, track scales in freight yards on various railroads, methods adopted for weighing cars, and descriptions of railroad freight houses and warehouses at Newark, N. J., and Pittsburgh, Pa.

Conclusions.

The committee recommends the following changes in conclusions, and the recommended principles of practice:

HUMP YARDS.

(1) Hump yards should consist of receiving, classification and departure tracks, in consecutive order.

(2) A hump yard is a desirable form of yard for receiving, classifying, and making up trains, because cars can be handled through it faster and at less cost than through any other form of yard.

(3) Receiving tracks should be of sufficient length to hold maximum trains of the various classes handled.

(4) Receiving tracks should be sufficient in number to hold a number of trains arriving in quick succession. The number will depend on the amount and character of traffic handled, and upon the relative location of the yard with respect to the other yards and connections.

(5) If it is possible, the grades of the receiving tracks should be such that one engine can push the maximum train over the hump.

(6) No definite recommendation can be made as to length or number of classification tracks, except that when they are to be used as departure tracks they should be long enough to hold full trains, and that when conditions permit, there should be as many of them as can be used to advantage to avoid subsequent classification and consequent delay.

(7) Departure tracks should be full train length and of sufficient number to provide ample standing room for trains while being tested for air, and while waiting for engines.

(8) An air brake testing plant should be provided in the departure yard; the tracks should be piped, and sufficient outlets furnished with hose to test air brakes on all outgoing trains.

(9) To secure the greatest possible efficiency or to so construct a hump that the greatest number of cuts of cars may be classified over it, the steepest part of the grade should be reached in the least available distance after passing the summit, and the grade or fall should provide sufficient momentum to carry all cars to lower ends of classification tracks.

(10) Where cars to be classified are largely empty or light, and the scale is on the hump, grades are recommended for average conditions as follows:

The summit of the hump should be reached by vertical curves with radius of about 1,500 ft. that raise the grade about one foot in a distance of 60 ft.; the curve over the summit to be continued on the descending grade a distance of about 30 ft. to join a grade not exceeding 2 per cent. for a distance not exceeding 60 ft. Thence descending by a vertical curve with radius of about 2,000 ft. a distance of 10 ft.; thence descending on a grade of 4 per cent. a distance of 50 ft.; thence descending by a vertical curve with radius of about 5,000 ft. a distance of about 155 ft. to join a grade of 1 per cent. at the heads of the ladder tracks. Thence down through ladder tracks and turnouts, 1 per cent.; thence down through classification tracks, 0.5 per cent.

(11) Where cars to be classified are largely heavy or loaded, and the scale is on the hump, the same grades are recommended for use over the hump as for light cars, but as the proportion of light cars diminishes the length of the grade of 4 per cent. may be reduced.

It is recommended, however, that the length of the 4 per cent. grade be at least 25 ft.; that the grade of ladder tracks be at least 0.8 per cent., and that the grade of classification tracks be at least 0.4 per cent., where conditions permit.

(12) Where traffic or climatic conditions require, the summit of a hump may be made higher in the winter and restored when the increased height is not needed.

(13) When required by traffic conditions, a track scale not exceeding 60 ft. in length should be located at such a distance from the summit of the hump (30 to 40 ft. is recommended) that when cars to be weighed reach the scale they will be properly spaced from following cars and will be running slowly enough to easily secure correct weights. The grade over the scale should not exceed 2 per cent.

(14) For average conditions it is recommended that No. 8 frog be the sharpest used in classification yards.

YARD LIGHTING.

(1) For yard lighting the use of arc lamps of 2,000 candle-power is recommended.

(2) For lighting hump and ladder tracks, the lamps should be spaced 140 to 150 ft. apart and hung 28 ft. (or more) above the tracks.

(3) For lighting body tracks, the spacing should be such that cars will be clearly visible.

FREIGHT TRANSFER STATIONS.

(1) Freight transfer stations should be located at points where traffic converges or diverges, or both, and where necessity exists for its consolidation of separation.

(2) The installation should provide for the greatest possible economy of operation, both as to time and cost of handling.

(3) Where fixed platforms are used, they should be covered, and it is recommended that the width under ordinary conditions be not more than 24 ft., and that the tracks on either side be built in pairs. If greater facilities are required, additional platforms 8 ft. in width may be provided outside of the first two tracks and additional tracks placed outside of them. The width of these additional platforms may be 8 ft. if without roofs, or 12 if covered by roofs supported by a line of posts in the middle.

(4) Where large amounts of freight are to be transferred, the use of power-driven covered traveling platforms, instead of fixed platforms, is suggested.

FREIGHT HANDLING MACHINERY.

(1) The use of freight handling machinery at railway freight houses, warehouses and shipping piers is worthy of consideration.

The report is signed by F. S. Stevens, Chairman; E. E. R. Tratman, Vice-Chairman; E. P. Dawley, A. C. Everham, A. P. Greensfelder, F. G. Jonah, Paul Jones, B. H. Mann, J. D. Mason, A. Montzheimer, G. F. Morse, H. J. Pfeifer and M. E. Shire.

IRON AND STEEL STRUCTURES.

The report on Iron and Steel Structures embodies a discussion of Inspection, Reports and Records of Bridges, and Classification of Bridges as to Safe Carrying Capacity.

Under the heading of Inspection, the committee recommends the following plan:

INSPECTION.

(1) *Daily*, by trackmen, who, in connection with the inspection of track, shall examine every bridge, with the object of discovering any change in condition or movement of super- or substructure, damage from drift, high water, falling objects, broken or loosely hanging bars or members, broken or badly damaged ties, missing bolts or nuts.

(2) *Monthly*, by competent bridgemen, who shall examine every member and every part of the super- and substructure of every bridge whose inspection is not governed by Article 3, with the object of detecting cracks, wear of parts, loose bars or members, loose rivets, excessive deterioration, crushing or breaking of the masonry, scouring or undermining of foundations and any defects whatsoever. They shall carefully observe the action of the structure under traffic, with the object of directing any new, unusual or excessive motion.

(3) *Quarterly*, by competent bridgemen, who shall inspect, in the manner and with the object as defined in Article 2, those good and substantial bridges which shall be particularly designated by the proper officer.

(4) *Annually*, by an experienced bridge inspector, who shall with thoroughness examine in detail the condition of every part of the super- and substructures. The object of this inspection is to obtain a check on the monthly and quarterly inspections, a report on the *extent* of defects, deterioration, motion, etc., from which may be determined the degree of safety of the structures, the necessity for repairs and extent of strengthening and renewals required.

(5) *Annually*, by the authorities in charge of bridges for the purpose of officially deciding the *extent* of reinforcing, renewals or traffic restrictions which must be made during the following year.

(6) In addition to the foregoing, the following special inspections should be made, as occasion may require:

(a) Of all structures which are severely strained or show signs of distress under traffic.

(b) Of all substructures which show signs of movement, until the movement ceases, or the conditions causing it have been remedied.

(c) After heavy freshets for evidence of damage to superstructures by drift and to substructures by scour.

(d) By the engineering department whenever a structure is reported as requiring "extensive" repairs or renewal.

Reports.

The following reports are considered necessary by the committee:

(1) It is not necessary for trackmen to make reports unless something wrong is discovered, in which case the proper authorities should be immediately notified, in order that necessary measures may be taken to insure the safety of the bridge.

(2) Bridgemen making monthly and quarterly inspections should report on each structure each time examined. These reports should cover briefly all the items outlined in Article 2, under the heading of Inspection, as well as any other items shown on the printed forms.

(3) The annual report, by experienced bridge inspectors, should be complete in detail, as it will form the basis from which will be determined the degree of safety of the structures, the necessity for repairs and the extent of strengthening and renewals required.

(4) In addition to the foregoing, reports should be made of all special inspections.

Records.

The following records are deemed essential to show a complete history of structures:

(1) General drawings of bridge sites, showing alinement of tracks, span lengths, skews, etc., with all necessary profiles. When the structure is over a stream, the profile of the river bottom should be revised from time to time, to show the rate of scour and condition of foundations.

(2) Set of strain sheets and detail drawings of the superstructures, preferably on tracing cloth.

(3) Detail drawings of the substructures as actually built, showing all information relating to the foundations.

(4) Copies of all specifications, contracts, tests of material and inspector's shop and mill reports.

(5) Records of all repairs, repainting, renewal of ties, etc.

(6) Copies of the annual inspection reports, kept up to date by frequent revisions.

(7) Tabulated statement of all clearances, covering the traffic through, under or over the structure.

(8) Copies of all documents relating to the work, such as special legislative acts, licenses, findings and awards of commissions, agreements relating to the sharing of cost of construction, maintenance, etc.

(9) Complete calculations and schedules, showing classification of the bridges as to their safe carrying capacity.

(10) For convenience of reference in the office, it is advisable to make a synopsis of the above information on cards or loose sheets. This should include:

(a) Name and location of the structure.
(b) Character of crossing.
(c) Spans, skew, height above rail, clearances, high-water mark, number and alinement of tracks.
(d) Brief description of the super- and substructure.
(e) Specifications under which structure was built.
(f) Quality of materials.
(g) Date of building and name of builder.
(h) Details of timbering.
(i) Abstracts of inspection reports.
(j) Records of painting and repairs.

(11) In addition to the above, each division officer and inspector should have a list containing every bridge coming under his supervision, and copies of all inspection reports pertaining thereto.

Classification of Bridges.

The subject of Classification of Bridges has been subdivided into (1) carrying capacity, and (2) classification for operating purposes.

Under the first subdivision, the committee offers the following conclusion:

(1) The *carrying capacity* of a bridge is here understood to mean the heaviest moving loads which may be operated over it in regular service for a limited time without subjecting it to such severe strains, motion or wear of parts as to seriously impair its safety and serviceability.

(2) The carrying capacity of any bridge will depend upon a large number of controlling factors, all of which must be taken into consideration. Some of these factors are design, material, workmanship, speed, strains, behavior, physical condition and the possibility of maintaining falsework for a considerable time should the bridge show distress under increased loading.

(3) A railroad bridge which has been constructed in accordance with a specification which provides for strength, design, material and workmanship at least equal to the standard of the American Railway Engineering and Maintenance of Way Association specifications will, when in good condition, carry for a limited period a loading in excess of that for which it was originally designed. The bridge, however, will be subjected to a greater amount of motion and wear of parts, have a lower margin of safety, less efficiency and a shorter life.

(4) When the span is less than 200 ft., all controlling factors

given in Article 2 good, the mathematical analysis made in accordance with the American Railway Engineering and Maintenance of Way Association specifications of 1906, using full specification allowances for impacts for regular service fast speed and one-half of these impact allowances for slow speed, then, so long as the controlling factors remains good, unit strains in tension to the extent of 26,000 lbs. in structural open-hearth steel and 22,000 lbs. in wrought iron, will not in themselves, be sufficient justification for suspending traffic or condemning the structure.

(5) When the controlling factors as outlined in Article 2 are not good the limiting strains or capacities cannot be determined by any general rule, as they are questions of actual conditions, judgment and experience, supplemented by a close watch on the structure in service.

Under the second heading classification for operating purposes, the committee advances the opinion that bridges should be classified according to their efficiencies under a loading of the type outlined in the association's specifications, that the efficiencies should be indicated by figures representing either the total weight or driving axle weight of the heaviest permissible engine of the specification type, and that these figures should be placed on the map of the railroad in such a manner as to show at a glance the capacity of the weakest structure on the main line, branches and engine districts. A schedule on the map giving the service classes of engines and cars whose operation is permitted by the stated efficiencies is recommended. Notes on the map would indicate restrictions as to speed and double-headers. The scheme outlined is illustrated by a map and schedule.

IMPACT TESTS.

The convention of 1907 by vote authorized the inauguration of a series of experiments to determine the effect of moving loads on railroad bridges, and the committee on Iron and Steel Structures was entrusted with the work of conducting the tests. A fund was provided to defray the expenses of making the experiments, and the work commenced during the summer of 1907.

A sub-committee, composed of Prof. F. E. Turneaure, University of Wisconsin; C. H. Cartlidge, Bridge Engineer, Burlington Railway System, and Prof. C. L. Crandall, of Cornell University, were appointed to take charge of the work.

Twelve instruments were constructed at the shops of the University of Wisconsin, with which the experiments were made. The first bridges tested were on the Illinois Central Railroad; subsequent tests were made on the Chicago, Burlington & Quincy; Chicago, Milwaukee & St. Paul; Chicago, Rock Island & Pacific, and New York, Chicago & St. Louis railroads. The results of these tests are embodied in a preliminary report, published in Bulletin 97, pp. 13-25. The experiments will be resumed next summer.

The report is signed by J. E. Greiner, Chairman; C. F. Loweth, Vice-Chairman; M. F. Brown, C. H. Cartlidge, C. L. Crandall, B. W. Guppy, A. J. Himes, Charles M. Mills, A. D. Page, C. D. Purdon, A. F. Robinson, C. C. Schneider, J. P. Snow, F. E. Turneaure and J. R. Worcester.

OPEN VERSUS BALLAST DECK STRUCTURES.

By A. F. Robinson, Bridge Engineer, A., T. & S. F. System.

The object of the author is to demonstrate that it is more economical to use ballast deck structures than open decks, and presents comparisons as to cost of the two types.

Formulas giving the distribution of the wheel loadings of the various kinds of decks are embodied in the paper.

The author assumes a life of 28 years for creosoted ballast decks on metal bridges and seven for the untreated pine used in open decks on metal bridges. He also assumes 24 years as the average life of creosoted ballast deck pile bridges and eight years as the average life of ordinary open deck pile bridges with soft wood timber and piles untreated.

The author has given in the paper in itemized form the total cost and the average annual cost per lineal foot of track for various kinds of decks, which he has designated by numbers. Following is a summary:

	Per lin. ft. of track — Total cost.	Avg. an'l cost
Open deck No. 1	$23.40	$0.86
" " " 2	27.46	95
" " " 3	30.62	1.03
" " " 4	34.12	1.10
" " " 5	41.70	1.32
Ballast deck No. 6	18.19	66
" " " 7	21.18	74
" " " 8		76
Open deck pile bridge No. 9	46.13	1.79
" " " " " 10	58.03	2.12
" " " " " 11	53.13	1.99
Ballast deck pile bdge. No. 12 ($19)	50.62	1.82
Ballast deck pile bdge. No. 12 ($20)	53.18	1.90
Reinforced concrete plan No. 13		1.67
Plan No. 13, average $30 per ft.	...	1.83
Ballast deck No. 6 A	21.93	76
" " " 7 A	26.68	85
" " pile bdge. plan No. 14	63.13	2.23

In presenting the foregoing comparisons for various structures, the author recognizes the fact that any great variation in market prices for material or labor may show decidedly different results.

Conclusions.

The advantages of the use of ballast deck structures, in the opinion of the author, are given in the following conclusions:

(1) Ballast to a large extent absorbs or dissipates and distributes the effect of impact in such a manner as to materially increase the life of structures.

(2) Ties will not "bunch" in good stone or gravel ballast and this kind of floor gives increased safety in case of derailment.

(3) It almost entirely prevents accidental fires that can catch from falling coals, thereby rendering insurance unnecessary.

(4) It gives a more nearly perfect riding track, there being no breaks in ballast from beginning to end of division.

(5) It gives an increased feeling of safety to the traveling public, to the trainmen and operating officials.

(6) It gives a more stable structure in time of high flood.

(7) By the use of ballast floor structures we are enabled to use the poorer or second grades of timber, thereby tending to reduce the great and dangerous drain on our visible supply of first grade material.

In final conclusion, the writer believes ballast deck structures are advisable from all points of view, that they should be used on bridges of all kinds, both on main and branch lines, and believes the time not far distant when open deck structures will be ancient history.

The Signal System of the Interborough Subway

In a report on the signal and interlocking system in use in the New York subway, Bion J. Arnold, Consulting Engineer, has recommended to the Public Service Commission that improvements be made in the signal apparatus by which less headway for express trains may be obtained without sacrificing the safety of passengers, and that after these improvements are perfected the local tracks be equipped with the same block signal system as is now used on the express tracks. The signal changes he recommends would make possible a headway of 90 seconds, or 40 trains an hour, on both express and local tracks. At present the rate is about 30 trains an hour.

Mr. Arnold declares the existing signal system as complete as it was possible to make it at the time it was put in (1904) but says that the art of signaling has made rapid strides since that time. According to the records furnished him by the Interborough company for the two years from October 1, 1905, there were 155,064,891 signal and stop operations with 497 failures, or one failure to 312,001 of block and interlocking signal and automatic stop movements. This he considers a satisfactory test of the signal system in use, but he believes that with new methods and appliances perfected since the installation of the system, it can be greatly improved.

"Although the original installation of the signal system," says Mr. Arnold, "was such that safety was obtained at all points, the congestion due to the long delays at the station platforms caused changes to be made in the station blocks on the express tracks. These changes were based upon the assumption that a reduction in speed would be made when trains approached stations, and it therefore follows that safe automatic control of trains is not now always obtained. In other words, the motorman's intelligence and judgment, as well as his physical condition now entered as a factor in the safety of train movements, particularly when approaching stopping stations. To maintain a uniform standard of safety over the entire system, it is necessary to introduce some device that will insure this reduction in speed when approaching the stopping point."

Several observations were made of the movement of trains in the subway. The highest observed speed was 40 miles an hour. The usual speed of express trains at places favorable for fast running was 35 miles an hour. Heavily loaded northbound express trains leaving the Brooklyn Bridge made 32 miles an hour. At the Grand Central Station, where observations were confined to the movement of trains at express platforms, the number of trains moved an hour was 27 northbound and 29 southbound, and the average time interval between the arrivals of trains was 2 minutes and 12 seconds northbound and 2 minutes and 1 second southbound. The average length of stop was 58 seconds northbound and 35 seconds southbound. The shortest stop was 25 seconds on both tracks and the longest stop was 82 seconds on the northbound and 62 seconds on the southbound track.

Summing up these observations, Mr. Arnold concludes:

"These figures show the average length of time required for the trains to pass from Grand Central Station block and indicate that under present conditions it is hardly possible to maintain a two-minute headway upon the express tracks during rush hours. A two-minute headway corresponds to the rate of 30 trains an hour whereas trains were passed through this station at the rate of only 27 trains an hour northbound at night, and at the rate of 29 trains an hour southbound in the morning rush hours."

There is a special signal placed just outside of each express station which operates to prevent approaching trains from running into a train standing at the station. Since the system was installed this stop signal has been brought nearer the station platforms for the purpose of reducing the delay in trains stopped by it, and thereby increasing the capacity of the express tracks. Inasmuch as the alertness and attention of the motorman are relied upon to prevent collisions, Mr. Arnold thinks that some automatic device should be added so as to make the safety absolute in the case of signals at express stations. Final changes in the present system should move the automatic stop further away from the platform rather than closer to it. The existing system with its automatic safety trip insures absolute safety on the express tracks between stations, and it should be important to provide the same degree of safety in the station blocks by means of automatic stops.

Speaking of the design of the express stations, Mr. Arnold says: "The subject of the proper design of express stations will be discussed in another report, but it is proper to state here that, had the express stations been constructed from the beginning, by being double decked or otherwise, so that trains could have been alternated first on one side of the platforms and then on the other, the capacity of the subway could have been increased at least 50 per cent. with the signal system as originally installed, but as this was not done it seems necessary under present conditions to revise the present signal system to the greatest extent practicable consistent with safety in order to secure capacity.

As a temporary means of increasing the efficiency of the existing signal system, Mr. Arnold suggests a visual and audible signal to be given by a stopped entering train to a subway platform station attendant that it has been delayed to the extent of a full stop. He also suggests a manually operated switch whereby an attendant can release the emergency stop holding the entering train and give it the signal to proceed after the leaving train has begun to move. Much time is now lost, he says, because the proceed signal is not given to the motorman of the entering train until the last car of the leaving train has left the platform.

In regard to the signal system for the local tracks, Mr. Arnold says that the only difference between train movements on the different tracks is that more frequent stops are made by local trains. As the introduction of more frequent stops between the terminals introduces a risk, the need for safety signals on the local tracks is really greater than it is on the express tracks. It would therefore appear that if the practical degree of safety decided upon for subway operation demands the installation of the signal system and automatic stopping devices on the express tracks, the same or similar equipment is necessary on the local tracks.

As the local and express trains alternate on the same tracks north of 96th street, it is desirable that the same headway should be maintained on both systems south of 96th street. As far as the signal system is concerned, there is nothing to interfere with such an arrangement up to the capacity of the express tracks which can eventually be operated with a headway of 90 seconds, corresponding to 40 trains an hour, although it cannot be denied that the introduction of the block signal system on the local tracks will thus reduce their present possible capacity from 50 trains an hour to 40 trains an hour. Inasmuch as there are now being operated on the local tracks during rush hours only about 30 trains an hour, it will be seen that the block signal system can be installed upon these tracks and at the same time allow an increase in the number of trains of $33^1/_3$ per cent. over the present number."

Mr. Arnold's conclusions are:

(1) The subway signal system is in the main, modern, effective and well maintained.

(2) There is no reason so far as the signal system is concerned why a 90-second headway cannot be maintained.

(3) This 90-second headway will eventually be desirable upon both local and express tracks.

(4) The signal system at the present time does not afford positive safety at the approach to stations, as the motormen are relied upon to reduce the speed of the trains.

(5) In addition to the excessive platform waits additional time is lost at each station stop by holding the following train a considerable distance out of the station until the leaving train has entirely cleared the platform.

(6) As at present operated delays at the station platform have a cumulative effect upon the following trains, so that even one prolonged stop may disarrange the schedule for the entire hour.

The report recommends the following changes:

1. That the necessary steps be taken to develop and install an automatic speed control signal system to be used as an auxiliary at station blocks, which will allow the incoming train to safely approach the rear of the train at the platform and to enter the platform promptly upon the leaving of the outgoing train without sacrificing any of the standard of safety which is now maintained between stations.

2. That during the development of the system there be installed at every express station the changes in the block signal system proposed by the Interborough company for Grand Central Station. The equipment required for these changes will reduce the present possible headway by 7 seconds, and could ultimately become a part of the permanent recommended arrangement.

3. That the subway officials consider for the purpose of effecting temporary relief the installation of a manually operated permissive signal at every express station to be used to expedite a delayed incoming train and thus overcome the cumulative effects on the schedule of a prolonged station wait.

4. That the local tracks be protected by a complete block signal system when the automatic speed control system herein suggested has been perfected.

5. That, when the load on the subway increases to such an extent as to require additional conductors for carrying the electrical energy to and from the trains, the present signal system be altered so as to use both rails for carrying the return current, and at the same time make the system conform to the latest accepted practice whereby the signal system detects and indicates a broken or removed rail, provided the system shall at that time have proven superior to the single-rail system.

The Failure of the Quebec Bridge.

The Royal Commission appointed by the Canadian government to inquire into the cause of the collapse, on August 29, 1907, of the Quebec bridge, has recently published its report which is dated February 20, 1908. The scope of the inquiry was described and the summarized findings of the Commission published in the *Railroad Gazette* of March 13, 1908, page 383. The Commissioners were Henry Holgate, C.E., of Montreal; John G. G. Kerry, C.E., of Campbellford, Ont., and John Galbraith, Dean of the Faculty of Applied Science and Engineering and Professor of Engineering in the University of Toronto.

The Commission acknowledges its great indebtedness to the following gentlemen: Charles Macdonald, formerly Chief Engineer of the Union Bridge Company, contractor for the superstructure of the Memphis cantilever bridge; H. W. Hodge, of Messrs. Boller & Hodge, engineers of the Monongahela cantilever bridge; Ralph Modjeski, of Messrs. Noble & Modjeski, engineers of the Thebes cantilever bridge; Colin M. Ingersoll and Henry B. Seaman* of the Department of Bridges of the city of New York, and Messrs. Reynders and Kunz, of the Pennsylvania Steel Company, respectively the engineers and the contractors for the superstructure of the Blackwell's Island cantilever bridge; Prof. Mansfield Merriman, Prof. W. C. Kernot, Prof. W. H. Burr, Prof. Edgar Marburg, Prof. H. M. MacKay, Prof. G. F. Swain, and Messrs. W. R. Webster, T. K. Thomson and W. W. Stern, Consulting Engineers; also "the hearty co-operation of all officials of the companies directly concerned. Messrs. Cooper, Szlapka, Deans and Hoare especially have made every effort in their power to assist us to establish the facts and have not attempted to spare themselves."

Most of the Commission's discussion of the difficulties that arose during erection of the bridge and of events at the time of its collapse, including the correspondence between the interested persons immediately preceding the catastrophe, follows:

The contract for the construction of the main spans was made conditionally on June 19, 1903, and finally accepted by the Phoenix Bridge Company on March 15, 1904. By the 1st of August 1904 the assembling of materials for the falseworks on the south shore had commenced, and by the beginning of September 1904 the erection of the falsework was well under way. The wooden falsework for the supply tracks, and the steel falsework for the traveler and bridge trusses were erected simultaneously, not quite one half of the falsework being put up before December 1, 1904. The erection of the big traveler was commenced, and the storage yard at Chaudiere was in working order before the end of the season of 1904.

A considerable amount of material was delivered at the Chaudiere yard during the succeeding winter, but the work was not pushed in the spring of 1905, because there was no rail connection between the bridge site and the Chaudiere yard. This connection was completed on July 9, 1905, at which time the framework of the big traveler was being completed, and the falsework had been erected to the main pier but was not finished.

The equipment of the traveler was installed and the erection of the steelwork was begun at the anchor pier on July 22, 1905. By the middle of September the lower chords of the anchor arm had been erected, the pedestals and feet of the center posts were being placed and the erection of the web members and upper chords had commenced. By the end of the season six panels of the anchor arm, out of a total of 10, were in place. The total amount of metal erected during 1905 was about 10,500,000 lbs.

In 1906, erection commenced on April 16 and the south anchor arm was all in place, except for some decorative details by June 27. Erection continued on the south cantilever arm and this was completed with the exception of some connecting pieces between it and the suspended span, before work closed down for the year on No-

*Mr. Seaman is now Chief Engineer of the New York Public Service Commissioner, First District.—Editor.

vember 26. The total weight of metal erected during this season was about 21,000,000 lbs. Work on the north shore commenced about the middle of July and a small portion of the falsework was in position by the end of the season.

During this season few difficulties occurred, and these were of a kind usually met with on all large work. The following quotation from Mr. McLure's report to Mr. Cooper, under date of July 21, 1906, gives a fair idea of the conditions existing on the work: "The whole policy of the Phoenix erection department seems to be to make things safe and take no chances, which is a very satisfactory one to us, and in pursuance of this everything is being bolted up full in cantilever arm, with the largest size bolts the holes will take, post and chord splices, main and sub-diagonal splices as well as all lateral and transverse bracing connections."

The Commission has been unable to satisfactorily determine the respective duties of Mr. Hoare and Mr. Cooper. According to Mr. Deans, Mr. Cooper had to approve all plans, but all other authority was vested in Mr. Hoare, and this opinion Mr. Deans continued to hold throughout the work. According to Mr. Parent, Mr. Hoare was practically an executive officer acting in all technical matters on the direction of Mr. Cooper, who was, *de facto*, Chief Engineer. Mr. Cooper himself has stated that the erection plans were not subject to his authority and has disclaimed any responsible connection with the inspection either in the shop or in the field. With few exceptions, all his directions are advisory and not imperative, and he seems to have endeavored throughout to avoid encroaching on the privileges and rights properly pertaining to Mr. Hoare's position. He gave frequent directions to both Mr. McLure and Mr. Edwards on technical matters, but throughout the construction period (August, 1905 to August, 1907) he had practically no correspondence with Mr. Hoare. Mr. Cooper's opinions, when given, were accepted by the Inspectors as instructions. The impression left with us is that throughout the work Mr. Cooper was in a position of a man forced in the interests of the work to take responsibility which did not fully belong to his position, and which he was not authorized to take, and that he avoided the assumption of authority whenever possible. Such an organization cannot from an executive standpoint be considered entirely satisfactory.

Work for the season of 1907 began in March, it being necessary to have a yard prepared to receive material on the north shore by early spring. The yard was located at Belair, close to the junction of the Canadian Pacific and the [projected] National Transcontinental Railway. Work on the trusses began on May 1, but until May 31 was confined mainly to riveting. Using the big traveler, the connecting links between the cantilever arm and the suspended arm were put in, and the small traveler was built. On July 13 the erection of the suspended span was commenced, the small traveler being used and the dismantling and removal of the big traveler was begun. Both of these operations were in progress when the bridge fell, on Thursday, August 29. On the north shore, work continued at a leisurely rate from about May 15 until the day of the accident. The north shore falsework was not fully erected by that date, there being no reason to hurry, because rail connection could not be obtained. During this season less than 3,000,000 lbs. of metal were erected. The last progress estimated (August, 1907) showed that about 34,400,000 lbs. in all had been erected.

The difficulties with the lower chords that finally resulted in the collapse of the bridge were noted early in the season, but those first observed were considered to be of minor importance.

On June 15 Mr. McLure reported to Mr. Cooper as follows:

In riveting the bottom chord splices of south anchor arm, we have had some trouble on account of the faced ends of the two middle ribs not matching as per following sketch. (The sketch shows that at the lower sides the middle ribs of the abutting chords were out of line by 1/8 in. to 1/4 in., this offset decreasing to nothing near the mid depth of the ribs.) This has occurred in four instances so far and by using two 75-ton jacks we have been able to partly straighten out these splices, but not altogether. These were probably in this condition when erected, but owing to the presence of the bottom cover plate it was then impossible to detect them, and it was only when this plate was removed for riveting that the inequality was noticed. The chords found in this shape were between 3 and 4, 7 and 8, and 8 and 9 in east truss, and 8 and 9 in west truss. You will note that this occurs only on inside ribs, which are provided with but a single thin splice plate each. I think that a heavy plate on each side of these ribs, bolted up tight when chords were erected, would have remedied this, *i. e.*, drawn the ribs together till the "faced ends matched."

Mr. Cooper replied on June 17 saying:

Make as good work of it as you can. It is not serious. It would be well to draw attention to using as much care as possible in future work to get the best results in matching all the members before the full strains are brought upon them.

It should be noted that of the four joints mentioned, those between chords 3 and 4 and 7 and 8 had originally been opened at the lower side and had come together by "camber" movement; but the 8 and 9 joints had been set with the lower edges abutting. During the first stages of erection, the upper edges of all the ribs at a joint were exposed to view, as the upper cover plate was not in place. Mr. Kinloch states in his evidence that he observed gaps between abutting ribs as great as [illegible] in. due to irregular finish of the planed ends of the chords. In the examination of the material in Belair yard the Commissioners found irregularities of workmanship which would account for the conditions described above, and in our judgment these could have been avoided only by matching the chords together in the shop previous to shipment. The small gaps between abutting ends of chords closed as the pressure on the chords increased, with no result other than producing irregularity of stress, but the lateral deviations had to be corrected by the use of jacks.

As Mr. Cooper, in his evidence, has expressed the opinion that these lower chord joints were, during erection, the weakest and most hazardous part of the structure, and that they suffered from lack of appreciation of the necessary care to be given them, it is advisable to closely review all evidence concerning them.

The chords consisted of four deep and narrow ribs latticed together and finished with square ends so that the pressure might be transmitted from one chord to the next by contact of the abutting ends. Under the system of erection adopted it was possible to place the adjoining chord ends in contact only at either the upper or lower edges, and it was expected that the chords would gradually turn during the settlement of the bridge until the end surfaces came fully in contact. This expectation was realized. The adjoining chords were held together by eight splice plates; an upper and a lower horizontal plate, two vertical plates on each outside rib and one vertical plate on each inner rib. The order of erection required that the lower plate should be put in position before the next chord was set; the vertical plates were next placed and the erection of the joint was finished by bolting on the upper plate. Owing to erection angle at the joint it was possible to use full size bolts on only one horizontal plate and one edge, either upper or lower, of each vertical plate.

The instructions with regard to the bolts were very definite and read as follows: "All bottom chords to have two-thirds of all holes of web splices filled with 1-in. bolting on the outer ribs, and 7/8-in. bolts on the inner ribs, or their equivalent in smaller bolts or drifts. For top splice plate apply rule (1), (this requires that every hole shall be filled with a bolt) and never take off splice plate again, not even while driving rivets in web splices. Bottom splice plate to be bolted with bolts two-thirds value. While driving rivets in web splices of chords, remove bottom splice plate and bolt across flanges temporary angles to keep flanges in place." Owing to the camber openings at the joints it was found necessary in some cases to use 5/8 in. bolts, as no larger bolts could enter the holes in their erection condition.

The evidence shows that these instructions were carried out but not with a full appreciation of their importance. Mr. Birks, who was admitted by all witnesses to have been an exceptionally accurate and painstaking Inspector, examined all the bolting towards the end of the season of 1906 this examination being made on direction of Mr. Deans, and at the express request of Mr. Reeves, the President of the Phoenix Bridge Company. He reported as follows:

"All bottom chord splices in anchor arm—top plate full—bottom plate and webs 67 per cent.—all joints bolted as per instructions" and also "all chords in the first five panels of the cantilever arm top plate full—rest 67 per cent."

Mr. McLure's report about bolting has already been quoted and Mr. Kinloch, in his evidence, states that the Phoenix Bridge Company's instructions about bolting were fully obeyed but that he personally did not pay much attention to the bolting of the bottom cover plate as he knew that it had to come off during riveting. We are of the opinion that the top and bottom cover plates and the splice plates for the outside ribs, all of which could be readily seen by the Inspectors, were correctly bolted, but there may have been some cases of insufficient bolting on the inside ribs. Such cases were, we think, rare.

It was intended that, as the camber openings closed, the smaller bolts should be taken out and replaced by larger bolts on all outside plates, the inner plates being difficult of access until the bottom chord plate was removed. This idea does not seem to have been followed in practice to any extent nor is there any evidence to show that the bolting was systematically tightened up as it worked loose with the adjustment of the structure. The evidence also shows that the bottom cover plates were left off during the whole period of riveting a joint (usually from ten days to two weeks), and that in the case of 7-8 L cantilever arm this plate was off for nearly the whole month of August, 1907. We must therefore conclude that the splice plates at the joints were rather loosely attached and that the importance of rigidity at these points were strangely overlooked.

It should be noted that this system of bolted splices was a necessity due to the method of erection adopted, but that there was no reason why the end details of the chords and the splice plates themselves should not have been much more strongly and rigidly designed. The erection problem was unique in magnitude, particularly in the camber requirements, and the method followed by the Phoenix Bridge Company closely corresponds to that in general and successful use on smaller structures. It is open to criticism on theoretical grounds and it is possible that other engineers might.

by other design serve the same ends; the problem in its dimensions is so entirely new, that there is room for much study and invention in erection methods for great structures.

We know of no reason why the method adopted cannot be successfully used, but the evidence shows that the Phoenix Bridge Company failed to appreciate the important influence that end details and splices had on the strength of the chords. Steps were not taken to insure that the work was so handled that the maximum rigidity consistent with design was secured at these joints. Considering the circumstances, we know of no good reason why the riveting should not have been much further advanced before the great stresses created by the erection of the suspended span were thrown upon the joints. The report of Mr. McLure on November 10, 1906, shows that all but eight of the 40 lower chord joints were then closed and ready for riveting. Mr. Cooper has clearly stated that he did not consider that the erection methods were subject to his control, although the evidence shows that he was frequently consulted about them, both by Mr. Szlapka and by Mr. McLure. The erection problem in this case was of great importance, and the Quebec Bridge Company did not place their interests under the direct and responsible control of an experienced engineer acting solely on its behalf.

Difficulties developed almost as soon as the erection of the suspended span got well underway. On August 6 Mr. McLure reports as follows:

New Liverpool, P. Q., Aug. 6, 1907.

Mr. Theodore Cooper, Consulting Engineer, 45 Broadway, New York.

Dear Sir:—In riveting up the splice between chords 8 and 7 in the west truss of south cantilever arm we found the condition of the inside ribs at splices as indicated in following sketch. Owing to the limited space between the two inside ribs, it would be impossible to jack this splice back, and as the condition is not nearly as bad at the top of the splice, we have proposed putting a diaphragm between the two inside ribs to cover the first five rivets up from the bottom on each side of the splice, as indicated in red in the sketch above. The splice plates being riveted on the two inside ribs, it will be necessary to cut out and re-drive twenty rivets to do this. This provision, together with the top and bottom cover plates, should be sufficient to hold this splice against the thrust due to its being out of line, which thrust when under its maximum compressive stress I estimate at not over 60,000 lbs.

The Phoenixville office is being notified of this plan, and if they will approve will wire us. If this also meets with your approval or if you wish to suggest another way to remedy the difficulty, will you please wire me at St. Romuald, P. Q., care Phoenix Bridge Company, as the riveting gangs are ready to finish riveting this splice. Very truly yours,

N. R. M'LURE.

On receipt of this letter, Mr. Cooper wired the Phoenix Company as follows, August 8:

New York, Aug. 8, 1907.

Phoenix Bridge Co., Phoenixville, Pa.:

Method proposed by Quebec for splicing joints of lower 7 and 8 chords is not satisfactory. How did bend occur in both chords?

THEODORE COOPER.

and wrote Mr. McLure on August 9 as follows:

New York, Aug. 9, 1907.

N. R. McLure, Esq., Inspector for erecting Quebec Bridge, Liverpool, P. Q.

Dear Sir:—Yours of the 6th, regarding bent condition of lower 7 and 8 chord joints, came yesterday. I wired Phoenix that the proposed method as sketched by you for repairing was not satisfactory. Also asked, what you should have reported, how did both these chords get bent?

In my opinion these webs can be brought back to proper line by use of 15 to 20 1-in. bolts, threaded at both ends for nuts, passing through the two webs of that half of chord. Of course, means must be taken to stiffen the straight web against its bending when the bolts are tightened.

If necessary, after getting the bent web in line, to hold them, spacers and possibly some through bolts may be used.

Some more satisfactory method than the one shown in your sketch must be devised.

Mr. Deans telegraphs that upon Mr. Szlapka's return he will give me fuller facts. Yours truly,

THEODORE COOPER.

Then the following telegram was received from Mr. Deans:

Phoenixville, Pa., Aug. 9th, 1907

Theodore Cooper, Consulting Engineer, 45 Broadway New York:

Mr. Szlapka happened to be at bridge site yesterday—expect him home tomorrow, with full information concerning chord joint, will then write you fully.

JNO. STERLING DEANS.

To which Mr. Cooper replied as follows:

New York, Aug 9, 1907

John Sterling Deans, Chief Engineer, Phoenix Bridge Co., Phoenixville, Pa.

Dear Sir: Your telegram regarding chord joint at hand. The method proposed as sketched by Mr. McLure is not satisfactory, as I telegraphed yesterday.

These bent webs can be pulled back by use of about 15 to 20 1-in. bolts (in 1 1/16-in. holes) threaded at both ends for nuts, passing from the outer to the inner bent web, the outer straight web being stayed in some manner against its bending.

If the bent webs after being pulled into line, tend to go back when released from the bolts, stays must be introduced to hold them in position. Possibly it may be necessary to permanently rivet in some of these 1 in. bolts.

Please let me know what method you propose to use.

It is a mystery to me how both these webs happened to be bent at one point, and why it was not discovered sooner. Yours very truly,

THEODORE COOPER.

On August 10th, Mr. Deans wrote to Mr. Cooper as follows:

Dear Sir:—"Splice cantilever chords 7 and 8." Mr. Szlapka did not return to-day as expected, but will no doubt be here on Monday, when we will write you at once. Yours truly,

JNO. STERLING DEANS.

And on the 12th Mr. Deans again wrote to Mr. Cooper as follows:

Dear Sir: Chord splice south cantilever arm, 7-L and 8-L.

Mr. Szlapka reached the office this morning and I am able to give you information in connection with this one joint.

All ribs of the chord 7-L have a complete and full bearing on ribs of 8-L. The bend was no doubt put in the rib in the shop, before facing and was probably done when pulling the ribs in line to make them agree with spacing of these ribs and the clearance between ribs, called for on the drawing. The bend being on only one rib of one chord, there being a full bearing over the entire rib, all splice plates being readily put in position, we do not think it necessary to put in the diaphragm, suggested by the erection department.

Please let us hear from you on this subject promptly and oblige.

Yours truly,

JOHN STERLING DEANS,

Chief Engineer.

On August 13, in reply to Mr. Deans, Mr. Cooper wrote as follows:

Dear Sir.—The information regarding chord splice 7 and 8-L, is so different from the dimension sketch sent by Mr. McLure, I can take no action on this matter till the exact facts are presented. Please have your resident engineer and Mr. McLure re-examine this joint and send the exact condition of this rib, as to the amount of the bends and relation of the bearing services to each other.

I don't see how one rib being bent only, as stated in your letter, there can be a complete and full bearing of these ribs. Neither can I understand how pulling the rib into line at the shop could bend it out of line.

I will write Mr. McLure to-day to have a further investigation of this joint and to report as promptly as possible. Yours very truly,

THEODORE COOPER.

And on the same day Mr. Cooper wrote to Mr. McLure:

New York, Aug. 13, 1907

N. R. McLure, Esq., Inspector for erection, Quebec Bridge, New Liverpool, P. Q., Canada.

Dear Sir:—Mr. Deans writes me that only one rib at joint 7 and 8 L is bent and still that there is a full and complete bearing; that the bend was no doubt put in the chord in the shop before facing.

I have asked him to instruct his resident engineer to join with you in making an exact report, with dimensions of the conditions of this joint, with amount of bearing, and if it is a square bearing or askew.

In reference to the splicing of T 5 and T 50, mentioned in your letter of 10th, I do not care to interfere with the regular programme, as I have not followed the various actions of the loadings at different stages, without going into it carefully. I think there will be more compression at these points with more of the suspended span in place.

Please report promptly regarding joint 7 and 8 L with all the facts.

Yours truly,

THEODORE COOPER.

Mr. Deans wrote Mr. Cooper on August 14 as follows:

Dear Sir.—Chord splice 7 and 8 L. Your letter Aug 13.

I will have a full and complete report made of this joint by Mr. McLure and Mr. Birks, and submit it to you earliest possible moment.

Yours truly,

JOHN STERLING DEANS,

Chief Engineer.

On August 14, Mr. Cooper received the following letter of the 12th from Mr. McLure:

Dear Sir: I beg to acknowledge the receipt of your letter of Aug 9 and have noted what you say regarding the method of repairing splice between chord 7 and 8 cantilever arm west truss. We will not do anything with this then until the matter has been arranged between yourself and Mr Szlapka

The reason I did not report at first as to how these chords got bent was because there were many different theories here as to the cause, no one of which I was at that time ready to accept. One thing I am reasonably sure of, and that is, that the bend has occurred since the chord has been under stress and was not present when the chords were placed. This being the case, the cause of the bend would seem to be the slight overrunning in length of the bent rib in either chord 7 or 8. Owing to the fact that these chords are faced on the rotary machine the four ribs at once this would at first seem to be out of the question, but it seems to me that after the first end of a chord has been faced in turning it with the crane, to bring the other end into position for facing, it might be possible for one rib to work slightly by the others longitudinally, without being noticed, and in spite of the latticing and thus cause a slight difference in length. In fact, in taking the opening in the chord splices on the south anchor arm, it has often been noticed that a considerable variation existed between the openings of the different ribs at the same splice, which difference I was not able to account for except by the above theory that during transportation, and in the handling before erection, some of the ribs have worked slightly in a longitudinal direction by each other In the case in question, of course, this must have happened between the time of facing one end and the other If this is correct, then it will be a pretty hard matter to draw this splice back into line with bolts, and our idea in suggesting that a diaphragm was to prevent this eccentricity from increasing, rather than to correct that already there

As I had supposed, the strike in force for the last three days of last week has been settled, and work has again resumed this morning. A meeting of the union was held Saturday night and enough of the discontented element had been lost so that when the matter was brought to a vote the majority were found to be in favor of returning to work under the original agreement. Those who were not in favor of returning to work, however, are now leaving so that our force is reduced greatly on both sides of the river.

Since writing the above I have discovered that splice between the chords

8 and 9 on west truss of south cantilever arm is in the same condition exactly as that between 7 and 8, except that the bend is only $^5/_{16}$ in., instead of $^3/_4$ in., at the bottom, and runs out so that on top this rib is in line as are the other three.

This is the same rib and the bend is in the same direction as that reported for the other splice. When it is decided in what way to treat the splice between chords 7 and 8 we will repair that between chords 8 and 9 in a similar manner. Yours very truly,

N. R. M'CLURE.

To this Mr. Cooper replied to Mr. McLure on August 15 as follows:

Dear Sir: None of the explanations for the bent chord stand the test of logic.

I have evolved another theory which is a possible, if not the probable one. These chords have been hit by those suspended beams used during the erection, while they were being put in place or taken down. Examine if you cannot find evidence of the blow and also make inquiries of the man in charge. Yours very truly,

THEODORE COOPER.

A further report was made by Mr. McLure to Mr. Cooper on August 16th:

Dear Sir: Referring to your letter of 15th, regarding splice between 8 L and 7 L on south cantilever arm, you have not doubt by this time received my letter of the 12th inst., giving my theory of the cause of this bend. These conditions are as indicated in my report of Aug. 6. Mr. Birks, the resident engineer for the Phoenix Bridge Company, reported exactly the same thing, in somewhat different language to Phoenixville, but Mr. Deans had evidently taken a different meaning from his report than was intended. He evidently thinks that only one rib of one chord is bent, whereas it is the same rib at each chord, as indicated in the sketch I sent you. There is really nothing to add to the two letters I have already written regarding this bend, except to say that all the four ribs have full bearing on each other, as indicated also in the sketch of Aug. 6. In order to verify our first reports, Mr. Birks and I made a careful and more thorough measurement of this splice to-day, both top and bottom, and I am enclosing a blueprint of a sketch made as a result of these measurements. It indicates practically the same condition as described in my first letter, except that it is given more in detail.

As to the cause of this bend, regarding which I wrote you on Aug. 12, Mr. Deans seems to think that it was put in in the shops; but that is because he did not understand the condition existing. Aside from the fact that it would be hardly probable that these two ribs of different chord sections should be bent the same way exactly the same amount in the shops—to dimensions $^1/_2$ in. to $^3/_4$ in. less than called for, I am reasonably sure, as I said before, that this condition did not exist before the erection of these chords, as I have personally inspected every member yet erected in this bridge thus far, except the bottom chords of another arm, on the cars just before the erection, looking particularly for bends in ribs of compression members, and whenever discovered have taken measurements of the amounts and recorded them. If these ribs then had been this much out of line before erecting, it would be well nigh impossible to miss seeing them. Consequently, the only way the bend could have occurred, it seems to me, is that reported in my letter of Aug. 12.

I trust that these explanations, with the enclosed sketch, will make the matter entirely clear. Mr. Birks is sending same sketch to Phoenixville to-day. Very truly yours,

N. R. M'LURE.

Mr. Deans also received a copy of this sketch and wrote Mr. Cooper on August 20 as follows:

Dear Sir: We have advice from your field that you received copy of sketch No. 28, giving further details in connection with cantilever chord splice 7 L and 8 L. You will notice that the two chords have a perfect bearing with each other at all ribs. Both chords having one bent rib and not one chord only as we first understood. Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

To which Mr. Cooper replied on August 21 as follows to Mr. Deans:

Dear Sir: I received copy of sketch of joint 7 and 8 L two days ago.

I wrote Mr. McLure last week telling him none of the theories as to how this bending occurred was logical. That my theory was a blow on this rib after the two sections were in contact, and that it probably was done in moving those suspended beams used in erecting. To examine carefully to see if he could find any evidence of this. He has not yet reported. He did report a similar bend in L 8 and 9 west truss in same rib, but of less amount.

I still believe this bend can be partly removed by use of long bolts with threads at each end: outer rib being stiffened to prevent its bending. If it can be pulled nearer straight, stays or bolts must be provided to hold it against future movement.

I cannot consent to let it go without further action as the rivets in the cover splices would not satisfy the requirements to my mind.

Yours very truly,

THEODORE COOPER.

This letter was acknowledged by Mr. Deans on August 23 in the following letter to Mr. Cooper:

Dear Sir: "Joint 7 L and 8 L south cantilever arm."

Referring to your letter of Aug. 21, I notice you expect to hear again from Mr. McLure. As soon as you have this report kindly let us hear from you again, and oblige. Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

On August 26 Mr. Cooper wrote the following letter to Mr. Deans:

Dear Sir: Mr. McLure reports that he can find no evidence of the bent ribs having been hit and does not think they could have been struck. This only makes the mystery the deeper, for I do not see how otherwise the ribs could have been bent.

When convenient I would like to discuss with Mr. Szlapka the best means of getting these ribs into safe condition to do their proper work.

Yours very truly,

THEODORE COOPER.

This was acknowledged August 27 by Mr. Deans to Mr. Cooper.

Dear Sir: Chord splice 7 and 8 cantilever arm south side.

Replying to your letter of Aug. 26, I will have Mr. Szlapka call to see you first opportunity to discuss this question. He will write you later the day he will be in New York. Yours truly,

JOHN STERLING DEANS,
Chief Engineer.

This was the last that transpired with regard to the bent ribs at joint 7 L and 8 L cantilever arm, and it is plainly indicated that no one except Mr. Cooper looked on this matter as serious or as indicating any constitutional weakness. It will be noted that the bends at 7 and 8 were reported on August 6, the bends at 8 and 9 discovered on August 12, and that both bends were in the west truss, that previously from time to time chords with ribs more or less wavy had been reported, and Mr. McLure gave it as his opinion that these bends were caused by stress since erection because he was sure they were straight when erected, while Mr. Deans thought the bends were made in the shop.

While Mr. Deans after Mr. Szlapka's return gives certain information as to the bend in the 7 and 8 splices, Mr. Szlapka states that on his visit to the bridge he did not examine this splice, and further says that during none of his three visits to the bridge did he examine any chords. Mr. Kinloch states in his evidence that he did not notice the bends at the 7-L and 8-L joints when the bottom cover plate was first removed, and that he felt confident that these distortions took place after the removal of the cover plate.

It seems clear from the above that Mr. Cooper's statement that the delicacy of the joints was not sufficiently appreciated by the Phoenix Bridge Company is substantiated. Mr. Szlapka was on the ground and made no special examination in the matter, and Mr. Deans endeavored to throw the blame for the distortions entirely on the shop work. No evidence has been shown to us to prove that Mr. Deans had any grounds for this assertion, and his inspector, Mr. Morris, was in possession of information that indicated that there was no great probability that such an error could have escaped detection. On August 20, Mr. Kinloch discovered that chord 8-R of cantilever arm was bent, and afterwards found that 9-R and 10-R also showed distortion, he called Mr. Birks' attention to this condition, but neither of them considered it of importance. Mr. McLure was ill and did not see these bends until several days after they were found (August 23), but Mr. Yenser was made aware of them. On August 23 the joint at chords 5 and 6-R of cantilever arm was found to be off on one center rib $^1/_2$ in. at bottom, the offset running to nothing at top. Mr. Kinloch visited chord 8-R daily for several days and imagined that the bend was becoming greater, all four ribs being bent, but not alike.

The bend in chord 9-L anchor arm was discovered about 9.30 a.m. August 27 to have greatly increased, it having been previously noted and being under observation. Owing to the fact that the 25th was a Sunday and that there was practically no work done on the 26th, it is doubtful whether this chord was examined between the 24th and the 27th. Mr. Kinloch, who made the discovery, in his evidence says:

Q. Please relate the occurrences following your discovery of the bent chord on Aug. 27.

A.—Immediately after discovering the bend I brought the matter to the attention of Mr. Yenser and Mr. Birks, and with them re-examined both chord A 9 L and several other lower chord members. We did not know what to make of the matter and then went up to our office and arranged with Mr. McLure to have the deflections of the suspicious chords measured—this measurement, which was made by Birks, McLure and myself, showed the extent of the deflections, and their cause and their ultimate result immediately became a matter of very active discussion. Mr. Birks expressed himself definitely as being of opinion that there was no danger and endeavored to persuade me that the bend had always been in the chord. Mr. Yenser and I were uneasy and considered the matter serious, and finally suggested that Mr. McLure and Birks should go to New York and Phoenixville for advice. It was considered that the matter could not be satisfactorily explained by telegraph or telephone, and none of us expected immediate disaster. Mr. Birks and Mr. McLure did not welcome our suggestion, saying that they would only be laughed at on arrival, and it was finally agreed to refer the matter of sending to headquarters to Mr. Hoare, who decided in favor of our suggestion. Mr. Hoare visited the bridge on the Wednesday and spent most of the day there. He appeared very anxious that I should abandon my position of being positively convinced that the bend had occurred since the erection of the cantilever arm was completed, and argued both this and some possible method of strengthening the chord by bracing, several times with me. I was somewhat excited and much annoyed at the unwillingness of all the engineers to accept my statement of facts, and on both Wednesday and Thursday avoided further discussion of the matter as much as possible. It was understood that Mr. McLure would immediately wire me if Mr. Cooper took a serious view of the situation, but this he failed to do. Mr. Birks, however, told me on the morning of the 29th that he had been advised by 'phone from Phoenixville that they had a record which showed that the bends had been in the chord before it was shipped from Phoenixville, and that he had just advised Mr. Hoare by telephone at the request of Mr. Deans to that effect.

As soon as the measurements above referred to were made, it was recognized by Mr. Yenser and the inspectors that they were face to face with a crisis. Mr. Yenser announced his intention of stopping erection until he had referred the matter to Phoenixville. The measurements were plotted and were reported by mail to Mr. Cooper and to Phoenixville, these reports being delivered on the morning of the 29th. Owing apparently to anxiety already existing among the workmen it was not considered wise to use either telegraph or telephone. As suggested by Mr. Kinloch, Mr. McLure reported the matter fully to Mr. Hoare on the evening of the 27th, the delay of about 12 hours being accounted for by the making and plotting of the measurements and the necessity of using a personal messenger as it was not wished to report particulars over the telephone. It is clear that Mr. Yenser, Mr. Kinloch and Mr. McLure were very much alarmed, but Mr. Birks could not be convinced that the bends had recently taken place. He knew better than anyone else on the work the care with which the calculations and designs had been made; he was familiar with the experience and abilities of the designers, and could calculate that the stresses were then far below the expected maximum.

To engineers the force of such reasoning is very great and we do not consider that the confidence Mr. Birks placed in his superiors was in any way unusual or unreasonable. There was no misunderstanding, however, on his part; he realized that if the bends had not been in the chord before it was erected, the bridge was doomed, and although Mr. McLure had evidence that the bends had increased more than 1 in. in the course of a week, although Mr. Kinloch was positive that the bends had very recently greatly increased, and although Mr. Clark stubbornly maintained that the chord was absolutely straight when it left Chaudiere yard, Mr. Birks still strove to convince himself that they must have been mistaken. Mr. Hoare evidently concluded that the matter was too serious for him to settle by any offhand decision, and approved Mr. McLure's mission to New York, wisely requiring that he should get all possible facts before leaving, so that Mr. Cooper need not wait for further information on which to base a decision.

The text of Mr. McLure's report of August 27 is as follows:

New Liverpool, P. Q., Aug. 27, 1907.

Mr. Theodore Cooper, Consulting Engineer, 45 Broadway, New York.

Dear Sir: I enclose sketches showing condition of bottom chord sections "606—9 L" of south anchor arm and "621—9 R and 8 R" of south cantilever arm, as found from measurements made to-day by the Phoenix Bridge Company's Assistant Engineer and myself, by stretching a line from batten plate to batten plate as indicated on the sketches and measuring from this line held taut, to each rib, top and bottom. It was noticed this morning that these chords were bent in this manner, as it is very evident to one walking over them, and as it looked like a serious matter, we measured them.

Although a number of the chords originally had ribs more or less wavy, as I have reported to you from time to time, it is only very recently that these have been in this condition, and their present shape is undoubtedly due to the stress they are now receiving. Only a little over a week ago, I measured one rib of the 9—L chord of anchor arm here shown, and it was only ¾ in. out of line. Now it is 2¼ in.

In the sketches the red indicates straight lines and black ones the ribs of chords. A top and bottom view is shown in each case. You will note that chords 606—9 L and 621—9 R have all ribs bent in same direction, while 621—8 R has its ribs bent in reverse curves. These bends had become so apparent by to-day that the gangs riveting at these points noticed them, and called Mr. Kinloch's attention to them.

This matter is being reported in this mail, with sketches from the same measurements, to the Phoenixville office, and the erection will not proceed until we hear from you and from Phoenixville. Yours very truly,

N. R. M'LURE.

Wednesday, August 28, was a day of waiting and uncertainty. Mr. Yenser had changed his mind during the night and in the morning continued erection. The men were uneasy and alarmed and the officials were anxiously awaiting instructions from Phoenixville or New York. Mr. Yenser's decision to continue work was laid before Mr. Hoare, upon whom, as Chief Engineer, the final responsibility for every step taken rested, who decided that Mr. Yenser had acted wisely. Mr. Hoare makes this clear in the following letters to Mr. Cooper:

Letterhead (The Quebec Bridge & Railway Co.).

Quebec, Aug. 28, 1907.

Theodore Cooper, Esq., 45 Broadway, New York City.

Dear Sir:—I wired you to-day as under:

"Have sent Mr. McLure to see you early to-morrow to explain letter mailed yesterday about anchor arm chords."

Also the following message to the Phoenix Bridge Co.: "Mr. McLure will call to-morrow to explain Birks' letter *re* anchor arm chords. Will see Mr. Cooper first."

Regarding this matter I thought it best for McLure to go at once to be able to explain matters and answer questions. He did not have much time for extended investigation before leaving.

I have been at the bridge all day trying to get some evidence in connection with the bending of the ribs in this chord. Mr. Kinloch noticed it for the first time yesterday and all inspectors declare that no such pronounced distortion existed a few weeks ago. Mr. McLure made measurements yesterday afternoon and brought them to my house late last night, and stated that the erection foreman hastily concluded that he would not continue erecting to-day, which alarmed me at the time. Upon arriving at the work this morning he thought better of it and decided to go ahead, at the same time asking me if it would be all right. After ascertaining that the effects from moving the traveler ahead and proceeding with the next panel would be so insignificant I requested him to continue, as the moral effect of holding up the work would be very bad on all concerned and might also stop the work for this season on account of losing the men. From further investigation during the day I cannot help concluding that the metal received some injury before it was erected, as the corresponding chord in the same panel and stressed the same is in good condition. These panels are being stressed to-day, approximately, about 7/10 of their maximum, and it is difficult to believe that this is the entire cause of the distortion. Now and again a rib in certain members is found to be a trifle longer than another, which, when compressed, might cause a trifling kink in it. There are a few examples of this. The chord in question, when being lifted to the cars in the storage yard broke loose from the grips, one end of which fell a distance of 6 ft. on to timber sills; the other end fell a distance of 2 ft. on to a block of eyebars. In falling it fell over on its side, breaking one of its angles on the north end splice and twisting some of the lacing bars, all of which were renewed. After this the inspectors reported the ribs perfectly straight. On account of this chord falling on to two rigid higher points at ends, with no support in the middle but soft material, the conclusion would be that the deflection would be downward, as a matter of fact the evidence shows that it was in the opposite direction. Since Mr. McLure left, Mr Birks has made careful examination of the chord and states that the actual bending commences at the south splices and was not confined entirely to the length between the bottom plates, where the lacing angles are used. As the foreman and inspectors declare that these defects were not noticeable until recently, perhaps the stress in this chord has made previous defects more pronounced. I thought I would give you the above story from further investigation by to-night's mail to help you to come to some conclusion

Yours truly,

E. A. HOARE.

Letterhead (The Quebec Bridge & Railway Co.).

Quebec, Aug. 22, 1907

Theodore Cooper, Esq.

Dear Sir:—Mr. Birks has just called me up on the telephone from the bridge and states that he has received a message from Phoenixville stating that they have positive evidence that the chord was not straight before it left the shops. This possibly clears up the mystery why the deflection was in the opposite direction to what it should have been, due to its fall in the storage yard. Mr. Birks has wired that information to Mr. McLure at your office. Mr. Birks further stated that he is positive that the chord ribs were more or less out of line when the splices at the south end was riveted up in the bridge. Yours truly,

E. A. HOARE.

Letterhead (The Quebec Bridge & Railway Co.).

Quebec, Sept. 2, 1907

Theodore Cooper, Esq.

Dear Sir:—I thank you for replies to all our messages. I am sorry that you are not well and of course, this appalling disaster has made you feel a thousand times worse.

Mr. Berger will answer our purpose very well for the present. The investigating commission may find it necessary later to interview you in New York, due notice of which will be given you.

I wish to correct a misstatement in my letter to you of the 28th of August, which was written late and very hastily to confirm telegram and conversation with Mr. Birks about the chord under discussion. The statement in my letter as follows

"Mr. McLure made measurements yesterday afternoon and brought them to my house late last night and stated that the erection foreman hastily concluded that he would not continue erecting to-day, which alarmed me at the time. Upon arriving at the work this morning he thought better of it and decided to go ahead, at the same time asking me if it would be all right. After ascertaining that the effects from moving the traveler ahead and proceeding with the next panel would be so insignificant I requested him to continue, as the moral effects of holding up the work would be very bad on all concerned and might stop the work for this season on account of losing the men."

is to some extent a misstatement of facts and not clearly stated, due to too much haste, and which I wish now to correct as under

"Upon arriving at the work that morning the foreman told me that he had considered it during the night and had already removed the traveler forward, asking myself, Mr. McLure and Mr Birks if we thought that what he had done would do any harm. We all thought that it would not as they stated it would only add 50 lbs. to the square inch to the chord in question We all thought at the time that to discontinue the work would entirely stop the work for this season as the men would not wait and would go elsewhere to prepare for the winter."

As stated in my last letter, strictly speaking, I did not request the foreman to continue the work, as he had already done so; at the same time we thought there was no immediate danger in adding so small a load. This letter more clearly states the conversation between us, and I am sorry that I have misstated in my hurry one or two points which would be more or less confusing. Yours truly,

E. A. HOARE.

It was clear that on that day the greatest bridge in the world was being built without there being a single man within reach who, by experience, knowledge and ability was competent to deal with the crisis. Mr. Yenser was an able superintendent, but he was in no way qualified to deal with the question that had arisen. Mr. Birks, well trained and clear headed, lacked the experience that teaches a man to properly value facts and conditions, and Mr. Hoare, conscious that he was not qualified to give judgment, simply assented to the courses of actions that had been determined on by Messrs. Yenser and Kinloch and made no endeavor to make a personal examination of the suspected chords.

Some measurements were made to test the stability of the main pier, but no one seems to have thought of testing the span for alinement or levels, and, above all, to measure the chords again to see if they showed any increase of deflection. Mr. Moore discussed some means of bracing the chords, but decided to postpone action until Mr. Cooper was heard from. At Mr. Hoare's request Mr. Birks inspected the chord A 9 L and the A-L 8 9 joint carefully, and his observations tended to reassure both Mr. Hoare and himself, as he thought that he found evidence of original crookedness in the chord.

His report to Phoenixville, which was received on August 30, reads as follows:

New Liverpool, P. Q., Aug. 28, 1907.

The Phoenix Bridge Company, Phoenixville, Pa.

Dear Sirs: I have made a further investigation of chord 9 A, and beg to report following additional data: The bend in the chord starts at the faced splice at the shore end and not at the edge of the splice batten. It appears from this that at least a large portion of the bend was in the chord when the top and bottom splice battens were riveted early in June. This and the fact that the lacing angles are not disturbed leads me to believe that the ribs were bent before erection, in spite of the fact that Mr. Clark and Mr. Kinloch think all ribs were straight when the chord was repaired. From the evidence, so far, I do not think we are justified in assuming it to be a fact that the ribs of any of the chords have buckled since erection, and Mr. Yender has come to the same conclusion. Yours truly,

A. H. BIRKS.

After he had made his examination, Mr. Birks called Mr. Kinloch and waited at track level, while Mr. Kinloch went down to the chord and checked Mr. Birks' observations. After careful discussion with Mr. Kinloch of what was then done we are forced to conclude that the sketch in Mr. Birks' letter shows only his personal idea of the shape and extent of the existing distortion and cannot be considered as furnishing data on which to base engineering conclusions, as no actual measurements were taken.

On August 29 Mr. Birks' report of the 27th was received at Phoenixville and was immediately discussed by Messrs. Deans and Szlapka and Milliken. It was finally decided that it was safe for the work to proceed and a telephone conversation took place between Messrs. Milliken and Yenser and another between Messrs. Deans and Birks. Mr. Szlapka had made some calculations and Mr. Birks reported his observations of August 28. Messrs. Yenser and Birks were assured that the office approved their action in continuing work of erection and Mr. Birks was told to tell Mr. Hoare that the bends had been in the chords before they left Phoenixville. This Mr. Birks did.

Mr. Deans also telegraphed Mr. Hoare as follows:

Phoenixville, Pa., Aug. 29, 1907.

E. A. Hoare, Esq., Chief Engineer, Quebec Bridge Co., Quebec, Canada:

McLure has not reported here; the chords are in exact condition they left Phoenixville in and now have much less than maximum load.

Mr. Hoare had telegraphed to both Mr. Cooper and Deans on August 28 advising them of Mr. McLure's mission. Mr. Deans has since explained that his telegram did not refer to the chords measured on the 27th, but after considering the circumstances, we are entirely satisfied that Mr. Hoare was justified in thinking that it did, and in so doing he was confirmed by Mr. Birks' telephone message previously received.

From the time these assurances were received, anxiety at the bridge practically ceased, and there is no evidence that any further measurements were made to determine the movements of the suspected chords. As Mr. Hoare expressed it: "I felt quite comfortable that day about it. I knew it could not be long before the matter would be taken up."

Shortly after 11 a.m. on August 29, Mr. Cooper reached his office and found Mr. McLure there. After a brief discussion, Mr. Cooper wired to Phoenixville as follows:

New York, Aug. 27, 1907, 12:16 p. m.

Phoenix Bridge Co., Phoenixville, Pa.:

Add no more load to bridge till after due consideration of facts. McLure will be over at five o'clock.

This message was received at Phoenixville at 1:15 p.m. Mr. Cooper has explained in his evidence that he was not aware at the time that erection was proceeding. Mr. McLure having advised him to the contrary, and that he telegraphed to Phoenixville instead of to Quebec because he thought action would be more promptly secured by so doing.

Mr. McLure had promised to wire Mr. Cooper's decision to Mr. Kinloch immediately, but he did not do so.

Mr. Deans reached his office about 3 p.m. and found Mr. Cooper's telegram there. He arranged for Mr. Szlapka and Mr. Milliken to be on hand to meet Mr. McLure, but otherwise took no action. After Mr. McLure arrived there was a brief discussion during which Mr. McLure mentioned that he had received a wire from Mr. Birks giving him the result of that gentleman's observations on August 28. It was decided to postpone action until the morning and to await the arrival of Mr. Birks' letter of August 28. This decision was made almost at the minute that the bridge fell.

As a conclusion reached from the evidence and from our own studies and tests, we are satisfied that the bridge fell because the latticing of the lower chords near the main pier was too weak to carry the stresses to which it was subjected, but we also believe that the amount of those lattice stresses is determined by the deviation of the lines of center pressure, from the axes of the chords, and this deviation is largely affected by the conditions at the ends of the chords. We must, therefore, conclude that although the lower chords 9 L and 9 R anchor arm which, in our judgment were the first to fail, failed from weakness of latticing, the stresses that caused the failure were to some extent due to the weak end details of the chords, and to the looseness, or absence of the splice plates, arising partly from the necessities of the method of erection adopted and partly from a failure to appreciate the delicacy of the joints, and the care with which they should be handled and watched during erection. We conclude from our tests that owing to the weakness of the latticing, the chords were dangerously weak in the body for the duty they would be called upon to do. We have no evidence to show that they would have actually failed under working conditions had they been axially loaded and not subject to transverse stresses arising from weak end details and loose connections. We recognize that axial loading is an ideal condition that cannot be practically attained, but we do not consider that sufficient effort was in this case made to secure a reasonable approach to this condition. The Phoenix Bridge Company showed indifferent engineering ability in the design of the joints and did not recognize the great care with which these should be treated in the field.

We consider that Mr. Deans was lacking in judgment and sense of responsibility when he approved of the action of Mr. Yenser in continuing erection, and when he told Mr. Birks and Mr. Hoare that the condition of the chords had not changed since they left Phoenixville.

No evidence has been produced before the Commission in proof of the correctness of this statement about the chords, and Mr. Szlapka's calculations, as stated in the following letter, showed that the rivets were even then loaded to their maximum specified stress of 18,000 lbs. per sq. in.

Montreal, Jan. 24, 1908.

Phoenix Bridge Company, Phoenixville, Pa.

Gentlemen.—Will you please file with the commission a copy of the calculations made by Mr. Szlapka on Aug. 29, 1907, and which are referred to on pages 967 and 968 of the evidence.

As we are nearing the completion of our report, we would esteem it a favor if you would have this information sent to us immediately.

It is possible that you may not have an exact copy of these calculations, but no doubt they can be duplicated, and Mr. Szlapka's certificate to this effect will be sufficient. Truly yours,

HENRY HOLGATE.

Phoenixville, Pa., Jan. 31, 1908.

Henry Holgate, Esq., Chairman Royal Commission, Montreal, Canada.

Dear Sir:—Replying to your letter of Jan. 24, I enclose herewith letter from Mr. Szlapka of this date giving calculations similar to that made on Aug. 29, regarding chord 9 L south cantilever arm. Yours truly,

JNO. STERLING DEANS,
Chief Engineer.

Phoenixville, Pa., Jan. 31, 1908.

John Sterling Deans, Esq., Chief Engineer the Phoenix Bridge Co., Phoenixville, Pa.

Dear Sir:—Referring to Mr. Holgate's letter of Jan. 24, addressed to the Phoenix Bridge Company, I beg to give you below the calculations similar to the one made on Aug. 29, 1907, referring to chord 9 L south anchor arm.

Taking $1\frac{1}{2}$ in. as the average reported curvature of chord 9 L, we have

$$\frac{W\ L}{1} \times 12 = 780 \times 18{,}000 \times 21{,}060{,}000 \text{ in. lbs.} \qquad W = 61{,}000 \text{ lbs.}$$

$$\text{Stress in each lattice, } S = \frac{61{,}000 \times 1}{\ } = 21{,}600 \text{ lbs.}$$

Yours truly,

THE PHOENIX BRIDGE COMPANY,
PER P. L. SZLAPKA.

The theory underlying these calculations is very questionable, but it was adopted in the design of the bridge, and we cannot understand why its warning was so entirely disregarded in the face of the consequences that might result.

With reference to Mr. Cooper's telegram, Mr. Deans knew that he was in possession of later information from the bridge than had reached Mr. Cooper and therefore decided to wait for Mr. McLure and afterwards for the arrival of Mr. Birks' letter of August 28 before taking action. The whole incident points out the need of a competent engineer in responsible charge at the site.

Mr. Hoare was the only senior engineer who was able to reach the structure between August 27 and August 29. He was fully advised of the facts, yet did not order Mr. Yenser to discontinue erection which he had power to do. We consider that he was in a much better position than any other responsible officer to fully realize events that had occurred, and his failure to take action must be attributed to indecision and to a habit of relying on Mr. Cooper for instructions.

We are satisfied that no one connected with the work was expecting immediate disaster, and we believe that in the case of Mr. Cooper his opinion was justified. He understood that erection was not proceeding, and without additional load the bridge might have held out for days. Our tests have satisfied us that no temporary bracing such as that proposed by Mr. Cooper could have long arrested the disaster, struts might have kept the chords from bending, but failure from buckling and rivet shear would soon have occurred.

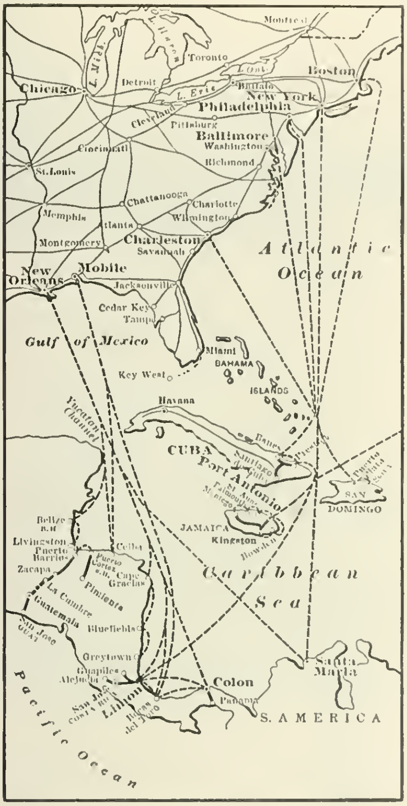
The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XI.

The Renaissance of the Merchant Carrier: The Private Steamship Line.

The nineteenth century has witnessed the evolution of the common carrier by sea. At the beginning of the period the merchant carrying his own goods was the conspicuous figure. But, by one of the strange repetitions of history, his disappearance was quickly followed by reappearance. The twentieth century opens with private carriers, operating on such a scale that they are able to run lines of steamships as links in huge productive and mercantile enterprises. This change is due to the magnitude of the modern corporations, which outrank the individual as a regiment outranks a policeman.



Map of United Fruit Lines.

Present operations in coal, iron, petroleum, asphalt, fruit and other industries are prosecuted on a scale unprecedented in size and made possible only by the modern corporation, in which property and resources sufficient for a medieval kingdom are bound together by telegraph and telephone by which a more than military organization can control an army of men laboring towards a common result. Like a state or a regiment, the corporation has an organization and a continuous existence that depends upon no man's life, and it can, by this scope and continuity of action, attain a scale enabling it to incorporate and use a steamship line as a part of a single business. This has occurred in both agriculture and manufacture, in the marketing of products, and the assembling of raw materials.

There are several reasons for this development of the line as an adjunct to an industry:

First.—The freight for shipment from the ports of a certain region may be only of the coarse and bulky character that goes in full cargoes. There is then small demand for the services of a common carrier to furnish line service. It is chiefly in such regions that the industrial steamship line has arisen.

Second.—With private-carrier traffic of the character just referred to, it is natural for the large operations of modern business to demand regularity of movement. Hence a line arises within the service that naturally belongs to tramps.

Third.—Special service may be required with specially designed vessels to supply it.

Fourth.—The ordinary arguments in favor of consolidated enterprises—elimination of intermediate profits and reduced cost of supervision per unit of output incident to the enlargement of the business are potent in water transportation.

Probably the best examples of the industrial steamship lines are to be found in the oil industry and in the American banana industry. Well over 100 steamers are engaged in carrying bananas from the West Indian and Caribbean region to the United States and Europe. Over nine-tenths of these vessels are operated or controlled by a single company. The evolution of the business and its transportation organizations have been rapid. In the beginning bananas were occasionally sent to this country on consignment, a group of growers sometimes combining to send a small schooner, leaving the sale to some American commission merchant. This method is the one followed by the distant farmer who sends his produce to a large city market, but in the banana trade the practice did not survive. The usual method, even in the early days of the trade, was for the importer to send or take his ship to purchase the fruit at export points and bring it to our ports for sale on his own account. This has led to rapid changes in the business because of its especial need for organization and because the banana trade, owing to the perishable nature of the fruit, requires a faster ship than can commonly be found for hire. Ship owners will gladly build such boats if the banana merchant will promise to hire them all the time or for long periods; otherwise the ship might be compelled to take employment for which she was not well suited. The result is that the banana merchant must hire his ship for a long period, if at all.

The banana importer enters the business with heavy stakes and it is a business in which competition is particularly destructive. There is no middle ground upon which competition can exist. A steamer holds a great many bananas, and as they are a perishable commodity sometimes sold at auction in the process of dis-

Steamship Ellis; United Fruit Co.—Designed Especially for the Banana Trade.

tribution, two steamers arriving at one port at about the same time may easily so overstock the market that there would be low prices and loss for both parties. It is therefore necessary for each company to know what the others are doing and keep out of the others' way or make conditions of mutual loss. Agreement is hard to maintain for some firm must exercise the whip hand, a position usually not to be accorded without competitions and wars. In the tropical fruit business these fights have come often and have usually been fights to a finish or to consolidation, so that by 1899 the chief survivor, the United Fruit Co., handled 98 per cent. of the American banana traffic, and with its hundred steamers it now scours the West Indian and Caribbean coasts, runs lines to Boston, New York, Philadelphia, Baltimore, New Orleans, Mobile and Bristol, England, and occasionally sends steamers to other ports in both England and America. At the present time this company's monopoly is not so complete as in 1899, but the independent companies do so small a business that they are not worth the cost of the general price reduction that would result from attempts to drive them out. A small company running one steamer to Philadelphia, for example, could not be forced out by competition unless the large company reduced the price on eight cargoes in that and other ports easily reached by rail. The independent knows that he dare not grow, or he would be big enough to be dealt with and put out of business. He has seen others die the death through prosperity in just that manner.

Captain A. F. Lucas; Standard Oil Coastwise Towing Service.

These vessels of the banana fleet do not usually belong to the fruit company. There is a drawback to the full working out of the process of consolidation at this point. Why does it not pay the fruit companies to stop paying profits to ship owners? Some of the earlier companies tried it, but it is being given up. The fruit is marketed in the United States and the companies are American companies, but owing to the cost of building and operating American ships they cannot afford to use American ships, and they must be operated under foreign flags and through foreign companies. This, combined with the large capital involved, has served to limit the fruit companies to carrying on most of their traffic in foreign steamers. It is, however, currently reported that there is some American money in these steamers. They are built on the specifications of the user, who often charters them for four-year terms before they are built, and some vessels have been taken for ten-year periods. These long charters show the real solidarity of the enterprise.

This process of consolidation is complete so far as water transportation is concerned, but it is only the beginning of the fruit company's enterprise. When a fruit company owns or is financially responsible for a steamer, that steamer must be kept employed as constantly as the banana seasons will permit. If she goes for bananas and cannot get them, there is loss on the steamer and loss of profits on the bananas that are not secured. As a consequence, the fruit business, which began as a mercantile operation and was compelled to include a carrier to have something to sell, has been compelled to become a producer to have something for the steamers to carry. Private producers on the hot, turbulent and sparsely peopled shores of the Caribbean could not be induced to produce a regular and sufficient supply of bananas and other fruits, and in self defense the underlying companies of the United Fruit Company long ago started plantations and orchards. The present company produces a large part of the fruit that it carries and sells. It is stated by their representatives that the cost to them of producing their own fruits is as great as that of the purchased fruit, but the quality is better and the supply more regular. The process has even gone farther* for the fruit company has organized subsidiary companies that build and lease railroads to carry the fruit from the plantations to the port of original shipment.†

Narragansett; Anglo-American Oil Company.

Once the steamer service of the United Fruit Company was organized, it was inevitable that this regular service should devote some room to other freight and to passengers, particularly as the other freight is almost exclusively return freight which can be put into an otherwise empty ship as she goes out for another cargo. The managers of the fruit company are also cognizant of the fact that the passenger traffic is profitable and that the fruit steamer is speedy and well suited for it. The addition of a limited number of state rooms does not seriously interfere with the fruit carrying capacity, so the fruit steamer has become a common carrier to a limited extent, for both freight and passenger, but this, like the company's ownership of Jamaica hotels for the entertaining of the tourists, is purely incidental to the main business which is the marketing of its own fruit. When the passenger business sprung up, the fruit company merely completed this circle also by providing hotels of the elegance and comfort necessary to satisfy the tourists attracted by their ships.

The formation of the United Fruit Company has in nearly all its steps been the result of economic causes and has resulted in the great enlargement of the industry. If some Czar should sell separately at public auction every single piece of property owned by the United Fruit Company and common carriers should attempt to carry the fruit, it would not be three years until some central power guided its distribution. It is but a step to the guidance of the ships themselves. If conditions demand the sending of one cargo to a port not regularly served, the ship, under central control, can be sent. If this business depended upon a line or lines of common carriers such a shifting would be impossible.

The even supply of bananas is in strong contrast to the spasmodic supply of strawberries, peaches and other perishable, seasonable produce shipped by rail to the same markets. The lack of common carriers has compelled the banana shippers to become their own carriers and then distribute their product by central control. The peach and strawberry business is larger when it comes, but it is not organically advanced beyond the stage of the banana business in its first beginnings. Each shipper sends, as suits his fancy, to commission men here and there. Markets are alternately glutted and starved, the demand is half met. The California orange growers have, by voluntary association, learned to control the distribution of their product, and in a few years probably other important industries will similarly organize and distribute their prod-

*President's address, 1905, meeting Royal Mail Steam Packet Co.

†It is easy to see here the possible basis for the bitter complaints that arise from the independent banana planters who declare that they have been forced out of the business. A returning traveler tersely puts it "The United Fruit Company owns Costa Rica." In this country the fruit company has some of its most extensive land operations.

uct as the exigencies of ocean transportation have compelled the banana shippers to do.

The marketing of asphalt, lumber, coal and petroleum is less exacting than fruit, in that these commodities are not perishable or easy of injury. There is consequently no imperative need of prompt despatch and the commodities may be carried in ships not especially constructed for one commodity. In the case of oil, however, tank steamers specially designed to carry kerosene or naphtha or crude petroleum in bulk show very great economies over other methods of shipment. The table appended indicates that the Standard Oil Company owns or controls nearly a third of the total tank steamer tonnage.

The first carrying of oil in bulk seems to have been in the Caspian sea in 1873. In the same year two vessels were built for the Philadelphia-Antwerp service and equipped for carrying bulk oil as a part of their cargo.* Oil and passengers, however, will not mix, owing to the regulations for the protection of the passengers, and as these steamers of the Red Star Line were in a very profitable place for passenger traffic, their oil tanks were unused. The use of tank steamers requires a corresponding large scale shore equipment of pipes and pumps and tanks that can only be provided by distributors on the largest scale. The carriage of bulk oil, therefore, is not a simple question of ships, shipping and ship management. In many parts of the world where there is large oil traffic there is no equipment for the accommodation of tank vessel cargoes. Consequently it was not until 1888 that vessels of this character were used on the Atlantic. Since that date, the extension of their use has been rapid. The larger ports of the great consuming countries of western Europe have the necessary receiving equipment and the pipe lines from the Ohio valley to the Atlantic coast ports, from the Caspian field to the Black Sea ports, and latterly from Texas and adjacent fields to the Gulf of Mexico, give wide sources for the supply of the cargo. The same method of distribution prevails east of Suez, where the chief supplies are in Burma, the Dutch East Indies, and to a lesser extent in Japan. Some firms† of tank carriers make a practice of supplying large users throughout the world and avoid paying Suez tolls by using Texas oil for points west of Suez and East Indian oil for stations to the east of the high tolled canal.

Tank steamers are used also in the American coasting trade, Texas crude oil being carried to the refineries on the Atlantic coast and the refined oil thence to Europe.

Recently the economy of this specialized transportation has gone one step farther than the tank steamer. It is the tank barge which the tank steamer tows. For several years prior to 1905 the Texas product had gone to Atlantic refineries in Standard Oil Company's steel barges. In that year the barges were first sent to Europe. This, however, was not the oceanic barge record, as a year before a barge had been towed by a tanker from New York to San Francisco, 13,090 miles, in 72 days.‡

Of late years these tank steamers have almost superseded the older form of oil traffic by which barrels were carried in any available vessel of ordinary type. Some of the tankers are owned and operated by European refining companies. In the old-fashioned way, 12,000 barrels were considered an enormous cargo, but the efficiency of special construction and the private industrial line is demonstrated by the 30,000-barrel cargoes of the new tank steamers.

The growth of the bulk oil traffic is indicated by the tonnage of the fleets engaged in that traffic. According to the Bureau of Corporations, this tonnage is as follows:

Companies.	Vessels.	Gross tons.
Standard Oil Co.	61	204,506
Standard Oil Co.	18*	11,367
Independent American	21	58,847
Independent American	8*	11,367
Russian companies	30	96,559
Dutch East Indian traders	41	125,161
Burmese and Japanese traders	6	12,810
English tramp steamships	18	55,831
English tramp sailing vessels	1*	8,209
French companies	2	2,525
Unclassified	9	12,707
Unclassified	4*	4,224
Total steam	188	568,946
Total sailing vessels(*)	34	51,866
Grand total	222	620,812

*Sailing vessels

The enormous tonnage of this fleet of specialized vessels of peculiar type, for carrying one commodity only and belonging to a few owners, and nearly all of them merchant carriers, shows how in this age of common carriers the present merchant carrier, inconspicuous in his ocean work, nevertheless outranks by far his conspicuous prototype of a century ago in the actual amount of transporting that he does.

Nor does the above list of bulk vessels tell the whole story for petroleum. Many ordinary vessels are also used by the oil companies. The Oriental countries are heavy importers of American refined oil, and their markets, devoid of tank equipment, require it in small tin cans called cases. The transportation of this refined case oil has long employed a large amount of shipping, and the greater part of it has gone in full cargoes in sailing vessels. Oil alone comprises a high percentage of the value of American exports to China and much more than one-half of the total tonnage of the traffic. The Standard Oil Company for many years chartered other people's ships for this work, but some years ago it changed this policy and became sailing vessel owners for the better marketing of their own case oil product. The oil company does not own enough vessels to do all the ocean work, and some are still chartered, but all are operated under one management, so that the oil company's vessels now sail from Philadelphia and New York for the ports of East Asia, and one ownership carries the oil from the well in the Ohio valley to the Mongolian merchant in Shanghai or Yokohama. Inasmuch as the oil company had nothing for these sailing vessels to bring back, they have frequently aided the exchequer of the company by bringing back, from Calcutta, Manila and other ports, any available cargo that might be obtained.

The asphalt industry in America is one with a multitude of companies, but beneath them is a simplicity of interests that sifts down to two rival concerns. The raw asphalt comes almost exclusively from the island of Trinidad and the northern shore of Venezuela. It is consumed in all of the larger American cities and many of the smaller ones, and also in Europe, South America and elsewhere. The companies are international in their field of opera

Coal Barge; Philadelphia & Reading.

*Fry, "The History of North Atlantic Steam Navigation."
†*Fairplay*, London, June 20, 1901, p. 1005.
‡*Railroad Gazette*, 1905.

tion. New York, being a city with much paving, with a good harbor, and near many other cities requiring asphalt, is a convenient base for the operation of an asphalt company. This large traffic is much like that in oil. A line of steamers has succeeded irregular vessel movements and now regularly carries asphalt from Trinidad to Perth Amboy on New York bay. There is even some effort made to have the ships get return freight and thus develop, as a strictly side issue, the services of a common carrier for the out voyage. The same company that operates the asphalt steamship line is constantly in the ship market to charter steamers on the single trip basis, to handle any sudden increase of traffic for New York or to send a special shipment to other ports in the United States or foreign countries. The amount of this irregular shipment is very great, because of the fact that the paving contracts are constantly being let and executed in scores of cities, necessitating a very wide and constantly shifting field of operation for the paving companies and their steamship traffic, which is all managed from a common center.

The production of anthracite coal in Pennsylvania has led to operations on a large scale. It is well known that the larger share of the coal is owned and mined by railroad companies, which get most of their income from coal freights. Much of the coal sent to New England goes thither in the company's coal fleet, which is regularly employed in plying between Philadelphia, Boston and other New England points. This fleet consists of powerful tugs and barges or sea lighters that transport several million tons a year. The enormous extent and the divided ownership of the soft coal lands of the United States have not yet resulted in any such organization of the soft coal traffic, but it is within the bounds of probability that steel barges will carry coal down the Ohio and Mississippi rivers, and across the Gulf and the Caribbean to soft coal markets along those shores in a manner analogous to the shipping of anthracite to New England. The present aggressive action of railroads in taking possession of bituminous coal lands in the Ohio valley indicates that they will be in a position to take up this barge traffic if they so desire.

The traffic on the American Great Lakes is not classed as maritime, but the only difference is a matter of 3 per cent. of salt in the water and a barrier that keeps the lake ships from extending their voyages to sea. In its economic essentials it is sea traffic, and in the magnitude of the commerce, the size of the ships, and the waters traversed, it ranks with, and in some respects outranks the commerce between England and the nearby Continent. This lake commerce should be discussed here because it possesses the world's most thoroughly organized and largest example of an industrial steamship line.

The United States Steel Corporation manufactures iron and steel in Pittsburgh from ore brought a thousand miles from mines beyond the western end of Lake Superior. This company owns the ore mines, the coal mines, coke ovens and lime stone quarries necessary to produce all of the raw material used. It also owns and operates the necessary railroads and steamship lines to carry all of these materials to the points of manufacture. The lake ore fleet must carry many million tons per year, and, owing to the ice of the winter, it has only about seven months in which to do the year's work. The largest of these ore vessels carry about 12,000 tons of cargo, while 8,000 and 10,000 tons are very common sizes, and the new vessels are usually of largest type. This one company owns and employs in its own business over 200 vessels with an aggregate tonnage that puts it in the class with the second rate maritime powers. No ocean fleet in the world except the oil fleet equals this in the speed with which its vessels are loaded and unloaded. The work is practically all done by gravity and machinery, and the ratio of the time the steamers are actually under way doing the work of going from port to port to the time they are at the docks has no equal in the general commerce of the salt seas. At the end of each lake and at other places there are opportunities for the giving of telegraphic orders to the captains of the vessels. The ease of communication, combined with the great number of the steamers, and the fact that they connect with the company's railroads at each end of their route, enables one man in his Pittsburgh office to manage this whole fleet and order the vessels from place to place and dock to dock as a train despatcher manages the trains on the tracks under his control. These lake ore steamers, sometimes carrying coal on the return voyages, are as absolutely a part of the steel company's industrial organization as is a blast furnace or an overhead crane in a mill.

What is to be the future of the industrial or merchant steamship line? Is it to be eliminated again as was the merchant carrier of the eighteenth century? Probably not. The present private operator seems to be large enough in his operations to hold his own and grow and keep up with the growth of the ocean steamer.

The operating unit in each of the industries mentioned in this chapter seems to be enlarging and, therefore, becoming more able to maintain among its activities a private transportation system. The trade in tropical fruits especially is one showing rapid increase. It was stated on the best authority in 1901 that the imports of bananas had doubled every five years for 30 years.

Many forms of tropic agriculture adapt themselves to the type of large scale production above described. Sugar plantations on the coast of Peru are owned by firms having steamship lines to New York, where the sugar is marketed. The sugar plantation is a late addition to the list of activities of the firm. It began as an exporting house, but the late addition of productive industries is a suggestive move. In Chile the nitrate for export is sometimes carried in lines of vessels belonging to the firms manufacturing the nitrate.

These examples of incidental combination of ocean transportation and production, taken in connection with the more formally organized services mentioned above, are suggestive of the continued growth of this form of organization in ocean transportation.

(To be continued.)

J. Pierpont Morgan; United States Steel Corporation Fleet on the Great Lakes.

Before the Telegraph Was Invented.

To compare the present with the ancient means of communication is to appreciate that you are living in the commercial twentieth century.

One of the first systems of aerial telegraphy was attempted in the fifteenth century. The originator was Amontons, at that time considered one of the cleverest scientists of the world. He developed a system of signal telegraphy so that a message could be sent from Paris to Rome in three hours. Those who assisted in the transmission of the message along the line were unable to tell the nature of the message.

Posts were placed from Paris across the Alps at consecutive points, where men were stationed with telescopes. Different signals, representing combinations of letters, were run up at each post. The man at the other end, seeing the signal, placed a similar one before his post, and so the message was carried to its destination. The key to the signal was known only to those who sent the message in Paris and the recipients a thousand miles away. Amontons was not encouraged in his work by the puffy, gouty functionaries of the time and discontinued his efforts.

Perhaps the real inaugurators of the system of long-distance transmission of messages were the Gauls. If you leave your office some afternoon and see a friend across the street and cry, "Oh there!" you are using a system of telegraphy in vogue in Europe until 1792. The cry of "huppa," from which the English "Oh, there!" was derived, was the mouth telegraphy of the ancient Franks, by which they sent a message at the rate of 150 miles a day.

A number of men, stationed at certain intervals over a long stretch of country, sent messages, one to the other, so quickly that Caesar, in his Commentaries, said the natives forwarded warnings of his approach at the rate of 50 leagues from sunrise to sunset.

At night they used signal fires or "bauchees." While tympans were beaten, fires were lighted from mountain top to mountain top.

To the tourist wandering through France and over the Pyrenees into Spain the old towers which appear from time to time across the mountain may seem purposeless and strange. Yet they are vestiges of the greatest system of old time aerial telegraphy in existence. These towers—both square and round—are situated on the most prominent hillocks. Up to 1844—when experiments assured the success of the electric telegraph—these towers were the means of communication in France. In that year there were 535 stations. The towers were two stories high, with index signals of light wood or iron mounted at the top of a pole on the roof.

This system was originated by Claude Chappe, and was presented to the National Assembly of France on March 22, 1792. Chappe had prepared a secret vocabulary composed of 9,999 words, represented by characters. The convention conducted a series of trials, and, elated by what its members called the simplicity of the scheme, adopted it.

At that time France was at war with nearly the whole of Europe. The first telegraphic national message was received by Carnot, grandfather of a recent French president, telling of the restoration of Conde to the Republic.

The news of the taking of Brussels by the French was transmitted from that city to Paris in 25 minutes. Messages were sent by placing signals at the top of the poles on the towers. The telegrapher at the one end mounted a ladder and changed them by hand. There was always someone on watch on the towers to note the signals from the others. The line of stations was extended by the first Bonaparte to Milan, Italy, and thence to Mayence, Germany. As the French army retreated the telegraph posts were destroyed.

During the Crimean war (1854) a system of sending messages by the use of semaphores was adopted, by which messages were conveyed from one camp of the allied armies to another. Arms extended from a framework of wood, which could be operated by wires by a man below in a tent. By lifting or lowering the arms messages were sent from one division to another.

While the efficiency and success of the electric telegraph was assured by 1850, and wires were strung up all over Northern France, it was not until the end of that year that they were opened for public use. Even when private individuals were allowed to send messages, they were required to give proof of their identity, but the secrecy of the despatches was considered inviolable. A few months after the wires were given for public use the first submarine cable was laid.—*Express Gazette.*

Foreign Railroad Notes.

The latest development in Russian passenger traffic is the use of counterfeit tickets. These, it is said, neither the gatemen nor the train ticket collectors are usually able to distinguish from genuine tickets. A train ticket collector who had that ability recently found 140 counterfeit tickets on one train! The holder of one of them protested by shooting the collector, who, however, escaped with his life and the 140 counterfeit tickets.

That traffic may grow even in the "effete European despotisms" is shown by a statement of the number of cars and locomotives on the railroads of Prussia and Hesse (which are worked as one system, under one management) since 1893. We give below the numbers at five-year intervals:

	1894.	1899.	1904.	1908.
Locomotives	10,715	12,460	14,837	18,306
Passenger cars	17,871	22,674	27,393	34,910
Baggage cars	1,648	5,861	7,222	10,327
Freight cars	218,033	276,933	310,653	393,998

From 1894 to 1908 there has been an increase of 70 per cent in locomotives, 95 per cent. in passenger cars, 123 per cent. in baggage cars, and 87 per cent. in freight cars. There has doubtless been a large increase in the tractive capacity of locomotives since 1894, and some increase in freight car capacity.

In the United States, with a much more rapid increase in population and railroad mileage, the rolling stock has increased as follows:

	1895.	1899.	1902.	1906.
Locomotives	35,699	36,703	41,225	51,672
Passenger train cars.	33,112	33,850	36,987	42,262
Freight cars	1,196,119	1,295,510	1,546,101	1,837,914

The "year" here ends with June. The figures thus begin six months later and end 18 months earlier than those for the Prussian railroads. The increase in locomotives for the 11 years here was 44 per cent., against 70 per cent. for the 14 years in Prussia; the increase in passenger cars 28 per cent. here and 31 per cent. there; the increase in freight cars 54 per cent. here and 87 per cent. there. The increase in engine and freight car capacity has doubtless been much greater here than there since 1894; though it began here much earlier than that year.

The Metal Tie.*

BY DR. ING. A. HAARMANN.
Geheimer Kommerzienrath.

In January, 1892, 16 years ago, I discussed in this place, "The Use of Metal and Wood in Permanent Way." To-day, permanent way, as such, is not my theme. I shall confine myself to the examination of only one of its parts, the tie, for it seems to me that the time has come that metal should get its due recognition as a material for supporting rails.

Our society has, for a long time, been deeply interested in clearing up the points connected with this subject. I need only refer to the illuminating work of Bueck, of Brauns and of Beukenberg. In the same way the various German railroad managements and the "Verein für Eisenbahnkunde" and the "Stahlwerks-Verband" have labored for a more general use of the metal tie. The paths followed may not always have been the best. Even in our own ranks many occupied the untenable position that the field of activity of the manufacturer of iron and steel was limited to the production of good rails or ties following the specifications furnished by railroad managements, while their design was solely the concern of the railroad engineer. I am the last to deny or to minimize the propriety of collaboration on the part of the railroad officer in so important a matter; on the contrary, I have often pointed out, in this society and elsewhere, that hearty working together of both is necessary. Indeed, I am convinced that the prominence which metal permanent way has attained in Germany, and especially in Prussia, is due to this very collaboration.

For the information of those who think it premature to speak of the existence of a recognition of the capabilities of the metal tie, I will preface my remarks with some statistics. I will not go back further than 1898, as the figures prior to that date are arranged on a different basis.

TABLE 1. *Comparisons of the Mileage and the Number of Wooden and Metal Ties in the Standard Gage Tracks of Germany.*

Fiscal year	Standard gage track: Wooden ties, miles.	Standard gage track: Metal ties, miles.	Percentage of metal tie track to: Total track.	Percentage of metal tie track to: Wooden tie track.	Number of: Wooden ties.	Number of: Metal ties.	Percentage of metal ties to: Total.	Percentage of metal ties to: Woodn ties
1898.	28,479	10,005	25.9	35.0	56,250,330	19,904,493	26.1	35.4
1899.	29,213	10,314	26.0	35.4	57,748,211	20,616,468	26.3	35.7
1900.	29,914	10,687	26.3	35.7	59,326,504	21,190,912	26.6	36 2
1901.	30,680	10,948	26.3	35.6	61,459,928	22,272,430	26.6	36.2
1902.	31,484	11,247	26.3	35.6	63,434,161	23,066,490	26.7	36 4
1903.	32,166	11,515	26.4	35.8	65,224,411	23,908,406	26.8	37 7
1904.	32,526	12,057	27.0	37.7	66,351,513	25,226,882	27.5	38 0
1905.	32,932	12,491	27.7	38.0	67,885,129	26,575,507	28.1	39 1

TABLE 2. *Number of Ties Used for Reconstruction and Renewals on the Standard Gage Tracks of Germany.*

Fiscal year of	Number of: Wooden ties.	Number of: Metal ties.	Cost of ties: Wooden, per 100.	Cost of ties: Metal, per ton
1898.	4,218,007	1,413,230	$99.84	$22.18
1899.	4,199,690	1,498,707	107.52	23.31
1900.	4,355,415	1,743,298	108.00	24 41
1901.	4,305,011	1,654,241	110.64	24 88
1902.	4,342,440	1,929,561	104 61	23.81
1903.	4,280,468	1,727,890	105.60	23.81
1904.	4,013,003	1,954,447	106.56	23.56
1905.	4,126,828	2,098,611	106.04	24 44

TABLE 3.—*Wooden and Metal Ties in Service in the Tracks of the Prussian and the Prussian Hessian State Railroads*

Fiscal year of	Wooden ties: Total No.	Wooden ties: Per mile.	Metal ties: Total No.	Metal ties: Per mile
1898.	35,991,584	1,926	11,992,182	1,920
1899.	36,829,657	1,950	12,576,920	1,936
1900.	37,799,131	1,959	13,201,525	1,955
1901.	38,880,771	1,966	13,689,567	1,982
1902.	40,099,309	1,985	14,552,280	2,005
1903.	41,856,235	1,995	15,499,252	2,032
1904.	42,321,031	2,005	16,551,418	2,055
1905.	43,338,050	2,032	17,730,362	2,100

In 1892 the ratio of length of track laid with metal ties to track with wooden ties was 30.2 per cent.; in 1898 the ratio had increased to 35 per cent., and in 1905 to 38 per cent.

Table 3, giving the total number of ties in the tracks of the Prussian State Railroads, is of particular interest. By referring to columns 3 and 5, it will be noted that the number of ties per mile has steadily increased to keep up with the greater demand of traffic, but that the rate of increase has been more marked in the case of the metal tie. This is due to the more rapid increase of these latter in recent years. The result is that there are relatively more metal ties in the newer sections of track over which fast trains requiring closer tie spacing pass, while in the older sections, on which traffic is not so heavy, there are more wooden ties. Thus the specifications of the Prussian State Railroads for 1905 required 2,467 ties for tangents and 2,576 for curves per mile of track. This proved increase in the use of metal ties is in no way the result of arbitrary preference. Had not the metal tie been markedly improved from the structural point of view, no amount of unmerited preference could have enabled it to compete successfully with the wooden tie.

Judging from a recent address by the secretary of the asso-

*Address delivered at the meeting of the "Verein der deutschen Eisenhüttenleute," Dec 8, 1907 at Dusseldorf Reprinted from *Stahl und Eisen*, by permission.

ciation for furthering the use of wooden ties, there is a tendency among its advocates to champion its cause in a narrow, partizan spirit. The railroads have, in a sense, become public property, and the public is vitally interested in their development. It demands that their operation be in accord with the laws of economics, that the maximum of safety attainable be secured, and that a track be provided over which trains may pass smoothly and with the least possible jar. As the public, so the railroad management is interested in these matters, and as the constituted guardian of safe and economic operation it must satisfy these demands. Only after they have been satisfied is it reasonable to consider particular interests such as forestry, the wood industry or the iron and steel industry.

To get a clear conception of the development of the tie, it will be profitable to present illustrations of some of the most character-

Fig. 1—Cast Iron Rails on Stone Blocks at Merthyr Tydfil, Wales, 1804.

istic exhibits in the Track Museum at Osnaburg, taken from my work on railroad track.

The beginning was stone. The first metal railroad track was built of cast-iron angles fastened to blocks of stone. Fig. 1 shows a section of the track used by Trevethik at Merthyr Tydfil, in southern Wales, more than 100 years ago, for the notable trials of his primitive locomotive with flangeless wheels. The stone blocks, while of various shapes and sizes, still furnished fixed points for the support of the yard long angles of cast iron. In spite of the small strains to which they were subjected, they were not able in practice to remain long in service. The line of rails was only a chain made up of short links on which the primitive "iron horse" pounded along. There was no thought given to joint connections, or stiffness or distribution of pressure, etc.; every stone support in carrying the load had to be sufficient unto itself.

Twenty five years later George Stevenson, whom we rightly call the father of railroads, and who with his "Rocket" opened a new

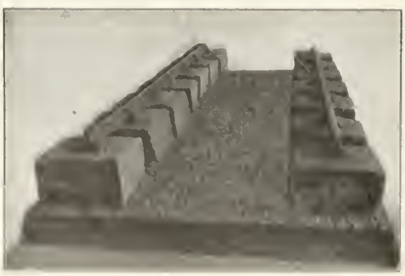


Fig. 3—Mushroom Rails on Stone Ties; Nuremberg-Fürth Line, 1835.

era in railroading, improved on this method. He introduced regular shaped stone for the rail supports, and used a rail (designed by Birkenshaw and originally rolled with fish bellies) that reached over five stone blocks (Fig. 2). In spite of firm tamping these blocks gradually settled and the difficulty of tamping them condemned them as not fit for the work. But they were not abandoned at once, their inherent qualities of resistance to atmospheric influences and to compression securing them adherents for a few years longer. Our first public steam railroad, the line from Nuremburg to Fürth, opened in 1835, was provided with stone blocks (Fig. 3). Following this, a number of small lines in Bavaria were built with them, some retaining them up to a comparatively recent time, they were provided, however, with wooden ties at the joints (Fig. 4). Wooden

Fig. 2—Fishbelly Rails on Stone Ties; Stockton-Darlington Line, 1825.

ties, binding together the two strings of rails and furnishing a larger bearing surface, were evidently so superior to stone blocks that they soon reigned supreme in railroad construction.

Thus stone gave way to wood. In the early decades of modern railroading, the shape and dimensions of the wooden tie varied considerably. At that time there was ample room for choice of wood both as to kind and age, and the price was comparatively low. It was not uncommon to cut six ties out of one section of a tree while to-day a single tie is the rule. Unfortunately, no ties of this early period have come down to us, and we are unable to determine by personal inspection their weaknesses and defects. For the purpose of studying the changes due to weathering and to mechanical wear, we must content ourselves with specimens that have been taken out of the track in recent years, after having seen service. For a long time it has been one of the important problems of the railroad engineer to minimize the effects of weather and wear. The illustrations show clearly the depression and wearing away of the tie at the places where the rail was in contact with it.

Fig. 4—Chair Rails on Stone Ties; Bavarian Railroads, about 1850.

In addition, we have the splintering and crushing caused by spikes and screws, effects that are more evident in the original specimens in the Track Museum at Osnaburg.

The rapid introduction of wooden ties in Germany dates from the building of the railroad from Dresden to Leipsig in 1838 (Fig. 5). The broad-flanged rails were laid directly on the wooden ties, being the first use of this enticingly simple method of construction which has remained the model for Germany and for many other countries. In the same year, in the construction of the London-Birmingham Railway, Robert Stevenson used a track consisting of double-headed rails supported on cast-iron chairs resting on wooden ties. The English have held fast to this chair-rail system and it is in use at the present day.

A few samples will illustrate the development of the wooden tie permanent way. First, I will call attention to a section of track with broad-flanged rails that was in service between Copenhagen

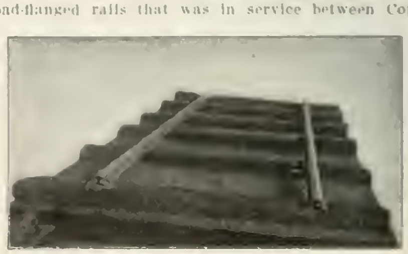


Fig. 5—Broad-Flange Rails on Wooden Ties; Leipsic-Dresden Line, 1838.

and Roskilde for 11 years, 1847 to 1858 (Fig. 6). The cross ties are fir and the rails are fastened to them by spikes; they have butt joints and one of the oldest styles of splicing, only one splice bar, and that on the outside. For 15 years, 1870-1885, track such as shown in Figs. 7 and 8 was in use. The considerable wear on the impregnated fir tie, especially where no tie plates were used, is apparent, and, indeed, small plates placed under the joints did not afford much protection (Fig. 8).

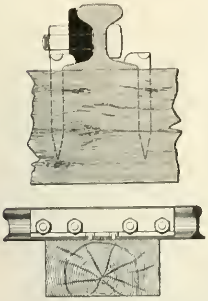


Fig. 6—Rail Joint with Single Splice Bar; Copenhagen-Roskilde Line, 1847.

The reason for the rapid introduction of tie plates is evident on examining Figs. 9 and 10. Fig. 9 shows an impregnated fir tie that had been in service from 1875 to 1885, and on which the rail had rested directly. The great diminution of cross section at the points of contact due to the repeated resurfacing or spotting of the tie is very noticeable; its neighbor (Fig. 10) of the same wood suffered less, on account of the plate with which it had been provided. Worthy of note are the attempts made to counteract the splitting of the ends of ties, especially beech ties, by means of wooden dowels or metal screws and clamps (Figs. 11 and 12).

Wooden ties, rather irregular in shape and size but closely spaced, are found on American roads (Fig. 13). The rails are spiked to the ties and, of late, tie plates are being used more liberally. A sample of the Pennsylvania Railroad's track is of interest as showing the staggered joint system of laying track in vogue on many American roads. This track arrangement, with 14 white oak ties of tolerably uniform dimensions under rails 30 ft. long and weighing 100 lbs. to the yard, is probably the heaviest in America and has been in use for 12 years on lines with very heavy traffic. Undoubtedly when the track is in perfect condition the staggered joint system furnishes a better bond and diminishes somewhat the jar. As an offset, the number of jars is doubled and, after a while, with fast running trains lateral as well as vertical oscillations of the cars are produced. The advantage of this system is rather doubtful, and this would especially be the case in comparison with a track laid with opposite joints, in which, with the joints supported by appropriate ties, the jar would be very slight, if noticeable at all.

The Pennsylvania is undoubtedly one of the best built, most carefully maintained and best operated roads in North America. The life of its ties, as I was informed, is seven years, and replacements are made almost constantly. The ties taken out of the track, in spite of the comparatively short time of service, are in such condition that their use for other purposes, especially if they have to be transported any considerable distance, would not be profitable. On this, as on other American roads, the ties are either simply dumped over an embankment and allowed to rot, or they are burned. Some important divisions of the Pennsylvania, e.g., that between Philadelphia and Altoona, have four tracks, the two inner serving for freight, the two outer for passenger traffic. Standing on the rear platform of the train it is an impressive sight to watch the mighty freight trains, with their 50-ton cars, following each other in rapid succession.

Fig. 14 illustrates the combination of Goliath rails and impregnated oak ties introduced on the Belgian State Railroad in 1893. At the joints, the horizontal flanges of the angle splice bars take the place of tie plates. We have no permanent way with wooden ties that equals the American and Belgian construction in weight

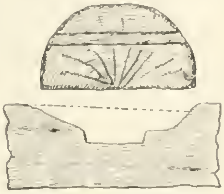


Fig. 9. Fir Tie without Tie Plate, 1875-1885.

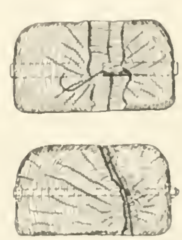


Fig. 11—Beech Ties with Wooden Dowels, Metal Clamps and Screws.

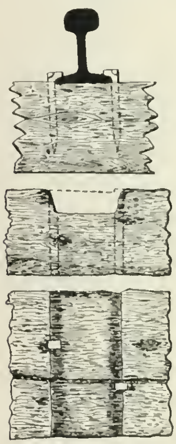


Fig. 7. Intermediate Tie without Tie Plate, 1870-1885.

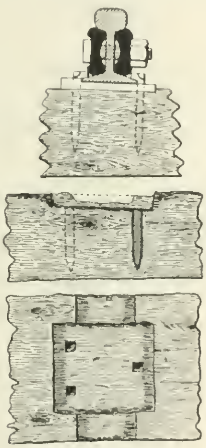


Fig. 8. Joint Tie with Tie Plate, 1870-1885.

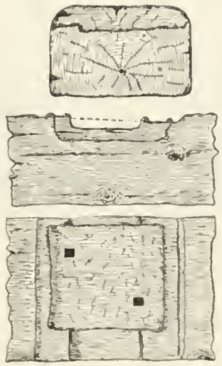


Fig. 10. Fir Tie with Tie Plate, 1884-1894.

Wear of Tie Under Rail Seat; Cologne-Hamburg Line.

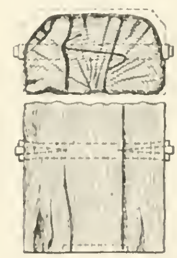


Fig. 12—Beach Tie with Wooden Dowels and Metal Clamps.

Fig. 13—Close Tie Spacing and Heavy Rails; Pennsylvania Railroad, 1895.

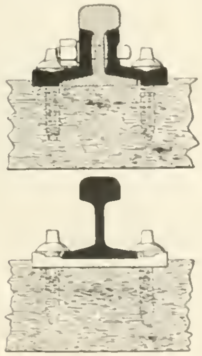


Fig. 14—Heavy Rails and Large Tie Plates; Belgian State Railroads, 1889.

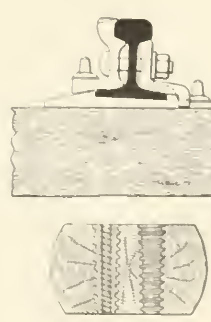


Fig. 15—Hardwood Dowels in Fir Tie; Bavarian State Railroads, 1900.

of metal, although the Bavarian track of 1900 (Fig. 15) makes a very respectable showing. The comparatively heavy rails and the tie plates of this permanent way certainly afford a better protection to the ties than do the hardwood dowels. These last, on account of the large holes required, weaken the tie, and the repeated tightening of the screw spikes ultimately strips the wooden thread.

The Prussian permanent way of 1892 has large plates at the joints and smaller ones on the intermediate ties (Fig. 16). At present the latter are only used in connection with oak ties. It is well known that more recently the Prussian State Railroads,

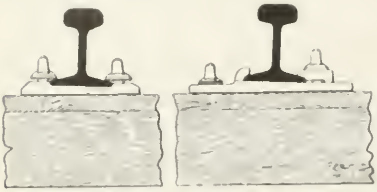


Fig. 16—Intermediate and Joint Ties; Prussian State Railroads, 1892.

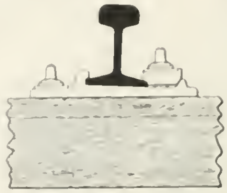


Fig. 17—Heavier Rails, 1905, and Hook Plates with Long Ribs, 1907, on Fir Ties; Prussian State Railroads.

on the lines serving for express trains, employ a rail with a larger profile, No. 15, weighing $90\frac{1}{2}$ lbs. per yard and supported throughout on large plates resting on ties spaced $21\frac{3}{4}$ in. between centers. The weight of metal per lineal yard of completed track is $257\frac{1}{2}$ lbs. (Fig. 17).

Since 1893 the Prussian government has made comparative tests with the materially heavier chair-rail system of the English roads, following the construction of the Midland Railway. The ties are not so thick as those customary in Germany, but are wider. The illustration (Fig. 18) shows the line between Minden and Bückeberg, which, ballasted with river gravel, was operated for $9\frac{3}{4}$ years. This gravel is not the best kind of ballast and is probably responsible for the very marked wear of the ties by the chairs (Fig. 19), greater than is usually the case in England. There, as now with us, crushed stone predominates on express tracks, no matter what kind of ties are used. So far, the trial has not demonstrated the economic advantage of the English permanent way with chair rails. The newer English constructions are still more massive. In 1896, the Midland Railway introduced a permanent way having 98-lb. rails, 55-lb. chairs and a total of 340 lbs. of metal per lineal yard of track (Fig. 20). The line between Derby and London, serving for very fast and heavy trains, is of this construction. From recent personal experience, I know that the track rides smoothly and is quite free from jars, a condition due in a great measure to the considerable weight of metal and to the good distribution of pressure. Still, as the joints are distinctly noticeable even when riding in the large corridor cars of the fast trains, I am convinced that securing the butt joints with flat splice bars would not suffice were it not for the heavy chairs. If these chairs, in spite of their great weight and large bearing surface (108 sq. in.), do not protect the wooden ties, it is not surprising that plates, the largest and heaviest of which have not half the bearing surface and one-quarter the weight of the chairs, should prove inadequate when used on wooden ties in conjunction with flange rails. In time they invariably grind into the tie, and the spikes or screws become loose; tightening these, adzing the tie and renewing the fastenings become necessary from time to time, until finally the ties are no longer fit for service. With the greater demands made on the permanent way, this goes on at a steadily increasing rate in spite of all the protective measures that have been employed. The average life of wooden ties does not increase; it decreases, while its cost fluctuates but does not become cheaper, the offerings of the better grades of ties lessen, but the demand, naturally, is steadily becoming greater. Repeated trials with beech ties have not given encouraging results. The untreated, or, following older methods, the insufficiently treated, beech tie, while presenting an apparently sound exterior, decays in the interior, so that in the course of a few years the inside is utterly rotten. It is hoped that this serious defect will be remedied by better methods of treatment, but while satisfactory results are uncertain, increase in cost is sure. We in Germany are not alone in being affected by an increase in the cost of ties. From my notes of a recent trip to the United States, I find that ties which in 1893 cost 45 to 50 cents apiece are now (1907) selling for 95 cents, an increase of 100 per cent., and with the steady diminution of the forests, a further increase is to be expected. English roads, I am informed, obtaining their supply from Norway and Sweden, are paying \$1.10 to \$1.22 per tie.

Fig. 18—Heavy Cast Iron Chairs on Fir Ties; Minden-Bückeburg Line, 1893-1903.

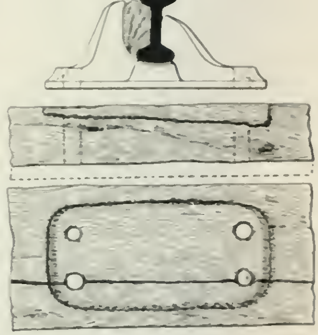


Fig. 19—Wear of Tie Under Chair; Minden-Bückeburg Line, 1893-1903.

The increasing difficulty of supplying our requirements, together with the problems connected with properly fastening the rails so as to meet the greater strains to which a steady increase of load subjected the permanent way made it imperative to consider the availability of a substitute for the wooden tie, one that would better meet all requirements. Thoughtful economists early recognized this and pointed out that to neglect the protection of the forests was markedly unthrifty, as far as the interests of agriculture were concerned. In this connection, the query naturally arises whether, in view of the progress in the iron and steel industry, the importation of large quantities of ties from foreign countries could be justified? The reply that the iron and steel industry, just as the wood industry, does not confine itself to utilizing the natural resources of our country but also works up large quantities of foreign ores, is not convincing to the earnest investigator. In the case of iron ore, we have to do with a raw material that is made to furnish an increase to our national wealth by German intelligence, by German work and by German capital. Then against that importation of iron ore is the offset of the export of iron. The excess of imports during the last five years has averaged 10 per cent. of the total quantity smelted in Germany. Moreover, this foreign material not only does not compete with the product of domestic mines, but is of advantage to it since the rich Spanish and Swedish ores mixed with the lower grade German ores enable larger quantities of the latter to be smelted. Finally, that answer does not apply because our country is deficient in ore supplies, both in quantity and quality, and because we lack a substitute of domestic origin to take the place of the ore. It must also not be forgotten that foreign wood is steadily deteriorating owing to the disappearance of the old trees,

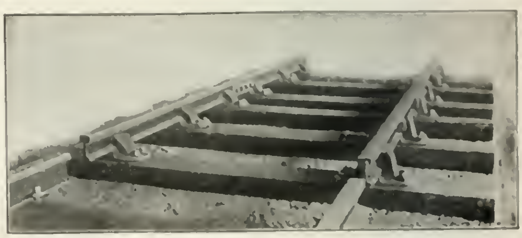


Fig. 20—Heavy Rails and Heavy Chairs on Oak Ties; Midland Railway, 1896.

the quality of whose heart wood is not being attained by that of the younger growth. Moreover, the more complete utilization of the wood of the forests for a great variety of purposes is increasing the difficulty of obtaining good ties. Although the decrease in the resisting power of the wood is being remedied, more or less successfully, by the use of larger and heavier tie plates and by screwing in hardwood plugs, yet this increases the cost to such an extent that only the superiority of this system can justify its adoption.

(To be continued.)

GENERAL NEWS SECTION

NOTES.

The Louisiana Railroad Commission in its annual report, March 11, asked the state legislature for a large increase of power.

The mail car on the Oriental Limited was robbed on March 15 near Bonners Ferry, Idaho, by a lone robber dressed as a post office inspector.

Announcement is made that the Baltimore & Ohio resumed all construction work on improvements in the Pittsburgh district, March 16.

The General Manager of the San Pedro, Los Angeles & Salt Lake is quoted as saying that 30,000 carloads of oranges will be shipped east this spring.

Roads in the Western Passenger Association have lowered their excess baggage rate from 18 per cent. to 16⅔ per cent. of the regular single-trip passenger rate.

The Cincinnati, New Orleans & Texas Pacific has laid off a large number of shopmen, following the refusal of the men to accept a 10 per cent. reduction in wages.

The Pennsylvania will run over the Buffalo & Allegheny Valley division a train with special apparatus to instruct farmers in the scientific growing of corn and alfalfa.

The Western Passenger Association has authorized a stopover of thirty days in Chicago on all tickets sold to summer tourists to all parts of the West, North and South.

The Brooklyn Rapid Transit Co. announces that on March 11, between 5 and 6 o'clock in the afternoon, 340 trolley cars made the round trip over the Brooklyn bridge and back.

It is announced that the Chicago & Alton has not renewed its contract with the United States Express Co., but has made a new long-time contract with the American Express Co.

The Texas Railroad Commission believes that the railroads are dismissing more employees than is necessary and proposes to take action if further reductions are made in working forces.

Five chiefs of national organizations of railroad employees are now in Washington trying to prevent the enactment of any legislation which will reduce further the earnings of the railroads.

Mississippi railroads have been ordered by the state commission to require their passenger conductors to reserve an extra seat for women passengers accompanied by an infant or young child.

The up-state New York Public Service Commission has appointed a public hearing on April 13 to consider complaints about commutation rates for service within the suburban zone of the New York Central.

The St. Louis & San Francisco pleaded guilty to 13 indictments charging the road with granting rebates to a Kansas City lumber company, and on March 11 was fined $1,000 on each count, the minimum penalty.

On March 16 the state of Oklahoma withdrew from the suit to dissolve the alleged merger between the St. Louis & San Francisco and the Rock Island, that part which asks that a receiver be appointed for the Frisco.

The lower house of the Mississippi legislature has passed a 2½-cent railroad rate bill applicable to all railroads except those that can prove that this rate is not just compensation, but it is not believed that it will become a law.

On March 12 representatives of the American Traveling Men's League argued in Washington that interchangeable thousand-mile mileage books good on any road in the country be required by law to be sold on a 2-cents-a-mile basis.

Employees of the Big Four have been advised by circular letter that wage pay checks must not be cashed in saloons, but that the money must be collected upon them at one of the banks designated in the letter. The order has stirred up a good deal of protest.

E. H. Harriman and O. H. Kahn have appealed to the Supreme Court of the United States, the decision of the Circuit Court requiring them to answer certain questions regarding the ownerships of stocks in the Chicago & Alton, Illinois Central and other railroads.

Arthur Hale appeared before the railroad committee of the Massachusetts legislature, March 11, and argued against the reciprocal demurrage bill, which provides for the payment of a dollar per car per day for failure to deliver cars within four days of the time ordered, and for a demurrage charge of the same amount to be paid by the shipper in case the car is not unloaded within 96 hours.

On March 10 the railroads of Kansas appealed to the United States Circuit Court for a restraining order enjoining the Kansas Board of Railroad Commissioners and the state attorney from putting into effect on April 1 the schedule of maximum freight rates ordered by the board of February 14.

The Central Vermont has been fined $1,000 by Judge Holt of the United States Circuit Court of the New York district for granting a rebate on a shipment of coffee from Boston to Western points. There were seven counts in the indictment and the road pleaded guilty to one of them on which this fine was based.

The Receiver of the New York City Railway Co. announces that 155 pay-as-you-enter cars will be installed on the Fourth and Madison avenue line before April 1. The cars accommodate 75 persons comfortably and it is not proposed to allow any more on board, though how this theory is to be carried out in rush hours is not stated.

On March 16 1,500 machinists, boiler makers and other shop employees of the Denver & Rio Grande went on strike. The new shop rules, which were rejected by the men, provided for the payment of all employees according to individual merit, regardless of maximum or minimum scales, the right to change shop rules without consultation with employees, a graduated scale of wages, refusal to give specific recognition to union men and other open shop features.

On March 16, Justice Davis, of the New York Supreme Court, awarded damages to a property holder claiming trespass against the Manhattan Elevated Company in building and operating a third track on Ninth avenue, on the ground that the legislative authority granted the railroad to build and operate a double-track elevated railroad in front of the plaintiff's premises made no provision for a third track, and that the building of this third track interfered with the plaintiff's easement.

The Attorney-General has prepared a report alleging that the Oregon & California Railroad has violated the terms of the grant under which it secured large holdings of land from the government. The report says that the railroad secured about 3,800,000 acres of government land under condition that the land so granted should be sold to actual settlers only, in quantities not greater than one-quarter section to one purchaser and for a price not exceeding $2.50 an acre. The Attorney-General alleges that in making sales the railroad company has always observed the law of supply and demand and has never obeyed the law of Congress.

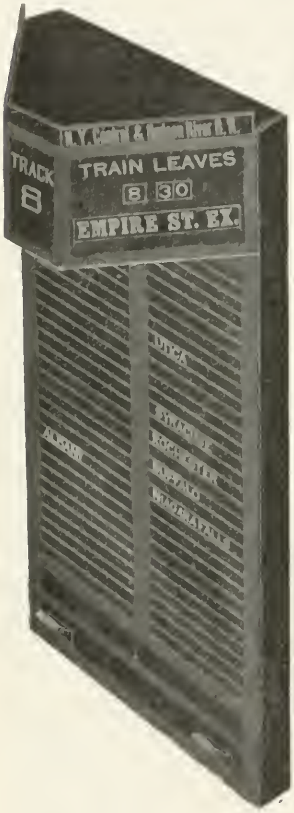
On March 16 the Supreme Court of the United States again upheld the validity of the Elkins anti-rebate law in a decision sustaining the conviction of the Armour, Swift, Morris and Cudahy packing companies for accepting rebates on packing house products, and of the Chicago, Burlington & Quincy for granting them. Each of the five defendants were fined $15,000. The court was divided five to three. Justice Moody took no part, while Justice Brewer delivered a dissenting opinion for himself, Chief Justice Fuller and Justice Peckham. Justice Brewer's dissent was based largely on the question of contract right. He asked who would engage in any new enterprise or invest money in a manufacturing industry if he knew that he could not make a definite contract for rates of transportation to and from his factory, but was advised that whatever contract he might make was liable, at the whim of the carrier, to be set aside and a higher rate imposed.

Editorial Manager for American Society of Mechanical Engineers.

Lester G. French has been put in charge of the editorial department of the American Society of Mechanical Engineers. Immediate improvements are to be begun; one of them is the establishing of departments in the monthly proceedings, thus providing a greater variety of technical articles of interest. Other features are planned and it is hoped that the value of the Proceedings will be much increased. All such papers, however, will, as formerly, first be presented and discussed before the society. Mr. French was born in Keene, N. H., in 1869. At an early age he worked under his father, who was the publisher of "The Vermont Phoenix," at Brattleboro, Vt., and a partner in a large printing establishment in that place. In 1891 Mr. French took his degree in mechanical engineering at the Massachusetts Institute of Technology. After four years' apprenticeship, drafting room and shop experience, principally at iron foundry shops in Providence, he wrote several text books. He then became one of the editors of *Machinery*, and for nine years was editor-in-chief. Mr. French has recently published text books on Algebra and Applied Mechanics and a treatise on Steam Turbines.

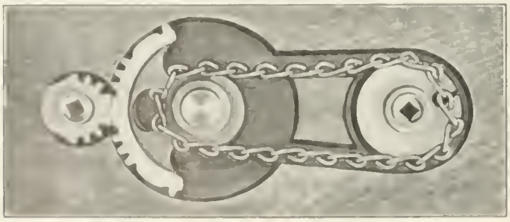
The Boynton Station Indicator.

The first Boynton indicator was put on the market in 1883. During the last few years it has been modified to provide for a larger number of station and train names. The indicators recently put up at the Grand Central Station in New York were an improved type, and a still later design is to be used in the new Hoboken terminal of the Lackawanna. One of the accompanying photographs shows the indicator used in the Grand Central Station. It differs from the first type installed in this terminal in that the upper part, which shows the name of the road, the leaving time and the train name, projects so that it can be read from any part of the concourse; in the older type, this portion was flat and could be read from in front only.



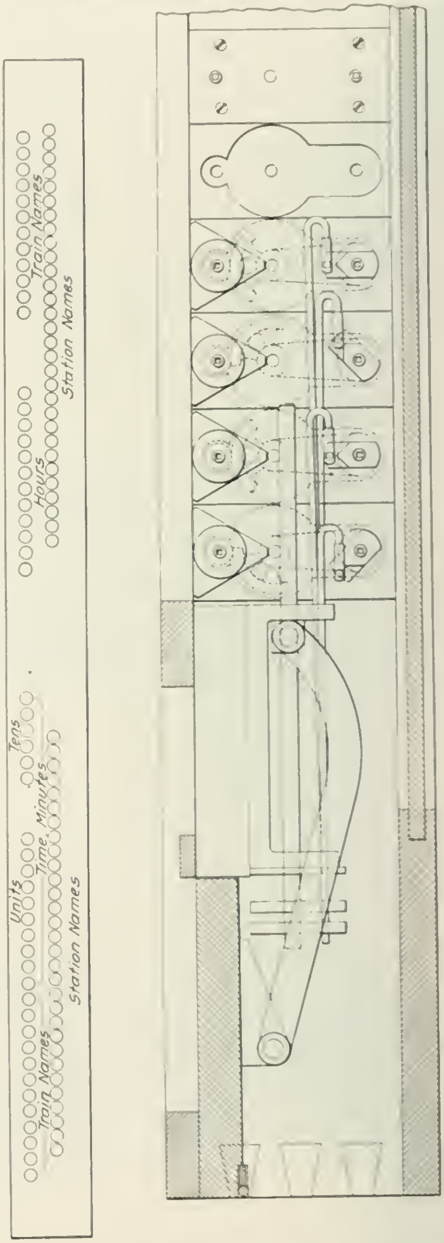
Boynton Train Indicator.

The accompanying drawing shows a vertical section of the newest design of indicator. The three-sided slats are blank on one side and bear station names on the other two sides. Each is revolved by a quadrant and pinion gear, driven by a chain from a rocker shaft to which a vertical wire is connected by a bell crank. The lower ends of the wires are centered over holes in bed plates extending the width of the machine. The bed plates are raised by closing the door at the bottom of the indicator. A perforated card of stiff pasteboard is laid on one of the bed plates. Where there is a hole in the card, the wire passes through the bed plate as the latter is raised and the slat is not revolved. Therefore it still shows blank. Where no hole is punched, the card lifts the wire and moves the slat. When the card is laid on the upper bed plate, the slat is turned through 240 deg.; when on the lower, the movement is only 120 deg. This drawing shows slats in all three positions; this does not occur in practice, as only one card is used at a time, making possible but two positions. The slats could take the three positions shown only if cards were laid on both bed plates at once. There is a separate card for each train, and one can be used until the time-table is changed. The makers furnish a matrix from which blank cards can be printed and the holes then punched out. The drawing shows a card for an indicator in which there are two columns of station names. The card has 60 station name spaces, so that with three-sided slats 120 stations can be shown (by putting the card on the upper or lower bed plate) or 180 stations if four-sided slats, with three bed plates are used. The latter is the type at the Grand Central Station. The card shown herewith has also spaces for train names, which are on revolving slats, and for time; the hours and minutes are on slides and the time is shown by lifting the proper slides according to the combination punched out on the card. The names of the railroads using the terminal are on revolving cloth curtains, which are not operated automatically.



Pinion and Quadrant Mechanism; Boynton Indicator.

Each quadrant and pinion is enclosed in a separate wooden box. As shown in the accompanying photograph of a model of one of these units, the cogs at three points on the quadrant and the pinion are replaced by smooth surfaces, convex and concave, respectively. These lock the slat in position, and also allow enough play at these points to compensate for errors in adjustment of the operating wires, which, if ordinary gearing were used, would leave the visible side of the slat out of parallel with the front of the indicator. Each slat may be removed for relettering without disturbing the rest of the mechanism.



Card and Vertical Section of Boynton Indicator.

These indicators are made by the Boynton Indicator Co., 1307 Pembroke street, Bridgeport, Conn.

Blackwell's Island Bridge.

The Blackwell's Island bridge, from East Fifty-ninth street, Manhattan, to Long Island City, was on March 18 connected from end to end by placing a steel girder in the bottom chord of the span over the east channel of the East river. The bridge was begun in 1901. The contract for the steel superstructure was awarded to the Pennsylvania Steel Co. in 1903 and the masonry piers and anchorages were completed in 1904.

The total length of the bridge is 8,231 ft. The roadway of the river span is 143 ft. 3 in. above mean high water. On the lower floor of the bridge is to be a roadway 53 ft. wide between curbs and four trolley tracks. On an upper floor will be two elevated train tracks and two footpaths, each 13 ft. wide. The width of the bridge is 88 ft. The weight of steel in the superstructure is 52,000 tons, and the cost, including land and approaches, will be about $20,000,000.

Transcontinental Traffic via Tehuantepec.

The agents of the American-Hawaiian Line of steamers claim that freight now moves from New York to San Francisco *via* the Isthmus of Tehuantepec as fast as it moves all-rail. According to the *Journal of Commerce*, the company's schedule of weekly sailings from New York shows delivery of freight in California in 26 days. Cargo is transshipped at Puerto Mexico (Coatzacoalcos), Mex., over the Tehuantepec National Railway, a distance of 180 miles, to Salina Cruz. The freight is handled at the Isthmus rapidly and carefully and delivery at destination shows that transshipment of cargo can be made without damage. From Salina Cruz freight is forwarded by connecting steamer to San Diego, San Francisco, Seattle and Tacoma.

The steamship company operates three services:

1. New York, Puerto Mexico.
2. Salina Cruz, Puget Sound, Hawaiian Islands, returning to Salina Cruz.
3. Local service between San Francisco, Puget Sound and the Hawaiian Islands.

The line carries practically all the sugar shipped from the Hawaiian Islands to Philadelphia and New York, and will shortly operate a regular eastbound service from Pacific coast ports to New York. It has modern piers at Tehuantepec and modern appliances for handling cargo.

The steamers of the Pacific service burn oil, thus demonstrating its success as fuel.

Following is the company's fleet:

Steamers—	Tons.
Atlantic Service.	
American	8,000
Californian	8,000
Hawaiian	8,000
Oregonian	8,000
Isthmian	6,000
Pacific Service.	
Alaskan	12,000
Arizonan	12,000
Columbian	12,000
Missourian	12,000
Mexican	12,000
Texan	12,000
Virginian	12,000
Nebraskan	5,000
Nevadan	5,000

The new westbound schedule follows:

Sailings from New York:	Due to arrive— San Diego or Los Angeles.	San Francisco.	Portland.	Seattle or Tacoma.	Hawaiian Islands.
March 7 and 14	Apr. 9.	Apr. 13.	Apr. 20.	Apr. 22.	May 9.
March 21 and 28	Apr. 23.	Apr. 27.	May 4.	May 6.	May 23.
April 4 and 11	May 7.	May 11.	May 18.	May 20.	June 6.
April 18 and 25	May 21.	May 25.	June 1.	June 3.	June 20.
May 2 and 9	June 4.	June 8.	June 15.	June 17.	July 4.
May 16 and 23	June 18.	June 22.	June 29.	July 1.	July 18.
May 30 and June 6	July 2.	July 6.	July 13.	July 15.	Aug. 1.
June 13 and 20	July 16.	July 20.	July 27.	July 29.	Aug. 15.
June 27 and July 4	July 30.	Aug. 3.	Aug. 10.	Aug. 12.	Aug. 29.

The rolling stock of the Tehuantepec National, both passenger and freight, is in good condition. Some of the latest passenger coaches are included, and Pullman cars are provided for service between Santa Lucretia and Salina Cruz. In view of the growth of the traffic, actual and prospective, the number of freight cars is being rapidly increased. Recently there were 929 box cars, 120 gondolas (each of 30 tons capacity), 60 stock cars and 50 locomotives. The Tehuantepac National was the first railroad in the Republic of Mexico to burn oil for fuel on its locomotives. It now has 14 oil-burning locomotives, and 23 others are being adapted to burn oil as rapidly as the shops can change them. Oil is found to be about 30 per cent. cheaper than coal or wood. The company at present obtains its oil from Beaumont, Texas. It is loaded on to tank steamers at Port Arthur, Texas, and is delivered at Coatzacoalcos, where the company has a 1,500,000-gal. steel storage tank, from which it is distributed to smaller supply tanks along the line, each having a capacity of 6,500 gallons. Before long it is expected that the locomotives will be burning oil obtained from local oil wells. Already the stationary boilers in the company's shops at Rincon Antonio are burning oil from the Isthmus.

When Pearson & Son took up the contract, Salina Cruz had merely an open roadstead. Now the Pacific port of the Tehuantepec National has a sheltered outer harbor of about 20 acres, and an inner dock basin capable of taking the largest vessels.

The saving in distance of the Tehuantepec route over Panama is shown by the following table in nautical miles:

	Via Tehuantepec.	Via Panama.
New York to—		
San Francisco	4,226	5,495
Acapulco	2,363	3,613
Mazatlan	3,017	4,055
Yokohama	8,666	9,825
Honolulu	5,639	6,688
New Orleans to—		
San Francisco	3,091	4,700
Acapulco	1,262	2,861
Mazatlan	1,759	3,458
Liverpool to—		
San Francisco	7,182	8,038
Acapulco	5,274	6,035
Honolulu	8,511	9,263
Yokohama	11,478	12,500

Anthracite Coal Production.

As in previous years of depression following panic the anthracite coal demand has stood up extremely well. The following comparative figures are shown of anthracite output per month:

Month.	1907-08.	1906-07.	1905-06.
November	5,666,205	5,182,153	5,421,584
December	5,343,477	4,836,028	5,395,113
January	5,618,339	5,249,916	5,458,084
February	4,503,756	4,563,720	4,712,099
Total	21,131,777	19,831,817	20,986,880

The stock of coal at tidewater on October 31, 1907, was 819,757 tons, and on February 29, 1908, it was 700,404 tons, so that as far as these figures indicate, the consumption of coal was greater than the supply. To arrive at an accurate result as to consumption, it would be necessary to have the state of stocks at interior points, but these are not available.—*Wall Street Journal.*

The Short Line Railroad Association.

The Short Line Railroad Association, which is endeavoring to increase the mail compensation of short line roads, was incorporated last October under the membership corporation law of New York state. The purpose of its organization is to protect and promote the business interests of short line railroads engaged in the transportation of mail, passengers and freight, doing business in this and other states; to advocate and use its influence in the enactment of just and equitable federal and state laws to govern these railroads; to establish social and commercial relations between short line railroads for the betterment of the same and for the economies which can be practised.

In December last the association appointed a legislative committee for the purpose of taking action in regard to increasing the pay for railroad mail transportation and also for the purpose of doing away with the mail deliveries beyond railroad terminals, also to look after and oppose all legislation inimical to the railroads, particularly the independent short line roads represented by the association.

For the accommodation of the committee and to promote the work of the association, headquarters were opened in Washington and an active campaign has been carried on there in favor of the passage of a bill which was prepared by the association and introduced in Congress. This bill does not interfere in any way with compensation paid the longer or trunk lines; it simply covers the minimum rates.

Previous to 1876, all roads carrying the minimum quantity of mail received $50 per mile per year for carrying 200 lbs. of mail per day, while roads carrying 500 lbs. received $75 per mile per year. In 1876 Congress made a reduction of 10 per cent from the rate then allowed, and this was followed two years later by a further reduction of 5 per cent. The result is that short lines, or roads carrying 200 lbs. of mail per day, are now receiving $42.75 per mile per year, while those carrying 500 lbs. receive $64.13 per mile per year.

Many of these short line roads carrying from 500 to 1,000 lbs. of mail per day supply apartment space from 10 to 25 ft., equipped with post office accommodations, also carrying a messenger to distribute the mail and receive no compensation whatever for the use of their car space nor anything for heating or lighting the car. They are also compelled to deliver their mail from the terminal of the railroad to the post office or postal station, no matter what the distance may be. It is claimed that there are roads in the organization receiving from $100 to $500 a year that disburse more than two-thirds of that amount to cover the messenger service.

The three principal changes suggested in the bill are as follows: That the roads carrying not more than 500 lbs. of mail per day over the entire route shall be paid $75 per mile per year; that they shall not be required to deliver the mails at a post office or a postal station unless it be located in the railroad depot or station of the carrier; that the Postmaster-General shall be authorized to allow for space used for post office purposes in compartment cars on roads where the daily average weight of mail carried does not exceed 500 lbs. a proportion of the rate of compensation allowed for postal cars forty (40) feet in length. For the use of these cars the longer or trunk lines are allowed 5½ cents per mile.

Report on Boston & Maine Merger.

The Commission on Commerce and Industry, authorized by the state of Massachusetts to report on the proposed merger of the Boston & Maine with the New York, New Haven & Hartford, finds that the New Haven holds 109,948 of the 302,928 Boston & Maine shares, which it is now by law disqualified from voting, and makes the following recommendations:

1. The New York, New Haven & Hartford Railroad Company to be permitted to hold and acquire stock of the Boston & Maine Railroad and vote thereon, and to be required to exchange its own stock, share for share, for all stock of the Boston & Maine Railroad that may be offered for exchange prior to July 1, 1909.

2. The Boston & Maine Railroad and the New York, New Haven & Hartford Railroad Company to be and remain subject to all the provisions of the laws of this Commonwealth which are now applicable to them respectively and not inconsistent with the act now to be passed.

3. The rates for the transportation of freight or passengers within, across, into or from this Commonwealth by any steam railroad or street railway or steamship line controlled by either of said companies not to be increased or the facilities therefor diminished without the approval of the Board of Railroad Commissioners, so far as it is within the power of this Commonwealth to regulate such transportation.

4. The principal office of the Boston & Maine Railroad and the control of its operation in this Commonwealth to be in Boston, its principal managing officers to be residents of this Commonwealth, and every director to be a resident of some state in which the company is incorporated.

5. All stock of the Boston & Maine Railroad at any time owned by the New York, New Haven & Hartford Railroad Company, or in which it has any interest, to stand of record in the name of the latter company; and, unless with the permission of the Railroad Commissioners, given after a public hearing, not to be disposed of or encumbered, or affected by any contract, arrangement or understanding in respect to its ownership, use or control, and not to be voted on, except for the choice of directors, unless in pursuance of a vote of the directors of the New Haven Company communicated to and approved by the Board of Railroad Commissioners prior to the meeting at which the stock is to be voted.

6. No conveyance, contract, agreement, arrangement or understanding to be made by the Boston & Maine Railroad or by the New York, New Haven & Hartford Railroad Company for the acquisition or use by any third company of any of the road, tracks, terminals or equipment of either of the said two companies, or of any of those of a third company by either of said two companies, or for the exchange of business, unless with the approval of the Board of Railroad Commissioners.

7. If at any time subsequent to December 31, 1913, the growth, development, maintenance or management of any of the railroads now operated by the Boston & Maine Railroad shall not be satisfactory, or shall not adequately meet the requirements of the public and the interests of the Commonwealth, and if the Board of Railroad Commissioners shall so certify to the Governor and Council either of its own motion or in response to an inquiry from the Governor or the Legislature, then the Commonwealth shall be entitled to buy all the stock of the Boston & Maine Railroad owned or controlled by the New York, New Haven & Hartford Railroad Company at a price to be determined as prescribed in the act now to be passed.

8. If at any time the substantial control of the New York, New Haven & Hartford Railroad Company shall pass to any other corporation, by lease, consolidation, change in the ownership of stock, contract, understanding or arrangement, and if the Board of Railroad Commissioners shall so certify, then the Governor may notify the New Haven Company that the stock of the Boston & Maine Railroad acquired by it shall not be voted on, and such prohibition shall continue until removed by the Board of Railroad Commissioners, with the approval of the Governor or the Legislature.

9. There shall be permitted a reciprocal use by the New York, New Haven & Hartford Railroad Company, the Boston & Maine Railroad and the Boston & Albany Railroad Company, of their respective terminal facilities in and near the city of Boston including tracks, docks, vacant land and water front and also of the Commonwealth property at South Boston to such extent and manner, upon such terms and for such compensation as may be for the public advantage; the matter to be determined in the manner provided in the act now to be passed.

Proposal to Sell Steinway Tunnel to New York City.

The New York City Public Service Commission announces receipt of a letter from the Interborough Rapid Transit Company offering to sell all the tunnel railroad and rights, excluding certain real estate of the New York & Long Island Railroad Company known as the Steinway tunnel, at its actual cost to the Interborough company for construction, etc; a cost estimated at about $7,000,000 to be paid in city bonds, and proposing that the city enter into an operating contract with the New York & Queens County Railway Company to operate the tunnel in connection with its surface railroad in Queens county for a term of 25 years at a 5-cent fare, the city to pay half of a certain sum agreed upon to represent operating expenses, and the balance to be met by the company; the city to take the local fares until reimbursed for its advances for operating expenses and interest on bonds issued to pay for the tunnel and 1 per cent. for a sinking fund; the company to take the through fares and, when the city has been reimbursed, the local fares to be divided equally between the city and the company. The counsel to the commission is of the opinion that this proposal is one for the decision of the city authorities concerned with the expenditure of public money. If the city authorities look upon it with favor, the matter may later come before the commission for its approval under the provisions of the law. But the present form of the Rapid Transit act gives to the commission no power which would allow the purchase of an existing railroad or tunnel with public money, and the Rapid Transit act would have to be amended to grant any such authority for the purchase of a railroad or tunnel instead of building it at public expense, and to provide for any such co-operative arrangement for operating and taking of fares in lieu of a guaranteed rental as now provided to cover interest and sinking fund for bonds issued to pay for the public improvement.

Better Feeling in Maryland.

State Senator Gorman, of Maryland, leader of the Democratic majority, has strongly advised against any adverse railroad legislation. Governor Crothers, in commenting on the Western Maryland receivership, finds a warning to Congress and to the legislatures of the states that the railroads are in no condition to withstand the assaults of adverse legislation or to endure increased burdens and decreased revenues. The Governor is quoted as saying that it is a bad time for 2-cent rate bills. Attorney-General Straus believes that legislatures and other government agents should realize the grave peril of legislation adverse to the railroads and the danger of indiscriminate attacks upon financial and public service institutions. President Seth, of the state senate, believes that it is time that legislatures try to assist the railroads through their troubles, and that they should refrain from oppressive and injurious action.

INTERSTATE COMMERCE COMMISSION RULINGS.

Shippers Held to Their Agreement.

The Commission has announced decision (opinion by Commissioner Cockrell) in the case of Laning-Harris Coal & Grain Co. and Kansas City Hay Co. vs. St. Louis & San Francisco. It appeared that certain shippers applied for cars in which to ship hay, which the carrier, because of car shortage, could not furnish at the time and place desired. The carrier informed the shippers that it had certain cattle cars which it could furnish if the shippers would clean and suitably prepare them for their shipments of hay at their own cost and expense. The shippers accepted these cars on these terms, cleaned and prepared them, and shipped their hay therein, and then claimed reparation for the cost and expense incurred by them. Upon the foregoing statement of facts the Commission held that the shippers' claim for reparation be denied and their complaint dismissed.

Through Route and Joint Rate Established.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of F. J. Gentry vs. Atchison, Topeka & Santa Fe et al. The complaint alleged that defendants failed to establish a through route and joint rate on lumber, lath and shingles from Ashland, Tex., to Nash, Okla. It appeared that there formerly existed joint rates over two established routes between these points, but that they have been recently canceled. The Commission decided that there is no satisfactory through route or joint rate for the shipment of such commodities between said points, and that a joint through rate of 28½ cents per 100 lbs. should be established over a through route specified in the decision.

Class Rates to Pecos, Tex., Upheld.

The Commission, opinion by Commissioner Clements, has announced decision in the case of Pecos Mercantile Co. vs. Atchison, Topeka & Santa Fe et al. The complaint alleged that the class rates of defendants for transportation of commodities from Chicago, St. Louis, Omaha and Denver to Pecos, Tex., are unreasonable as compared with rates from said points of origin to El Paso, Tex. The Commission declared that it is unable to find that the class rates now in effect from said points of origin to El Paso, Tex., unduly prejudice Pecos, or that the lower rates from such points of origin to El Paso constitute a violation of the fourth section of the Rate Law as that section is construed by the courts. Complaint dismissed.

Reparation Because Low Rate Temporarily Suspended.

In the case of North Bros. vs. St. Louis & San Francisco (opinion by Commissioner Cockrell) it appeared that the defendant carrier for some years had a proportional rate of 15 cents per 100 lbs. on hay when carried from Kansas City, Mo., through a part of the state of Kansas, to Cape Girardeau, Mo. This rate was canceled and a higher rate went in effect for a short time. Thereafter the 15-cent rate was restored. During the time the higher rate was in effect complainant shipped two carloads of hay over the route named. The Commission decided that the rate in excess of 15 cents per 100 lbs. on hay in carloads shipped under the circumstances named is unjust and unreasonable, and that North Bros. are entitled to an order for reparation.

Roads Built for Special Purpose May Charge Higher Rates.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of the American Asphalt Assoc. vs. Uintah Railway. The Commission decided that under the peculiar circumstances of this case a rate of $8 per ton is a reasonable charge to be imposed by the Uintah Railway for transportation of gilsonite, a low-grade commodity, for a distance of 54 miles. The former rate of $10 per ton was declared unreasonable. The Commission further held that where a railroad has been built for a special purpose, and does not form part of any general industrial development, it does not stand in the same relation to the public as a railroad chartered and built for general purposes, and the reasonableness of its rates must be determined by the financial returns which they produce rather than by comparison with rates in effect elsewhere.

No Reparation for Misrouting by Shipper.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of Hollis Stedman & Sons vs. Chicago & North-Western et al. In February, 1904, complainant shipped three carloads of potatoes from Wautoma, Wis., to Springfield, Mo., via the Chicago & North-Western, the Illinois Central and the St. Louis & San Francisco, and paid the combination of locals rate of 38½ cents per 100 lbs. The complainants insisted that this rate was unreasonable, because the shipments might have been made from Wautoma to Springfield over other lines for 25 cents per 100 lbs. The Commission held that the higher charge was due solely to complainants' error and that the Commission has no jurisdiction to establish a joint through rate, since a satisfactory one already exists, and that the rate charged is not found to be unreasonable in itself. If these shipments had been routed via St. Louis instead of via East St. Louis, the rate would have been 1½ cents less per 100 lbs. The Commission said that the Illinois Central was at fault in billing the shipments to East St. Louis instead of to St. Louis, and should make good this overcharge.

Car Shortage Answers Complaint of Discrimination in Car Supply.

In the case of Wagner, Zagelmeyer & Co. vs. Detroit & Mackinac and Michigan Central (opinion by Chairman Knapp), the complaint alleged that since July 13, 1906, the Detroit & Mackinac has discriminated against complainant in furnishing cars for interstate shipments of ice from Tobico, Mich., and the rates charged by defendant on ice from Tobico to points in Ohio are unreasonable. It appeared that the evidence clearly establishes and complainants submit that prior to September 15, 1906, the service was satisfactory, and since that time and continuing until after January 1, 1907, a car shortage, amounting to famine of freight transportation facilities throughout the country after October 1, 1906, existed. This car shortage, which prevailed on the Detroit & Mackinac in common with all other railroads, was brought about by circumstances over which that company had no control and for which it was not responsible. There was no evidence that the joint rates on ice from Tobico to Toledo and Cleveland are unreasonable. Under these circumstances the Commission held that complainants were not unduly prejudiced in their car supply, and that the joint rates on ice from Tobico to points in Ohio are not shown to be unreasonable *per se* or relatively. Complaint dismissed.

Joint Rates and Combination Rates.

In the case of the Laning-Harris Coal & Grain Co. vs. Missouri Pacific and Wabash (opinion by Commissioner Lane) it appeared that two cars of coal were shipped by complainant from Springfield, Ill., to Kansas City, Mo., via the Wabash, and after arrival at Kansas City one car was forwarded by complainant to Salina, Kan., and one to Kipp, Kan., both via the Missouri Pacific. The joint rate on coal from Springfield to Salina or Kipp via Kansas City is $3.73 per ton, whereas the combination rate is $3.50. On the foregoing shipments defendants charged and collected the higher joint rate. On complaint that this charge is unreasonable, the Commission held that these shipments consisted of strictly local shipments into and out of Kansas City, and that the application of the joint through rate was not in accordance with the published tariffs, but that the lawful rate applicable on such shipments was the combination of locals. Reparation was awarded.

The Commission further declared that there can be but one legal rate between two points. This rate must be either the local rate if over one road, or the joint rate if over a through route composed of two or more roads which have agreed to a joint rate, or a combination of separately established rates applicable on through business over a through route which does not enjoy a joint rate. In general, said the Commission, joint through rates are lower than the sum of the locals between two points, and obviously there can seldom be any transportation reason why this should not be the case.

Intra-State Private Cars as Affecting Interstate Car Supply.

The Commission, opinion by Commissioner Harlan, has announced decision in the case of Henry Ruttle et al. vs. Pere Marquette. The rulings of the Commission in this case are as follows:

While the right to use private cars may doubtless be denied to shippers by appropriate legislation, in the absence of a specific enactment to that effect the Commission is not prepared to say that their use in itself is unlawful; but if their use results under a given set of circumstances in an unlawful advantage to their owners and an unlawful disadvantage to other shippers, a question is presented which under existing legislation is within the control of the Commission and may be made the basis of such relief as the facts may justify. Because of defendant's insufficient equipment, a number of worn-out cars no longer serviceable for interstate movements were acquired and fitted up by certain shippers for the transportation of their hay from local points on the Port Austin division of the Pere Marquette to junction points with other lines, where the hay was transferred to empty system cars and moved forward to eastern markets. The Commission held, on the foregoing state of facts, that defendant's course in stopping its own cars as well as the cars of connecting carriers in its control at such junction points there to be loaded with hay from the "private" cars, instead of sending them up the line to the loading points where all shippers might share in their distribution, was to the detriment and at the expense of complainants and other independent dealers, and amounted to a denial to the complainants of the equal enjoyment of the facilities of defendant and was therefore an unlawful discrimination.

Unreasonable Rates Should be Paid and Reparation Sought.

The Commission, opinion by Commissioner Clements, has announced decision in the case of Coomes & McGraw vs. Chicago, Milwaukee & St. Paul and Chicago, Rock Island & Pacific. Complainant shipped over defendants lines from Elk City, Okla., seven carloads of broom corn to Sioux City, Iowa, via Omaha, paying 60.85 cents per 100 lbs. on one car, 80.5 cents per 100 lbs. on another car, and on the remaining five cars $1.14 per 100 lbs. The combination of locals on this commodity from Elk City to Sioux City, based on Omaha, is 60.85 cents per 100 lbs., whereas the joint through rate was at the time of the shipments $1.14; but subsequently defendants voluntarily established a joint through rate of 60.85 cents. Pending protest against paying the $1.14 rate on two of these cars unloading was delayed, causing demurrage charge, which was paid by complainant.

The Commission held that the joint through rates of 80.5 cents and $1.14 were unjust and unreasonable, in so far as the same exceeded the sum of the locals, and awarded reparation on that basis; but reparation on account of demurrage charges was denied. The Commission declared that rates duly established are binding on carriers and shippers alike so long as they remain in effect. The law requires that such rates shall be reasonable and just and authorizes the Commission to award reparation on account of the exaction of unreasonable transportation charges. It follows that although a rate is by the terms of the law binding on all so long as it remains in effect, such rate may be found and declared to be unlawful and reparation awarded on account of its exaction. To hold otherwise would be to make the mere establishment of rates by a carrier conclusive of their reasonableness and justness and leave shippers without recourse for recovery of excessive charges. It is the duty of carriers and shippers to observe the established rates, and there can be no waiver of demurrage charges which accrue by reason of the refusal of consignees to accept shipments and unload cars pending a contest or dispute as to the reasonableness of the established rates.

Present System of Compression Points for Cotton Upheld.

The Commission, opinion by Commissioner Clements, has announced decision in the case of the Chickasaw Compress Co. vs. Gulf, Colorado & Santa Fe et al. and of the Pauls Valley Compress & Storage Co. vs. the same defendants. The complainants in these cases, owning cotton compresses at Ardmore and Pauls Valley, Okla., respectively, alleged that the practice of defendants whereby cotton originating at points north of Ardmore and Pauls Valley is carried by those points to Gainesville, Tex., for compression, while cotton originating south of Gainesville is not permitted to be carried north through Gainesville to Ardmore and Pauls Valley for compression, results in unjust discrimination against them; and asked that the Commission establish a rule requiring defendants to have all cotton compressed by the compress nearest the point of origin. The Commission declared that carriers are permitted to adjust their rates, regulations and practices with due regard to the circumstances and conditions confronting them and the natural currents and laws of trade and commerce.

It appeared that cotton would not move from points in Texas south of Gainesville northwardly into Oklahoma for compression at Ardmore and Pauls Valley unless the rate to Ardmore and Pauls Valley should be as low as the rates to Gainesville. This would be true whether or not a higher rate were in effect from the compression point. It would also be true of all points as far south of Gainesville as the distance that cotton may be moved to Gainesville from points north of Ardmore and Pauls Valley, Okla. To require the rates from these points of origin in Texas south of Gainesville to be the same to Ardmore and Pauls Valley, Okla., as to Gainesville, Tex., would be to entirely disregard the added expense of the back haul. The movement of cotton is almost entirely southward from all points on defendants' lines, and cotton originating at points north of Ardmore and Pauls Valley naturally moves through Gainesville. To require the defendants to haul cotton northwardly through Gainesville for compression at Ardmore and Pauls Valley, and to protect on such shipments rates not higher than those in effect from points of origin to ultimate destinations, where such cotton must be ultimately hauled back through Gainesville to southern ports would not be justified. The Commission decided that the discrimination complained of is not undue. Complaints dismissed.

Prosecution to be Begun for Alleged Rebating and Destruction of Records.

The Commission, through Commissioner Lane, makes the following report in regard to a hearing in Richmond, Va., on February 19, 20 and 21, 1908, from which the following facts appear:

1. For some years a fraudulent practice, participated in by certain dealers in grain and also by certain dealers in packing house products and also by the Chesapeake & Ohio, has obtained at Richmond by means of which this railroad company has favored such shippers at the expense of the Seaboard Air Line and Atlantic Coast Line, its southern connections. This practice has resulted in obtaining for such shippers rates less than local rates over the Seaboard Air Line and Atlantic Coast Line for shipments of grain and also for shipments of packing house products, which local rates such shippers were legally bound to pay. This result has been accomplished by means of transfer slips issued by the station agent of the Chesapeake & Ohio on the written instruction of the Assistant General Freight Agent, said transfer slips falsely conveying to the southern lines the statement that such shipments had originated at points beyond Richmond and were entitled to move from Richmond to destination in the Carolinas at a division of a through rate, such division being less in amount than the local rates to which these shipments were legally subject.

2. The benefits of this arrangement have been reaped by the shippers enjoying it and also by the Chesapeake & Ohio, which, whether by express agreement or not, has received all of the inbound business of the shippers so favored by it.

3. It also further appears that the Assistant General Freight Agent of the Chesapeake & Ohio responsible for the above described abuse on discovering that the same was under investigation by special agents of this commission undertook to make amends for the same to the Seaboard Air Line and the Atlantic Coast Line. To this end he ordered that a list be prepared of all cars which had by his orders been moved at a division of the joint through rate less in amount than the local rates to which they were legally subject. Being informed by one of his subordinates that this list would be a very long one, he then gave orders that the list should show only the cars moving during the months of August, September and October, 1907. Having been furnished with a list covering these three months he forwarded it to the southern lines with a statement that it showed "all" cars so misbilled which he had been able to discover.

4. It also appears that certain records of the Chesapeake & Ohio have been destroyed, contrary to the provisions of the Rate Law. The testimony showed that the freight claim department of this road is under the charge of the Assistant General Freight Agent, he being the officer responsible for the false transfer slips. The testimony further shows that the auditor of disbursements on receiving from the freight claim office claims from shippers with direction that they be paid inquires no further into the merits or legality of such claims than to ascertain from the auditor of freight receipts that the shipments to which the claims relate have moved and that the charges have been collected. All claims so passing through the freight claim office and paid on the order of the Assistant Freight Agent prior to January 1, 1907, were destroyed during the latter part of the year 1907. This destruction appears to have been made by the auditor of disbursements under authorization of the comptroller of the Chesapeake & Ohio.

So far as the matters disclosed are criminal in their nature they are to be referred to the United States District Attorney at Richmond with the request that prosecution be instituted against all parties therein involved.

TRADE CATALOGUES.

Mine and Quarry.—The current number of this quarterly bulletin of the Sullivan Machinery Co., Chicago, has 30 pages of interesting articles, including the following: "Mining with Hammer Drills"; "Carthage Limestone"; "Adaptability of Hammer Drills"; "Diamond Drilling at Mapimi"; "New York, New Haven & Hartford Railroad Tunnels," and "Mechanical Conveyors as Applied to Long-Wall Mining." They are all written especially for this magazine by men having technical knowledge of the subjects, and are illustrated with interesting half-tone engravings.

Union Pacific.—A pamphlet just issued by the passenger department, entitled "Colorado—A Winter Resort" presents by half-tone engravings from photographs and by interesting text the attractions of Colorado as an all-the-year-round health resort and as a delightful place of residence.

MANUFACTURING AND BUSINESS.

The 2,500 steel underframe stock cars of 60,000 lbs. capacity to be built by the Chicago, Milwaukee & St. Paul will have Bettendorf cast steel trucks and swing-motion bolsters made by the Bettendorf Axle Co., Davenport, Iowa.

The Nathan Manufacturing Co., New York, has appointed Clifford Nathan General Western Manager. Mr. Nathan will make his headquarters at the Chicago office in the Old Colony building and will have charge of the Nathan Manufacturing Co.'s business in the West.

J. W. Scull has resigned as Purchasing Agent of the Pressed Steel Car Co., Pittsburgh, Pa., to become Manager of the Pittsburgh office of the Summit Lumber Co., St. Louis, Mo., makers of yellow pine lumber. Mr. Scull had been with the Pressed Steel Car Co. for the past ten years.

Frank F. Fowle has opened an office as consulting electrical and telephone engineer at 201 Dearborn street, Chicago, giving particular attention to railroad telephone systems, including simultaneous and multiplex telephony and telegraphy, and power transmission and distribution.

R. S. Stangland has been placed in charge of the construction office at New Fort Lyon, Colo., of Muralt & Co., New York, and will superintend the erection of the complete lighting, heating and power plant which this firm is building for the United States Government at the New Fort Lyon naval hospital.

The offices of A. P. Witteman & Co., makers of high-speed and special steels, have been moved to 112-116 North Broad street, Philadelphia, Pa. These will also be the Philadelphia sales offices of the

Chester Forging & Engineering Co., Chester, Pa. A feature of the offices will be desk, stationery, stenographer and telephone facilities for the exclusive use of customers.

George R. Carr, Vice-President of the Dearborn Drug & Chemical Works, Chicago, is on a combination business and pleasure trip to Mexico City. John W. Brashears, who for many years has been first assistant to W. A. Converse, Chemical Director of the Dearborn company, in charge of the analytical laboratories, has been appointed Assistant Superintendent of the manufacturing department.

During January the Duquesne Steel Foundry, which operates a large plant in the Pittsburg district, decided to adopt gas power to operate the works formerly driven by steam. The initial equipment will consist of a 400-h.p. (max.) Westinghouse gas engine of the three-cylinder vertical enclosed type, direct connected to a 240-k.w. generator, supplying current for motor drive. The engine will operate on natural gas.

At the annual meeting of the Union Switch & Signal Co., Swissvale, Pa., the following officers were elected President, George Westinghouse; Directors, George Westinghouse, Robert Pitcairn, William McConway, George C. Smith, Thos. Rodd, H. G. Prout, and John B. Jackson. After the stockholders' meeting, the directors met and reappointed the same executive officers as had served during the preceding year. The regular quarterly dividend of 3 per cent. was declared.

Harold A. Clark, President of the Central Inspection Bureau, New York, Auditor of the Middletown Car Works, Middletown, Pa., and President of the H. A. Clark Company, New York, domestic sales agents for the Middletown Car Works, died last week at Phoenix, Ariz., where he had recently gone for his health. Previous to Mr. Clark's removal to Middletown, Pa., and his connection with these three companies, he was Assistant Auditor of the American Car & Foundry Company, New York.

The United States Circuit Court of Appeals for the Third Circuit has decided that the Nolan patent, owned by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., is valid and that the Prudential Insurance Co. has infringed on it. This decision upholds the lower court, from whose decree the insurance company appealed. The Nolan patent is a device for fastening together, and to the supporting castings, the laminae of the cores of electric machines by using a spring split-ring.

The Athens Electric Railway, Athens, Ga., originally generated power at two hydro-electric plants, one about 6½ miles and the other 2½ miles from the city. Extension of the street railway lines and the rapidly increasing power and lighting load made it necessary to build a new power house in the town itself, where for some time past a horizontal steam turbine has been in operation. The requirements have now increased so much that a second steam turbine, of 1,000 k.w. capacity, is to be installed. This, with the generator designed for direct connection to it, is now being built by the Allis-Chalmers Co., Milwaukee, Wis. The unit will deliver three-phase, 60-cycle current at a terminal pressure of 2,300 volts, and is to be excited by a 40 k.w. induction motor generator set, also of Allis-Chalmers manufacture.

OBITUARY NOTICES.

William Horace Holcomb, President of the Holcomb & Hayes Company, died recently at Hinsdale, Ill. He was for two years soon after the war General Manager of the Union Pacific lines and was active in the early establishment of the Railroad Y. M. C. A.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of the Mechanical Section of this society March 19 a paper on "The Handling of Locomotive Coal and Ashes," by C. F. Whitton, was read by the author.

American Society of Civil Engineers.

At the meeting of this society, March 18, a paper on "The Electrification of the Suburban Zone of the New York Central & Hudson River Railroad in the vicinity of New York City," by William J. Wilgus, was presented for discussion, illustrated with lantern slides. This paper was printed in the "Proceedings" for February.

New York Railroad Club.

At the next meeting of this club, March 20, in place of a technical paper and its discussion, short talks by recognized authorities are to be made on the application of electricity for the operation of trains or important signal systems. Among those who have accepted invitations to speak are: W. J. Wilgus, George Gibbs, Hugh Hazleton, B. G. Lamme and Walter C. Kerr.

Franklin Institute.

At the annual meeting of the institute, March 18, the programme included an address on the Engineering Practice as Applied to the Fueling Equipment of Power-houses, by Harry P. Cochrane. A series of slides of the collapsed Quebec bridge were also shown by Norman R. McLure, who was an inspector during the erection of the bridge. See article on the Quebec Bridge Failure in another column.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Pacific.—Francis White Peters, who was recently appointed Assistant to the Second Vice-President, who is in charge of the western lines, was born March 25, 1860, at St. John, N. B. After three years education in the schools of that place, he entered railroad service when 13 years old as an operator working with the engineers who were building the Intercolonial. Also in his thirteenth year he was made agent of the road at Jacquet River, N. B. For the next three years he was agent at other points, and in 1876 assistant agent at Newcastle, N. B. In 1878, at the age of 17, he was agent at Chatham Junction, N. B. In 1880 he went to the Chicago & Grand Trunk, now the Grand Trunk Western, as agent, and a year later to the Canadian Pacific as a bill clerk in the local freight office at Winnipeg. Within seven months he was appointed agent at Brandon, Man., where he served for seven years, being then appointed agent at Fort William, Ont. For the next seven years he was local freight agent at Winnipeg, Man. From 1896 to 1899 he was freight agent of the West Kootenay district, with headquarters at Nelson, B. C., and in 1899 was appointed Assistant General Freight Agent with authority over the same territory. In 1900 he was appointed Assistant General Freight Agent of the Pacific division, with headquarters at Vancouver, B. C., and in July, 1901 General Freight Agent of the same division. On January 1, 1903, he became Assistant Freight Traffic Manager of the western lines of the Canadian Pacific, and on March 1 of this year was appointed Assistant to the Second Vice-President, with headquarters at Winnipeg.

Chicago Great Western.—W. J. Ainsworth has been appointed Assistant General Attorney, succeeding John L. Erdall, resigned.

Cincinnati, New Orleans & Texas Pacific.—W. J. Murphy, Vice-President, with headquarters at Cincinnati, Ohio, will take over the duties of T. C. Powell, Vice-President, who has been transferred to St. Louis in charge of the St. Louis-Louisville lines of the Southern Railway. On August 1, 1907, Mr. Powell was elected Vice-President of the Queen & Crescent lines in charge of the operating, traffic and purchasing departments, with Mr. Murphy as the chief executive officer at Cincinnati.

Illinois Central.—J. Ogden Armour has been elected a Director, succeeding Joseph F. Titus, who succeeded Stuyvesant Fish.

Mexican Central.—J. A. Naugle, Assistant to Vice-President C. R. Hudson, has resigned.

Mobile, Jackson & Kansas City.—H. M. Hood, who has been local auditor at Beaumont, Tex., of the St. Louis & San Francisco, has been appointed Auditor of the Mobile, Jackson & Kansas City, with headquarters at Mobile, Ala.

Southern.—The headquarters of T. C. Powell, Vice-President, have been changed from Cincinnati to St. Louis. See Cincinnati, New Orleans & Texas Pacific.

Operating Officers.

Buffalo & Susquehanna.—G. D. Reynard, who has been Trainmaster of the Northern division, has been appointed Assistant Superintendent at Galeton, Pa. His former office has been abolished.

Canadian Northern.—J. R. Cameron, now General Superintendent of the Canadian Northern, entered railroad service in 1882 on the Canadian Pacific at Winnipeg as brakeman. In the next year he was made conductor. In 1887 he went to the Northern Pacific in Montana as conductor, and in 1898 was appointed Trainmaster at Grand Forks, N. Dak., with jurisdiction over the Northern Pacific lines in Manitoba, then known as the Northern Pacific & Manitoba Railway. When in 1901 the Canadian Northern took over these Manitoba lines, Mr. Cameron went with them as a passenger conductor. Three years later, in August, 1904, he was appointed Superintendent of the Canadian Northern at Kamsack, Sask. In December, 1905, he was appointed Superintendent of the First district of the Canadian Northern, with headquarters at Port Arthur, Ont., and on January 20, 1908, General Superintendent, with headquarters at Winnipeg.

Canadian Pacific.—George J. Bury, who was recently appointed General Manager of western lines, was born March 6, 1866, at Montreal, and was educated at the Montreal College. At the age of 17 he entered railroad service as a clerk in the purchasing department of the Canadian Pacific. He has been with this company ever since. After four years in the purchasing department, he was in 1887 transferred to the General Manager's office. In 1889 he became secretary to T. G. Shaughnessy, then Assistant to the President, now President of the Canadian Pacific. In 1889 he was made Acting Superintendent of the dining, sleeping and parlor car services which, on the Canadian Pacific, are directly controlled by the railroad company. In March, 1890, he was appointed Superintendent of the Western Ontario division. In 1899 he was appointed Superintendent at Fort William, Ont. In 1901 he was transferred as Superintendent to Cranbrook, B. C. For three months in 1902 he was Assistant General Superintendent of the Lake Superior division and then was appointed General Superintendent of the same division. In February, 1904, he was made General Superintendent of the Central division, with headquarters at Winnipeg, and on March 1, 1907, Assistant General Manager of western lines. One year later, on March 1, 1908, he was appointed General Manager of the western lines in charge of maintenance of way and operation.

G. J. Bury.

Delaware, Lackawanna & Western.—George Arthur Poore, the new Superintendent of the Syracuse and Utica division, was born August 21, 1867, at Liverpool, England. He was educated at private schools in England. After having come to America he began railroad work in 1889 on the Illinois Central in the office of a Superintendent, and later was in the offices of the Superintendent of Transportation, the Assistant General Superintendent and the General Superintendent, becoming assistant chief clerk to the General Superintendent. In July, 1900, he left the Illinois Central to become chief clerk to the General Superintendent of the Lackawanna. After four years in this position he was made Superintendent of the Bangor & Portland division from which he was, on March 15, promoted to be Superintendent of the Syracuse and Utica division.

Denver & Rio Grande.—A. F. Brewer, Superintendent of Transportation at Denver, Colo., has resigned to go to another company, and the office has been abolished, the duties being assumed by the Assistant General Manager.

Great Northern.—F. S. Elliott, Assistant Division Superintendent at Willmar, Minn., has been appointed Superintendent at Crookston, Minn., succeeding T. F. Lowry, transferred to the Montana division.

Illinois Central.—The authority of P. Laden, Superintendent of the Peoria division, has been extended over the Indianapolis Southern Railroad division. The authority of A. H. Egan, Superintendent of the Louisville division, has been extended over the Nashville division, and L. E. McCabe, heretofore Superintendent of the Nashville division, has been appointed Assistant Superintendent of both divisions. The office of Trainmaster of the Nashville division has been abolished. B. F. Galvani, Trainmaster at McComb, Miss., has been appointed Superintendent of the New Orleans division of the Yazoo & Mississippi Valley, with office at Vicksburg, Miss., succeeding F. A. C. Ferguson, resigned.

Missouri Pacific.—W. E. Merrifield, Superintendent of the Northern Kansas division, has been appointed Trainmaster of the Atchison, the Omaha and the Northern Kansas divisions, with office at Atchison, Kan., succeeding J. J. Skinner, now chief despatcher. E. C. Wills, Trainmaster in charge of the line from Coffeyville, Kan., to Osawatomie, has been appointed Trainmaster of the entire Southern Kansas division, with office at Coffeyville, succeeding C. S. Welsh, in charge of the Chatopa-Larned division, transferred.

Southern Pacific.—T. F. Rowlands, Assistant Superintendent at Sparks, Nev., has resigned.

Yazoo & Mississippi Valley.—See Illinois Central.

Traffic Officers.

Canadian Pacific.—W. C. Bowles, General Freight Agent of the Kootenay district, with office at Nelson, B. C., has been appointed General Freight Agent at Winnipeg of the Central and the Western divisions, succeeding W. B. Lanigan, now Assistant Freight Traffic Manager at Winnipeg.

Chester, Perryville & Ste. Genevieve.—Ralph H. Schultz, Auditor and Assistant General Freight and Passenger Agent at Cape Girardeau, Mo., has been appointed General Freight and Passenger Agent.

Chicago & Alton.—G. W. Quackenbush, Assistant General Freight Agent at Peoria, Ill., will in future have charge of local territory in Illinois and Missouri, with headquarters at Springfield, Ill. E. C. Coffey has been appointed Assistant General Freight Agent, with headquarters at Peoria, in charge of Peoria and Pekin, Ill., and traffic through these places.

Chicago, Rock Island & Pacific.—DeWitt Hammond has been appointed General Agent of the Freight and Passenger departments, with office at the city of Mexico, succeeding C. B. Cleveland, resigned.

Illinois Central.—Thomas James Hudson, General Traffic Manager, has resigned, and the office of General Traffic Manager has been abolished.

Missouri Pacific.—L. D. Knowles, General Agent at Milwaukee, Wis., has resigned.

Northern Central.—Gamble Latrobe, Assistant Engineer of the Baltimore division, has been appointed Acting General Agent at Baltimore, Md., in place of H. W. Kapp, Superintendent and General Agent, who is on leave of absence.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—J. W. Monroe, Shop Foreman at Cedar Rapids, Iowa, has been appointed Master Mechanic at Chickasha, Okla.

Delaware & Eastern.—Otto Franklin Wagenhorst, Chief Engineer, has recently had his authority extended over the operating department with title of Superintendent. Mr. Wagenhorst was born April 25, 1871, at Gouldsboro, Pa. In 1896 he graduated from the University of Pennsylvania. His first railroad service was in 1898, as engineer locating a line for the proposed New York, Wyoming & Western Railroad, which was to have been built by the (then) independent anthracite coal operators from the western anthracite fields to New York City. After this project was given up because of the purchase of the independent anthracite holdings, he worked as transitman in the coal mining department of the New York, Ontario & Western. In 1901 he was appointed Resident Engineer of the Ellenville & Kingston division of this road, where he served for two years; in 1903 going to the Delaware & Hudson as Resident Engineer of the Chateaugay division. On April 10, 1905, he was made Chief Engineer of the Delaware & Eastern, which is now in operation from East Branch, N. Y., northeast to Arkville, 37.5 miles, with an eight-mile branch from Uniongrove north to Andes, and is projected north to Schenectady, and south to the anthracite coal fields.

Kansas City Southern.—George S. Hunter has been appointed Master Mechanic at Pittsburgh, Kan.

LOCOMOTIVE BUILDING.

The Keweenaw Central has ordered one 65-ton mogul locomotive from Ralston & LeBaron.

CAR BUILDING.

The Keweenaw Central has ordered 30 ore cars of 60,000 lbs. capacity from Ralston & LeBaron.

The Maine Central has ordered fifty 50-ton steel side dump gondola cars from the Pressed Steel Car Co.

The Western Glucose Co. has ordered ten tank cars of 100,000 lbs. capacity from the McGuire-Cummings Manufacturing Co.

The Sandoval Zinc Co., Chicago, has ordered four tank cars of 100,000 lbs. capacity from the McGuire-Cummings Manufacturing Co.

The Mt. Hood Ry. & Power Co., Los Angeles, Cal., has ordered 40 flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The New Orleans Railway Light & Power Co. has ordered 35 closed, single-truck electric cars from the McGuire-Cummings Manufacturing Co.

The Cold Blast Transportation Co., Chicago, as reported in the *Railroad Gazette* of March 6, has ordered 200 refrigerator cars from Haskell & Barker.

The Ardmore Traction Co., Ardmore, Okla., has ordered four double truck electric cars and two 30-ft. 10-bench open cars from the McGuire-Cummings Manufacturing Co.

The Chicago, Milwaukee & St. Paul, as reported in the *Railroad Gazette* of March 6, has ordered 12 passenger cars from Barney & Smith and three passenger cars from the Pullman Co.

The Atlantic Coast Line, as reported in the *Railroad Gazette* of March 6, has ordered for the Washington & Vandemere 100 ventilated box cars of 60,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co.

RAILROAD STRUCTURES.

NEW CARLISLE, QUE.—Plans are reported made by the Atlantic, Quebec & Western to replace about 26 of its present bridges with concrete and steel structures, at a cost of about $1,000,000.

NEW CASTLE, PA.—Plans, it is said, are being made for building a bridge over the tracks of the Pennsylvania at the foot of Croton avenue.

PHOENIXVILLE, PA.—The Phoenix Iron Company is putting up a steel bridge 578 ft. long, with approaches at each end of about 100 ft., over the tracks here. It is expected that the work will be finished about May 1st.

PROVIDENCE, R. I.—Plans for improving the dock facilities of the New York, New Haven & Hartford at Providence, it is said, have been completed. From Fox Point to India Point and 700 ft. out from the present wharf line a retaining wall with cuts for three slips, each wide enough for two of the big boats of the Consolidated's fleet, is to be constructed. The space at the rear of the retaining wall is to be filled in, and this will give 30 acres of wharf property over which tracks will be built to connect with the new route to Boston, via East Providence and East Junction. These improvements will cost about $2,000,000.

VERA CRUZ.—The Mexican government is understood to have approved plans for improvements here to cost about $8,000,000. The proposed union passenger station and office building is to cost about $1,000,000, and the rest will be spent for wharfs and warehouses, enlarging track facilities and putting in modern loading and unloading devices. The work is to be carried out by the Vera Cruz Terminal Company, composed of representatives of the various railroads entering Vera Cruz. Local directors of the company were recently elected as follows: J. D. Casasms, to represent the Mexican government; M. G. Ribon, the Interoceanic; Col. Palbo de Escandon and W. Moreon, the Mexican (Vera Cruz) Railway; J. B. Body, the Vera Cruz & Pacific and the Alvarado Railroads; M. Moreon, General Manager of the Mexican (Vera Cruz) was elected Director of the Board, and L. O. Brown, Secretary. The improvements are to be finished in about two years.

YORK, PA.—The Northern Central and Western Maryland Railroads, it is said, have agreed to pay $35,000, and the York Street Railway $25,000 toward building subways at West Market street. The total cost of the improvements will be $75,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BALTIMORE & OHIO.—Work is now under way for this company as follows:

New yard, engine terminal, etc., at East Side, Philadelphia, nearing completion.

Double-track bridge over the Susquehanna river at Havre-de-Grace.

New freight pier at Locust Point, Baltimore (about 400 ft. of the water end of this pier collapsed when its construction was nearly completed); about 85 per cent. of the wrecking of this part of the pier has been finished. It will be rebuilt. Very little damage was done to the land part of the pier.

Building a 500,000-bushels capacity grain elevator at Mount Clare, Baltimore; work in progress on one-half; provision being made for adding the other half when desired to replace the one destroyed by fire last August.

New engine terminal and enlargement of yard at Parkersburg, W. Va., nearly finished.

Passenger station jointly with the Western Maryland and Coal & Coke at Belington, W. Va.; passenger station and office building at Wheeling, W. Va., to be finished in several months; Medical Examiner's office and Hospital at Holloway, Ohio.

Laying second track between East End, Connellsville, Pa., and Mount Braddock; third and fourth tracks between McKeesport and Glenwood.

Extension of the Gardner Avenue yard, New Castle, Pa.

Construction of freight yard; also in and outbound freight house and office building at Columbus, Ohio, nearly finished.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CHICAGO, MILWAUKEE & GARY.—This company, organized at Springfield, Ill., with a capital of $10,000,000, is a consolidation of the Illinois, Iowa & Minnesota and subsidiary companies. Plans made for an extension from Rockford, Ill., north via Beloit, Wis., and Janesville to Milwaukee, and on the southern end from Momence, Ill., northeast to Gary, Ind. The Board of Directors include H. W. Seaman, B. H. Harris, Frank M. Clark, William F. McSwiney and Jonas Wafflie, all of Chicago, Ill.

COLORADO, OKLAHOMA & SOUTHEASTERN.—This company, which has projected a line from Weatherfield, Okla., northwest via Independence, Taloga Cestos and Mutual to Woodward, 90 miles, including a bridge over the Canadian river, has negotiations under way to finance the project. P. A. McCarthy, Chief Engineer, Lufkin, Tex.

DULUTH, RAINY LAKE & WINNIPEG.—This company, which last year finished the extension of the Duluth, Virginia & Rainy Lake to the Canadian boundary, at Ranier, Minn., expects to have the bridge over Rainy lake finished about May 1st, thus completing a connection with the Canadian Northern.

GRAND TRUNK PACIFIC.—The National Transcontinental Railway Commission recently received 19 bids for building 365 miles of line, 138 miles in New Brunswick, 52 miles in Quebec, and 175 miles in Ontario. When these contracts are let, 1,224 miles of the total of 1,807 of the government section of the Grand Trunk Pacific will be under contract, leaving 583 miles yet to be let. The bids submitted were as follows:

Section 1.—From a point 58 miles west of Moncton, N. B., 40 miles; Grand Trunk Pacific Construction Co.

Section 2.—For 67 miles to the Tobique river; MacDonald & O'Brien and Grand Trunk Pacific Construction Co.

Section 3.—From the Tobique river to a point 2½ miles west of Grand Falls, N. B., 31 miles; Craig & Thompson; MacDonald & O'Brien; J. T. Davis; Kennedy & MacDonald; the Willard Kitchen Co.; Trites, McPhail, Moore & Miller, and the Grand Trunk Pacific Construction Co.

Section 4.—From New Brunswick-Quebec boundary, west 52 miles; O'Brien & Fowler, J. T. Davis and the Grand Trunk Pacific Construction Co.

Section 5.—From Abitibi, west 100 miles; E. F. & G. F. Farquier and the Grand Trunk Pacific Construction Co.

Section 6.—For 75 miles west of Lake Nepigon; J. D. MacArthur, E. F. & G. F. Farquier, Chambers Bros., McQuigge & McCaffery and the Grand Trunk Pacific Construction Co.

It is estimated that during the summer about 30,000 men will be at work on the whole line from Moncton, N. B., west to Prince Rupert on the Pacific coast.

GREAT NORTHERN.—According to reports this company proposes to resume improvement work this sprong, including the reconstruction of the Kalispell, Mont., division, where the old ties and rails are to be replaced with new ties and 90-lb. rails.

ILLINOIS, IOWA & MINNESOTA.—See Chicago, Milwaukee & Gary.

INDIAN CREEK VALLEY.—Plans reported made to extend this line immediately from Rogers Mills, Pa., northeast to Ligonier, 30 miles. Surveys made for 10 miles. C. F. Hood, President, and S. M. Faust, Chief Engineer, Connellsville, Pa. (March 13, p. 391.)

KANSAS CITY & KANSAS SOUTHWESTERN (ELECTRIC).—Incorporated in Missouri to build an electric line to connect Kansas City with Topeka and Independence, Kan. The company proposes to take over the rights, surveys and other property of a number of projected lines between these places. It is expected to begin work this summer. The directors include J. E. Martin, Minneapolis, Minn.; W. L. Moyer, New York; N. L. Laming, Tonganoxie, Kan.; E. M. Lamken, Kansas City, Mo.; S. M. Brewster, Chanute, Kan.; H. E. Hopper, Indianola, Kan., and C. L. Dudley, Minneapolis, Minn.

LAKE SHORE & MICHIGAN SOUTHERN.—Plans for the elimination of grade crossings on this road have been submitted to the Erie, Pa., City Council for approval. The improvements are to cost $1,500,000.

MEXICAN ROADS.—Surveys are being made by the Creston de Cobre Company for a line from Cerro de Cobre, Sonora, to Port Libertad on the gulf of California, about 40 miles. It is stated that contracts will soon be let.

Compania Industrial del Oro, it is said, will soon begin work on a line from La Huerta, Michoacan, to Tlalpujahua.

The federal government recently amended the concession previously granted to John Henderson to build a line from the port of Lobos, on the Pacific coast, to Sasme, Sonora. The new agreements require that 15 miles shall be finished by April 1, 1909, and that the entire line shall be finished by December, 1917.

The Gigante Tunnel Railway Company is arranging to begin the construction of a railroad from LaLuz, Guanajuato to Leon and Guadalajara.

A British syndicate is said to have recently bought extensive coal fields in Mier Tamaulipas from the Compania Carbonifera y Irrigadora of Nuevo Laredo, and right of way has been secured over the old grade, originally intended for an extension of the International & Great Northern down the valley of the Rio Grande from Laredo, along the Mexican side of the river to Mier, about 100 miles. Plans have been made by the new owners to build a line to connect its coal fields with the National of Mexico at Nuevo Laredo.

MEXICAN (VERA CRUZ) RAILWAY.—This company, according to reports from Mexico City, has started betterment work on its line between Mexico City and Vera Cruz. About 3,000 tons of rails are being distributed along the line, and new steel ties will be laid where new tracks are put down. A large amount of bridge work is also to be carried out on the line.

MOLINE, ROCK ISLAND & EASTERN TRACTION.—This company, incorporated to build an electric line from Rock Island, Ill., to Carbon Cliff, also from Rock Island south to Galesburg, last year laid 1.55 miles of track from East Moline, Ill., to Silvis. J. T. Porter, of Rock Island, is interested.

SOUTHERN PACIFIC.—The Cananea, Yaqui River & Pacific has concessions from the Mexican government for two branch lines, one from Naco, Sonora, on the Arizona boundry, west along the international boundary to Nogales, Ariz., on the Sonora Railway just north of the boundary, 100 miles. According to the terms of the concession this must be built within 14 months. The other concession is far a branch from Naco, east to Juarez, Sonora, 150 miles.

TACOMA EASTERN.—An officer writes that this company has finished a new branch from Anderson, Wash., to McKenna, 16 miles.

RAILROAD CORPORATION NEWS.

ALBANY & HUDSON (ELECTRIC).—The holders of the $1,750,000 first mortgage 5 per cent. bonds of this company have been asked to surrender their coupons for 1908 and 1909 and receive in return negotiable certificates which shall be convertible into first mortgage on the basis of $1,000 in bonds for $875 in coupons.

ATLANTIC COAST LINE.—The Attorney General of the state of Connecticut has given an opinion that bonds of the Atlantic Coast Line Railroad no longer fulfill the requirements of the savings bank laws in that state, because the last dividend on the common stock of the company was paid, not in cash, but in certificates of indebtedness. A similar decision was given some time ago in New York state in regard to the Missouri Pacific.

BALTIMORE & OHIO.—Gross earnings for February decreased 21 per cent., operating expenses 8 per cent., and net earnings 61 per cent.

CAROLINA, CLINCHFIELD & OHIO.—This is the new name of the South & Western. The new company has authority to increase its capital stock from $7,000,000 to $27,000,000, of which $15,000,000 is to be 6 per cent. preferred stock and $12,000,000 common stock. The road is owned by the Cumberland Corporation and is being built through the coal fields owned by the Clinchfield Coal Corporation, which also is owned by the Cumberland Corporation. It is projected to run from Elkhorn, Ky., on the Chesapeake & Ohio, south via Hostic, N. C., to Spartanburg, S. C., 285 miles. Of this, 101 miles is now built from Johnson City, Tenn., south beyond Altapass, N. C. Work is under way on about 100 miles more. A mortgage is to be made on the railroad, securing $15,000,000 bonds, part of which will be reserved for refunding bonds of constituent companies. The Cumberland Corporation has recently issued $3,000,000 one-year 6 per cent. notes due in February, 1909, by bonds of three of these constituent companies, and also has $15,000,000 six-year 5 per cent. collateral notes of 1912 outstanding. The cost of the road to date is said to be $18,000,000.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—Moffat & White, of New York, have offered at 127, yielding about 4.15 per cent., $1,000,000 consolidated mortgage 6 per cent bonds of 1930. The consolidated mortgage covers the entire railroad of this company and all other property, and is a first mortgage on 627 miles of line. These bonds are outstanding at the rate of $11,871 per mile. Junior to them is $11,300,000 preferred and $18,607,000 Common stock, each paying 7 per cent.

CINCINNATI, BLUFFTON & CHICAGO.—John C. Curtis, General Manager, was on March 14 appointed receiver of this company, which operates 52 miles of line from Huntington, Ind., via Bluffton to Portland.

DAYTON & XENIA.—C. N. Ferneding, of Dayton, Ohio, was on March 13, appointed receiver of the Dayton & Xenia Transit Co., which operates 51 miles of trolley road from Dayton, Ohio, to Xenia and to Spring Valley. Twenty miles of the line is on private right of way.

GREAT NORTHERN.—The trustees of the Great Northern Ore Properties have made a report for the first fiscal year of the trust, ended December 7, 1907. The total receipts during the year were $1,650,000, administration expenses were $67,750, and the dividend paid September 7, 1907, to holders of certificates of the trust amounted to $1,500,000, leaving a profit and loss credit balance of $82,250. In addition to the 39,296 acres of ore lands leased to the Great Western Mining Co., a subsidiary of the United States Steel Corporation, there are owned and leased 31,238 acres more of ore lands.

Holders of the $4,700,000 first mortgage 5 per cent. bonds, of the Eastern Railway of Minnesota, maturing April 1, 1908, may receive cash for their bonds or may exchange them for Northern division 4 per cent. bonds of the Eastern of Minnesota, due 1948, in which case a payment of $20 per $1,000 bonds will be made.

ILLINOIS CENTRAL.—The special stockholders' meeting which has been called for May 18 is to vote on authorizing $28,600,000 new stock, half of which is to be offered to stockholders at par (to the extent of 15 per cent. of their holdings) and the other $14,300,000 reserved against an issue of convertible bonds which may be made.

INTERNATIONAL & GREAT NORTHERN.—Gross earnings for the week ended March 14, 1908, decreased 21 per cent., as compared with the corresponding week in 1907.

LAKE SHORE ELECTRIC.—Charles D. Barney & Co. and the Guaranty Trust Co., of New York, have offered at 87, yielding slightly over 6 per cent., a block of the general mortgage 5 per cent. bonds of 1933 of this company, of which $2,160,000 are outstanding.

LEHIGH & HUDSON RIVER.—See Lehigh Coal & Navigation Co.

LEHIGH COAL & NAVIGATION.—It is probable that this company will offer $1,737,850 new stock at par to its stockholders which will be to the extent of 10 per cent. of their holdings. The proceeds are to be used for improvements on the Lehigh & Hudson River and for other purposes.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—A semi-annual dividend of 3 per cent. has been declared on the common stock, raising the annual rate from 4 to 6 per cent.

NATIONAL LINES OF MEXICO.—See St. Louis, Brownsville & Mexico.

NEW YORK CENTRAL & HUDSON RIVER.—A quarterly dividend of 1¼ per cent. was on March 18 declared. This is a reduction in the annual rate from 6 per cent. which it has been since the last quarter of 1906 to 5 per cent., which it had previously been since 1899.

NEW YORK CITY RAILWAY.—Messrs. Joline & Robinson, as receivers of the Metropolitan Street Railway, have applied to the United States Circuit Court for permission to issue $3,500,000 receivers' certificates for improvements. They have also filed a complaint against the Metropolitan Securities Co. to recover $4,964,000 claimed to be still due the Metropolitan Street Railway from that company.

NORTHERN PACIFIC.—Freight earnings for February increased 18 per cent. and passenger earnings 5 per cent. Mail and express earnings decreased 25 per cent. Gross earnings increased 12 per cent. Comparison is with a month of terribly severe winter weather in 1907.

ST. LOUIS, BROWNSVILLE & MEXICO.—This company is reported to have bought from the National of Mexico, the Texas Mexican Railway, which runs from the international boundary at Laredo, Tex., east to Corpus Christi, 162 miles.

SEABOARD AIR LINE.—The voting trust formed in 1903 to last until 1910 is to be dissolved, on request of the receivers, on March 25.

SOUTH & WESTERN.—See Carolina, Clinchfield & Ohio.

SOUTHERN RAILWAY.—Directors of the Southern Railway have taken no action in regard to declaring a dividend on the preferred stock.

TEXAS & PACIFIC.—Gross earnings for the week ended March 14, 1908, were 23 per cent. less than in the same week of 1907.

WESTCHESTER TRACTION.—Edward G. Benedict was on March 14, by Judge Ward of the United States Circuit Court, appointed receiver of the Westchester Traction Company, which operates three miles of trolley line in Ossining, N. Y.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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BRADFORD BOARDMAN

CONTENTS

VOL. XLIV., No. 13. FRIDAY, MARCH 27, 1908.

We print this week in another column a paper on the strength and endurance of steel rails, by James E. Howard, Inspecting Engineer of the Watertown Arsenal, which is one of the most valuable contributions on rails that has been brought out in recent years. This is the first report of results obtained at the Watertown Arsenal under the increased appropriation. The bulletins which it is proposed to issue from time to time should perform important service in a branch of metallurgy which has been greatly in need of this kind of work.

The Pennsylvania Railroad, with that foresight and intelligent enterprise which characterize its management, has arranged to have freight claims paid more promptly. Not only has the force employed in the claim department been increased, but division freight agents have been empowered to settle small claims which are obviously valid, in cash, instead of waiting to have them audited and paid through the general offices. An attempt has also been made to hasten the settlement of claims in which other carriers are involved by addressing such correspondence more directly to the officers of such companies. This example of the Pennsylvania should be very generally followed. One great cause of dissatisfaction against the railroads has been the result of the methods too often adopted in handling claims. There have been vexatious delays in settlement. Oftentimes, whether because of inefficiency or shorthandedness of the claim department, lack of co-operation between different companies, or although we believe this to have been rare—actual intent to delay payment, it has seemed as though the railroad company was trying to avoid payment of the claim by discouraging the claimant. Not infrequently the vexation of a small shipper with a delayed claim has been increased and turned into bitterness by knowledge that his large competitor or his competitor with friends among the officers of the road has received prompt payment. It is easy enough to see the disadvantages which have come to railroads as a result of the legislation and agitation of the past two years. The advantages also should be recognized. One exceedingly important advantage, which is typified by this changing attitude of the railroads toward freight claims, is the fact that railroad managers now pretty generally recognize what many of them have in practice long denied—that railroading is a commercial business and that to succeed in it they must have satisfied customers.

The Interstate Commerce Commission in two cases just decided has established a through route and a joint rate between points which formerly lacked such opportunities for through shipment. A summary of these cases will be found in our "Interstate Commerce Commission Rulings" column. The more important of these is the case of the Cedar Falls & Iowa City (Electric) Railway against the Chicago & North-Western. Shippers at points on the electric line had no satisfactory through route from and to Chicago. It appeared that these points were not mere loading points serving one or two shippers, such as those involved in a similar complaint brought earlier by the Chicago & Milwaukee Electric Railway whose contention was denied by the Commission, but small local centers where general merchandising is done and the products of the countryside are concentrated for shipment and, on the other hand, coal, lumber and other commodities are brought in to supply the local needs of the immediately surrounding country. Under these circumstances the Commission ordered through routes and joint rates to be established by the electric line and the steam railroad between interstate points on their respective roads. This decision is likely to have far reaching effect in broadening the usefulness and increasing the importance of interurban electric railways, for it establishes the general principle that for interstate traffic any small community served only by an electric road which carries freight can have the benefit of reasonable joint rates over the electric line and its connecting carriers for through service. If past experience is a criterion, an ultimate result of this decision will be that electric lines will more and more be taken over by their steam railroad connections on exactly the same principle that branch lines of steam railroad have in the past been so extensively acquired.

One of the fundamental questions between employer and employed seems to be coming slowly but steadily to a focus in the case of the New Haven and its shopmen, to the number of some thousands. Forced, like other companies, to sharp economies, that corporation gave notice some weeks ago of a general scheme of piece work in its shops to go into effect March 10. The object was to secure the greatest efficiency in shop labor, to adjust wages to that efficiency and, probably, also to get rid, sooner or later of a class of shop workers described in the vulgate of shop toil as those who "lie down on their jobs." Representatives of the shopmen's unions met the general manager recently and are understood to have stated curtly and unqualifiedly that they would resist the new order; and, although the order has been suspended until March 28 the company is reported to be equally firm in enforcing it then. The policy of the unions of equalizing wages in the same classes of workmen and sinking the individual in the wage scale seems to be the only ground upon which the New Haven shop unions stand

and no question of breach of contract is raised. It looks therefore now like a head-on collision between the right of the New Haven company as employer to fix the *form* of its labor and the union policy—as the union sees it—of resisting the form. Legally, of course, the union has a right to reject such a form which, in fact, determines the nature of the job. But in that larger domain of bed-rock equities in which both employer and employed must appeal to public sentiment it will be interesting, should both sides remain firm, to see where a mere policy aimed at securing "dead level" wages comes out as against the basic right of the employer to an efficiency scale. But we must not forget that there is an Olympian judgment seat at the federal capital where such a conflict of fundamentals can be assuaged by official search warrant into corporative "misconduct." President Mellen may yet be informed by the voice of authority that he mustn't order piecework so long as the New Haven system includes watered trolleys or holds stock in the Boston & Maine.

BALLAST AND TRACK SURFACE.

In considering the papers on track and ballast, published in the *Railroad Gazette* March 13, it must be kept in mind that it is not possible to make general statements as to the value of particular kinds of ballast, or particular methods of track work, which will be true for all roads, or even for all roads in the same territory. Track that will stand up for two years without resurfacing under slow traffic will not last six months under high speed traffic. The divisions of which Mr. Rettinghouse and Mr. Auerbach are in charge are main line, but the density of traffic is, for example, not comparable with that on road beds within the limits of New York City. At one point on one of these lines, the substructure consists of stone blocks on which is a layer of broken stone, while the ballast proper is large sized, silicious limestone from Clinton Point. The rails are 100-lb. section and shoulder tie plates ⅝ in. and ½ in. thick are used. Yet this track will not maintain line and surface a year. Mr. Rettinghouse recommends stone ballast in sizes from 2 in. down, including a certain proportion of dust. The value of such a mixture depends on the quality of the stone. The dust of certain rocks forms too thick a mud to wash down to subgrade and the result will be a churning track. The depth of ballast to use also depends on local drainage conditions and overhead clearances. He recommends a mixture of three parts sand and five parts coarse pebbles in gravel ballast. Sand washes out easily unless water be prevented from flowing through it. It certainly has a tendency to squeeze out under heavy and fast traffic. The statement that gravel ballast can be maintained more cheaply than stone ballast is generally true. Yet the standard of track to be maintained, the kind of traffic, and the cost of each sort of ballast, must determine this for each place. There are divisions where the use of stone ballast would be as absurd as the use of gravel would be on others. More delicate surface can be obtained on gravel ballast, but it is more difficult to hold it.

Cinder ballast makes excellent track for light traffic until its structure is too far broken down. It has the proper resiliency to make an easy riding track, and it drains freely. It lasts about three years, but then begins to churn. As Mr. Auerbach says, it makes a good basis for gravel ballast; the layer should be about 6 in. thick. It has the advantage of mixing well with other forms of ballast. All ballast will let water through unevenly, which is Mr. Auerbach's criticism of cinder ballast on a new fill. New fills will settle somewhat, but the fill itself and not the ballast is at fault if rain falling on the area of the track alone will cut it away. Ballast is not intended to shed water; its function is to hold up the track and give the water every opportunity of soaking through and getting away somehow and anyhow, so long as it gets away quickly. His suggestion that 10 per cent. of clay be mixed with gravel is hard to understand, except under very light traffic. To be sure, if the surface of such ballast were so water tight as not to let in any water and so keep the bottom of the ties dry, it would be most desirable from the point of view of tie maintenance, but under heavy traffic such ballast would not hold its shape, and the idea is exactly opposed to the required porousness just mentioned.

Mr. Auerbach says that, except on rock ballast, track should never be raised out of face. Although in gravel and sand ballast track can be well surfaced by lifting only at centers and joints, a smoother riding track can be obtained in some ballast by lifting the whole track several inches, and this makes it easier to renew ties. On some divisions, the amount of a section which the gang could raise in a year has been taken as a rough measure of the efficiency of the gang. Part of the section would be raised out of face when repaired, and the rest would be surfaced and lined and tie renewals made not so freely. He says also, that no track becomes so easily center bound as rock. This is a matter of opinion. The statement has been made by one officer that he never had a case of center binding in rock ballast, and only a few in gravel or cinder. His practice is to tamp hard under the rail and for 16 in. each side, and to fill in snugly in the centers of the track, driving stone under at that point with a tamp pick to make sure the ballast is up against the bottom of the tie. As to lining track before raising, this depends on how much lining is necessary. Of course if the track is a foot out of line, it is a waste of time to raise it first. The lining and surfacing should be carried on as nearly as possible at the same time. Mr. Rettinghouse speaks of the difficulty in getting good section foremen because wages are too low to tempt good men. The remedy is to hunt up promising material and give bonuses, which need not be large enough to make any material difference in maintenance cost. Much can be done for a division by paying 10 or 12 section men $5.00 more a month.

THE MASSACHUSETTS MERGER REPORT

In these times when the axioms of political economy seem to have turned turtle, and radical speech as well as radical law is turned loose against railroad corporations, it is pleasant to hear one clear call to conservatism and common sense emanating from an official state body. The majority report of the Massachusetts Commission on Commerce and Industry is one of these comforting exceptions to the rule. It is to be sure but a special commission with a single year of legal life which has already expired by statutory limitation. But it has lived long enough to inject a clarifying stream into the turbid whirl of a railroad situation in Massachusetts where politics tipped with demagogism have been confusing alike policies and principles. From a commission that included in its membership such a name as that of Charles Francis Adams was to be expected not only an analysis of the local problem, but an exposition of certain broader principles as applicable to other states as to Massachusetts. The report has, in fact, this double character.

Taking up first certain general principles of the report it is important to notice that it places in the foreground not the penalizing of the New York, New Haven & Hartford Railroad, nor, on the other hand, the promises of that company to make certain specific improvements should the merger with the Boston & Maine be conceded. In place of such penalties and promises the report substitutes the broader and deeper question of the larger public policy for the state, of the merger as an ultimate fact. It is the long look ahead as contrasted with the near and superficial vision filled with the doubts, the passions and the prejudices of the short-sighted onlooker. This calm, dispassionate long distance reasoning is just the sort that our fevered times need. Everywhere, even in mentally well-endowed Massachusetts, is heard the "anti-monopoly" and not much less often the "anti-railroad" cry. A good many of the western and southern railroad commissions, even under the chastening experience of hard times, doubtless charge them up still to the railroads and look on the roads only as objects of punishment. It were well could such bodies, and higher authorities as well, catch the spirit of the Massachusetts commission report.

The commission so far recognizes the existence rather than the value of the anti-monopoly cry in Massachusetts as to combat it by the geographical facts. It shows what the briefest study of the railroad map of New England will show, that the New Haven and the Boston & Maine are connected and not competing systems. Perhaps, in the existing temper of public sentiment in Massachusetts it was not prudent, but the commission might have gone much further and shown certain absolute benefits of monopoly as represented by New England experience. In an editorial article (July 20, 1906, "The Outworkings of Railroad Monopoly") we set forth the facts. In brief, southern New England has had in the New Haven system a complete railroad monopoly made up largely of competing lines consolidated. Northern New England has had in the Boston & Maine a qualified monopoly due also to consolidation of competing lines. And between, has been the Boston & Albany, not a monopoly. In these three systems the variations downward in freight and passenger rates during the 10 years, 1896-1905 inclusive, were essentially in inverse ratio to the monopoly feature. Allowing for change of rates due to absorption of the New England by the New Haven and of the Fitchburg by the Boston & Maine, the New Haven's average freight rate fell during the ten years a little more than 3.8 per cent.; on the Boston & Maine a little less than 4.6 per cent.; on the Boston & Albany a little more than 1 per cent. But had the comparison been made for 11 years the New Haven's reduction would have been more than 9 per cent. Or, taking the Fitchburg merger (1900) as the date point, the New Haven freight rate fell during the five years .07 cents, while the Boston & Maine's rose .02 cents and the Boston & Albany's rose .10 cents. In passenger rates during the 10 years the New Haven showed a decrease per passenger mile of a little more than 7.3 per cent.; the Boston & Albany a little less than 6.3 per cent., and the Boston & Maine about 1.7 per cent. But public feeling in Massachusetts is probably more responsive to the "connecting systems" argument than to any returns based on monopoly outworkings in New England. It is to be noted, however, that elsewhere in the report the commission declares that "a monopoly in the case of a public service corporation has no necessary tendency to injure the public. On the contrary it may benefit it and the question in every case is purely one of expediency to be examined on its own merits."

Another point of wide and national interest is the finding of the commission on the question of allowing prosperous public service corporations to issue new stock at par. In Massachusetts prior to 1871 railroad stock could be offered stockholders at par; from 1871 to 1878 it was to be sold at auction; from 1878 to 1893 it could again be offered at par, and since 1893 it and new street railway stock have had to be issued at or above par, but at market price as fixed by the state railroad commission. The fifteen years' test of the law convinces the special commission that the old "par" plan is sane and expedient. The commission's main argument rests upon the theorem that the compulsory market price establishes a new par which the state must adhere to as a basis of regulation. Probably it would be fairer to say that it establishes really two "pars" with very confusing results to the relative rights of old and new stockholders when it comes to a matter of state regulation, especially if based on dividends. The commission also asserts that the "market price" law has deprived the state of the new capital needed for the development of her transportation systems. The subject has been and will always be a complex one with arguments on both sides, and it becomes especially perplexing in a period of rapidly fluctuating and falling values—perplexing not only to the state, but to the corporations. For example, the New Haven company in its last annual report practically announced a new issue of stock at $125 a share, and rights to the stock "to be delivered when as and if issued" were freely sold in the market. A rapidly falling market compelled the company to drop the plan and an issue of 6 per cent. debentures was substituted. From both the public and corporative viewpoint evidently an element of opportunism thus enters the question, resting on stable or fluctuating values. But what cannot be gainsaid as a piece of objective and telling evidence is the unqualified approval of the "par" plan of issue by an intelligent commission in a state whose policy for fifteen years has been in favor of the market value rule.

Turning from the broader meanings of the report to those features which bear specifically upon the merger a long and affirmative argument can be condensed into a few points. The New Haven is a New England corporation in organization, operation and interests. Solidarity with the Boston & Maine spells not only better control of traffic as against outside interests, but better service to the New England public, directly in operation, more remotely in improvements, especially on the Boston & Maine. The actual ownership already by the New Haven of what amounts to a controlling interest in Boston & Maine shares raises obstacles almost or quite insuperable to any plan for diverting such ownership, no matter what the courts decide—and the commission might have added that a final decision of the courts on the serious constitutional questions involved would probably be a matter of years. Almost the same line of reasoning holds good in the matter of the New Haven control of its Massachusetts trolleys. Finally, the financial ability of the New Haven to "handle" the Boston & Maine is certified by the commission's own experts. Their report is based upon the returns for the last fiscal year ended June 30. It might have been better if they had referred to certain changed fiscal conditions since. But if the New Haven has dropped in earning power so has the Boston & Maine, and what may be called the financial ratios of the two companies have remained substantially constant, or, if changed, the variation has been in favor of the New Haven. Incidentally may be noted in the report the first official statement showing the size of the New Haven's trolley system in Massachusetts with its sixteen lines, 565 miles of track, $11,626,200 of capital stock, $6,360,000 of funded debt and $3,234,924 of loans and notes payable. These street railways represent a fifth of the total mileage and about a sixth of the capitalization of the Massachusetts street lines, showing the magnitude of the problem of the proposed severing of the connecting link.

The proposals for safeguarding the merger of the two large railroad systems, which combined, create a unique and firm railroad monopoly in the six New England states, are naturally the real nucleus of this important report. They can be summarized almost in a single sentence. They allow well nigh free control and operation by the New Haven of the Boston & Maine—the localization features not being important—but subject to some pretty radical restrictions based on new and contingent conditions. Those restrictions are twofold: (1) The right of the state, if the merger in a public sense after five years is unsatisfactory, to buy in the New Haven's Boston & Maine shares, and (2) suspensive repeal of the voting power on Boston & Maine shares if control of the New Haven itself passes to an outside interest. On their face these provisions look severe; striking at a principle of ownership and opening a vista of future legislative interference. But five years, barring a "long drag" of hard times, seems long enough for the swift policy of President Mellen to try out the merger, and, under the prospective as well as existing state of public feeling in New England any transfer of the great property seems extremely remote. President Mellen, in his later letter to Governor Guild seems, in fact, to have practically accepted the commission's plan. To the twofold conditions named of Boston & Maine control, should be added a third one suggested by the commission for control by the New Haven of its Massachusetts trolley system by a Massachusetts corporation in which the state shall be represented on the board of directors with provision for sale of control if the plan after ten years works out badly for the public. This applies to the trolleys substantially the same policy as that outlined for the steam railroad merger and with the same arguments in its favor.

The brief report of the minority of two in the commission, one of them a "labor" representative and neither of them entering fully into its deliberations, may be dismissed with short shrift. It is hardly more than a variation of the familiar "anti-monopoly" and "special privilege" pleas coupled with charges against the methods of the commission the high character of whose majority furnishes alone prompt vindication. It is too early to forecast what effect the report will have on the Massachusetts legislature. But at least that body has now before it a working hypothesis for a solution of the merger question and a defined plan supported by constructive criticism where before have been crude utterance and frothy conflict.

The Belgian State Railroads have suffered the common railroad fate in the last year of an increase of expenses out of all proportion to the increase in gross earnings. For the last four years earnings have increased steadily: 7 per cent from 1904 to 1905; 4½ per cent. from 1905 to 1906, and 2.7 per cent. from 1906 to 1907. But the net earnings remained nearly uniform in the first three years, and last year fell 11 per cent. below those of 1906, in spite of an acquisition of a private railroad which added 3 per cent. to the fixed charges. The surplus over charges has fallen from $2,372,000 in 1904 to $1,856,000 in 1905, and $1,378,000 in 1906; while there is a deficit of $914,500 in 1907. In a country like Belgium, a large part of the production of which competes with other countries for a foreign market, it may be policy for a state railroad system to keep its rates close to cost, to support industry; but a loss which must be made good by taxation can only be regarded as a calamity. The proportion of expenses to gross earnings has grown from 60.03 per cent. in 1904 to 62.60 in 1905, 64.07 in 1906, and 68.61 in 1907. The Parliamentary Committee considering the matter estimates an increase for 1908 of 16 million francs in gross earnings and a further increase of 23 millions in expenses, which would bring up the percentage of expenses to 72.87 per cent.

Train Accidents in February.

Our record of train accidents occurring on the railroads of the United States in February, 1908, includes seven collisions and six derailments. The month of February has broken a long record in that it has furnished no especially prominent accident, using the term "prominent" in the sense with which readers of this column are familiar. It will be recalled, of course, that under the method now used in preparation of this record, accidents which two years ago would have been included in the list are now left out; but even on this basis there have been until now very few if any months in the past ten years in which the most serious accident did not result in five or more fatalities. The causes of this shrinkage are, in a sense, negative, and may be briefly comprised under two heads;

a month in which there was little severe winter weather and that in a restricted territory, and a falling off in traffic. The diminution of traffic means not only fewer trains, but a better average quality of men managing those trains; and the men, whether experienced or inexperienced, working under less severe conditions. The two most serious accidents of the month were each caused by a broken rail. The derailment by this cause of the three rear coaches of Southern Pacific passenger train No. 3 near Forest Grove, Ore., resulted in the death of three passengers and injury to 23 other passengers. As usual, our record is based mainly on accounts published in local daily newspapers.

TRAIN ACCIDENTS IN THE UNITED STATES IN FEBRUARY, 1908.[1]

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd
3.	Toledo, P. & W.	Bushnell.	xc.	P. & Ft.	0	3
10.	Pennsylvania	Cresson.	xc.	P. & Ft.	1	3
10.	Pennsylvania	Olean.	bc.	Ft. & Ft.	1	0
13.	Balt. & Ohio	Felton.	xc.	P. & Ft.	2	15
16.	Michigan Central	Black Rock.	xc.	P. & Ft.	0	5
*26.	N. Y., N. H. & H.	Barton.	rc.	Ft. & Ft.	1	1
*27.	Erie.	Brockwayville	rc.	Ft. & Ft.	2	0

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	No. persons reported Inj'd.
†3.	Wabash	Britton.	Pass.	b. rail.	2	34
3.	Pennsylvania.	Frackville.	Pass.	b. wheel.	1	0
7.	Pennsylvania	Franklinville.	Pass.	unx.	0	10
7.	Del., Lack. & Westn.	Hoboken.	Pass.	ms.	1	0
†11.	Southern Pacific	*Forest Grove.*	Pass.	b. rail.	3	23
13.	Louis. & Nashville.	Cherryville.	Ft.	rock.	1	2

Of the nine serious electric railway accidents reported in the newspapers as happening in the month of February, four resulted in fatal injury to one or more persons; namely, Chicago, Ill.; Hackensack, N. J.; Cambridge, Ohio, and Toledo, Ohio. The Toledo accident caused eight deaths and injury to ten other persons. It was a collision between a passenger train on the Cleveland, Cincinnati, Chicago & St. Louis and an electric car on the Toledo & Western.

NEW PUBLICATIONS.

The Elements of Railroad Engineering. By William G. Raymond, C.E., LL.D., Member American Society of Civil Engineers, Professor of Civil Engineering, and Dean of the College of Applied Science, State University of Iowa. 405 pages; 5½ x 9 in.; 107 figures, 18 plates. Cloth. Price, $3.50. John Wiley & Sons, New York; Chapman & Hall, Ltd., London. 1908.

The book at hand is Volume 2 in a series of three works on railroad engineering in preparation by Dean Raymond. Volume 1, which is to deal with railroad field geometry, and Volume 3, a railroad engineer's field book, have not yet made their appearance, but it should be observed that the three are intended to go together and supplement each other. This fact is important, for it answers what might possibly otherwise be a criticism—that the book on "Elements of Railroad Engineering" covers a tremendous amount of ground and that it is, therefore, impossible for it to handle quite enough of any one topic to entirely complete that topic and put it in shape for use by a practical man. Viewed as one of a series of books, however, and presuming that the other two volumes will complete the stock of detail working knowledge required by the field engineer the work at hand is admirable.

Perhaps A. M. Wellington did more than any other one man to impress upon the minds of railroad engineers that their work was a means and not an end, and that the successful engineer must keep always in mind the cardinal principle that he was building a railroad to haul freight and passengers and to pay interest on its charges and make some profit for its owners. Dean Raymond does not discuss the economics of railroad location with anything like the detail of Wellington, but he keeps the fundamentals perfectly clear in the mind of his reader. So far as the main scope of the work is concerned, it may be said that the author has brought Wellington up to date better than anybody else has done He was probably wise in not attempting, himself, to handle, in one volume, all the detail necessary for practical working. A volume big enough to hold this is too big to carry around, and the information contained in it is likewise too big to carry around. The author therefore adopts the expedient of giving principles with quite remarkable clearness, and then of supplying references (not too many of them, either,) to the books that the engineer in the field really ought to read to complete his researches.

The author says in his preface that a railroad with its rolling stock and buildings constitutes a manufacturing plant which its owners operate in the manufacture and sale of transportation. The layout or arrangement of a modern manufacturing plant is as much an item of design as is each individual machine or process, hence the book attempts to describe the fixed portion of a railroad plant and to give the underlying principles of the design of its layout.

After treating of the inception of a railroad enterprise, of the formation of companies, of stocks, bonds (in which the minor error is made of saying that the promises to pay are generally in units of $100 instead of $1,000), of engineers' estimates, construction, failures, overcapitalization, stock watering, valuation, the relation of the railroad to the public and the duty of the engineer, the author proceeds to the more technical parts of the work. There is a chapter on alinement, entirely descriptive and mathematical, a chapter on rails, in which manufacture, chemical composition, form, life of rail and specifications and inspections are touched upon; a chapter on rail fastenings and joints, on ties, ballast and roadbed, on culverts and bridges, turnouts, side tracks and yards, elevation of the outer rail, signaling, the locomotive and its work, locomotive and grade problems, railroad expenditures, effect on operating expenses of changes in the number of trains when tonnage remains constant, etc. Thus it will be seen that the book is really a mixture of descriptive engineering and of operating and engineering economics.

It is very clear that the author's aim throughout has been to give only salient points, and so to express them as to clear up absolutely the real and vital theory of each topic in the engineer's mind. In this he has succeeded extremely well, and we regard the work as being useful and important.

Bond Offerings Indexed, a Directory of Miscellaneous Bonds, showing where they possibly may be bought or sold. By Roger W. Babson, by whom the book is also published, at Wellesley Hills, Mass. 1908 Edition 284 pages; 4 x 6½ in.; leather. Price, $5.00, with reductions for large orders.

This pocket book in a highly specialized field is of very great utility. It purports to give a complete list of all bonds, except municipal bonds, offered during 1907 in this country, together with the names of the bankers offering them and the high and low prices at which the bonds sold during the year. We know of no other way in which bond offerings can so readily be ascertained and checked as by the use of this book. Mr. Babson is well known for his statistical work in preparing card catalogue descriptions of bonds and in issuing many other records and aids to the bond business, and we have considerable confidence in the accuracy of his results. Entirely apart from the purposes for which the book is issued, it throws an interesting light on the bond issues which are placed before the American investor each year and upon the necessity of dealing with careful and trustworthy banking houses. Without attempting to count the offerings, but estimating the whole by a count of a few pages, it is apparent that there must be over 4,000 offerings listed in this book, which, as stated, excludes municipals.

CONTRIBUTIONS

Rail Circuits and Treated Ties.

Jamaica, N. Y., March 15, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest your editorial on the above subject in your issue of March 13, 1908. I note that you say that "Signal engineers claim recently to have established the fact that there is a storage battery effect from these ties, but it does not interfere with the working of the circuits under the renewal conditions mentioned." I wish to take exception to this statement. At one time I had charge of a track-circuited section about 3,500 ft. long in which there was a cut section. All the ties were creosoted. The cut section merely broke the circuit for the track in its rear but did not shunt it. During the summer the signal governing the section stood clear after a train passed the cut section. Investigation disclosed the fact that the ties were acting as storage cells. Between trains the tie storage battery was charged by the track battery. When the battery circuit was opened by the cut section relay the ties discharged into the rails and picked up the main track relay clearing the signal. The trouble was remedied by adding a shunt to the cut section. This happened several years ago.

W. H. ARKENBURGH.

[1] Abbreviations and marks used in Accident List

re........Rear collision.
bc.......Butting collision.
xc.........Other collisions: as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.........Broken.
d.........Defective.
dr.........Defect of roadway.
eq.........Defect in car or engine.
n.........Negligence.
unf.......Unforeseen obstruction.
unx.......Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman)
ms.........Misplaced switch.
acc. obst. Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.......Cars burned while running.
Pass......Passenger train.
Ft.......Freight train (includes empty engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

The Engineering and Maintenance of Way Association Convention.

The ninth annual convention of the American Railway Engineering and Maintenance of Way Association was held in the Auditorium Hotel, Chicago, March 17, 18 and 19. The meeting was the largest the association has had, 266 members being in attendance. The total membership is now 650; there were 106 new members added during the year, the net gain being 78. The officers for the ensuing year are: President, Walter G. Berg (Lehigh Valley, First Vice-President; W. McNab (Grand Trunk), Second Vice-President; L. C. Fritch (Ill. Cent.); Secretary, E. H. Fritch, re-elected; Treasurer, W. S. Dawley (Mo. & N. Ark.) re-elected. Directors for three years, C. S. Churchill (N. & W.) and E. F. Wendt (P. & L. E.).

President A. W. Johnston (N. Y. C. & St. L.) called the meeting to order at 10.20 a.m., March 17. His address congratulated the association on the record of progress made during the nine years of its existence and the influential position it occupies in the railroad and engineering world. Reference in detail to the work of various committees was prefaced by comment on the condition of public mind which has been created by official reports of railroad accidents. "The make-up of such reports does not enable the ordinary reader to differentiate between those accidents arising from defects in railroad structures or equipment and those occurring from neglect or disobedience of employees, nor is the public rightfully informed as to the casualties to persons not employed in train service, so that the impression has gone forth, in spite of the increasing efforts of the railroads to promote the safety of travel, that the companies are indifferent and indisposed to heed suggestions or commands from authoritative sources. The answer to this may be found in the reports of committees of this association and of allied associations dealing with railroad problems. Among the questions particularly affecting public travel, more prominently discussed in legislative and other official bodies and by the public press and made the subject of serious inquiry, are those dealing with secure permanent way and efficient train protection." The work of the committees on Rail and on Signaling and Interlocking were particularly referred to in this connection, and also because these topics have been the subject of special consideration by the American Railway Association.

Other special topics for association work which were discussed in the address were the impact tests to determine the effects of moving loads on bridges—investigation of the question of flat spots on wheels in co-operation with the Master Car Builders' Association—a special committee having been appointed for this purpose, and the troubles from brine drippings from refrigerator cars, with the resultant bad effect on bridges, rails and particularly on signal circuits. This last evil, caused by brine, has only recently been brought to the attention of the association. Since it may have a serious bearing on the question of safe train operation it is worthy of careful inquiry by a committee.

DISCUSSION OF REPORTS.

Uniform Rules.—The committee submitted as its report a set of rules governing supervisors of signals. These were printed in the *Railroad Gazette* last week in the synopses of reports. The ten rules were adopted without change except a slight modification of wording in No. 9. Some objection was raised to the use of the word "foreman" in Nos. 5 and 6, because men maintaining signals are not always in charge of a gang foreman and may report direct to the supervisor. It was pointed out by the chairman of the committee, however, that these rules followed the form of others already adopted and printed in the Manual of Recommended Practice, and a change of the character desired would have to be made there also. A motion to change the wording was lost.

Two suggestions were made for points to be considered by the committee during the coming year: (1) Regarding the responsibility of the supervisor of signals in connection with the proper maintenance of switch points as affected by the working of signals, and (2) the responsibility of the supervisor with reference to the maintenance of insulated rail joints.

Signaling and Interlocking.—The committee changed the wording of the two conclusions printed in Bulletin 94 to read as follows:

(1) That the Requisite Indications, Exhibit No. 1, are adequate, permit a uniform system of signaling, are not in conflict with existing systems, and are recommended to the American Railway Association for approval.

(2) That the Requisites of Installation as set forth are practicable, form an adequate and proper basis for the design of a system of aspects by which the requisite indications may be displayed, provide an excellent means for attaining a uniform, universal system of signaling, and are, therefore, indorsed by this association and submitted to the American Railway Association for such action as may be necessary to enable roads desiring to use them to do so with the approval of that association.

The chairman also stated that this report was submitted by letter ballot to the Railway Signal Association, and was adopted, and that the requisites of installation were those of the Standard Code, with such changes and additions as the committee deemed essential.

Under the requisites of installation for the telegraph block system, light was asked on the paragraph reading: "A distinctive position of the arm for the caution approach indication."

The chairman explained that it was simply the use of a signal in the 45 deg. position for the distant signal, instead of a fish-tail arm standing at horizontal for caution—the same position of the arm as the stop indication for the home signal. The idea is to make the arm distinctive by position instead of by form.

Information was asked as to why no mention was made of disc signals in the requisites of installation for the automatic block system. It was thought by some that this omission might appear to discredit disc signals as good practice. In explanation it was stated that in order to get a uniform system of signals one form only could be used, and the semaphore, as the form generally used, was the one taken. All of the indications can be given with disc signals. It was pointed out that the Standard Code mentions only semaphores directly in its requisites of installation, discs being mentioned in a foot note and in the rules.

The requisites, "Adequate approach indications for all high-speed signals," which was one of the additions by the committee, occasioned considerable discussion.

Mr. Ewing (P. & R.).—Take a junction on a four-track railroad, where there are several routes, some high speed and one or more low speed, what does the "adequate approach indication for all high-speed signals" mean in a case of that kind?

Mr. Rudd (chairman of committee).—It would mean the distant signal for high-speed signals. Under these requisites of installation the interlocking signal would have a high, a medium and a low speed arm. There would be two "distant" arms for the high and the medium speeds.

Mr. Ewing.—As I understand it this method contemplates one blade for all high speeds. The one distant signal would give one distant indication for that high-speed route. There is no indication to the engineman as to what route he is going to take.

Mr. Rudd.—If there are two diverging routes of equal speed the second arm will govern both. He would get no indication in that case any more than when he comes to a terminal with a number of different ways of going from one signal to another. He gets an indication that he can proceed at a certain rate of speed. That is all he needs.

Following this there was considerable questioning and explanation concerning speed and route signaling, although attention was called to the fact that the 1907 Manual has signal arrangements and indications covering speed signaling, and the subject therefore is not a new one to the association.

W. C. Cushing (Pennsylvania Lines West) moved that in the requisite under interlocking signals reading "short arms and short range lights for all low-speed indications and dwarf signals" the words "short range lights" be stricken out.

Mr. Rudd explained the two-light system for speed signaling and the confusion that might result from having a long-range low-speed light. After some further explanation of the advantages of the short range light by other members the motion was put to a vote and lost.

Exhibit No. 1 referred to in the first conclusion was an outline of indications for a method of uniform signaling. Four indications were given under "stop," the fourth one being "stop within certain limits." This indication has been eliminated by the Railway Signal Association. It was included in this report by a vote of six to five of the committee because it conforms to present practice on a great many roads in respect to train order signals, although it is not sanctioned by the Standard Code. The reason for the practice is that the signal being placed in front of the telegraph office a passenger train, for instance, is allowed to pull by the signal far enough to do its station work conveniently. Discarding this indication necessitates providing a substitute. After considerable discussion it was voted to strike out this indication from the table.

The two conclusions proposed by the committee were then adopted.

Water Service.—The report of this committee consisted merely of a revision of the material in the Manual of Recommended Practice on the subject of quality of water, with methods of treatment and results obtained therefrom. These were adopted by the convention as printed, except for one slight change in wording in paragraph 11.

Buildings.—The conclusions on locomotive coaling stations were considered first. The first four having been adopted last year and reproduced in this report for convenience of discussion No. 5 was taken up first. This was adopted without discussion.

No. 6 covered points where the quantity of coal handled is small, it being recommended that the coaling be done directly from cars, or from cars to an elevated platform provided with a jib crane. Objection was made to specifying an elevated platform, the idea being that this would cost more than one not raised. The chairman pointed out that it saved in lifting the coal by the crane and saved time. However, by striking out this word it allowed any kind of platform to be used, and the conclusion was finally adopted in that form.

No. 7 read "At terminals where the daily consumption of coal does not exceed 75 tons, a locomotive crane with clam-shell bucket is desirable, provided that there is at such terminal other work that can be economically performed by the locomotive crane."

The question was asked why a limit of 75 tons was established for the locomotive crane, and considerable discussion followed regarding the advisability of setting capacity limitations for different devices and methods. Mr. Coburn, of the committee, said: "We feel that the association has given us a very difficult task. The coaling plant question is something which has not been thoroughly developed. There are a great many different kinds, and very few of the members have had a broad experience. We feel that it is going to be impossible for this association to agree on any satisfactory conclusions in regard to coaling plants. But we endeavored to meet the wishes of the association and prepared recommendations, and, as the minority report shows, we could not agree among ourselves. Referring to this particular point, it seemed to us that the locomotive crane was not a successful appliance where a large number of engines were handled or where they were liable to come in bunched. The experience at terminals has not been satisfactory. Another thing about the locomotive crane is that it provides no storage. If storage be provided, the cost of the plant is so heavy that its total cost, including interest and depreciation, and the cost of storage in cars, makes the cost of a locomotive crane excessive."

The first result of the discussion of this conclusion was to refer it back to the committee for further consideration, but this action was later reconsidered and a substitute conclusion adopted instead. This substitute, offered by Mr. Ewing, was: "At terminals, under certain conditions, a locomotive crane, with suitable bucket, is desirable, particularly where other work can be economically performed by the crane."

No. 8 read: "At terminals where the requirements are from 75 to 200 tons per day and a deep foundation is practicable, a 'balanced two-bucket hoist type' of coaling station is recommended." Mr. Coburn submitted a minority conclusion reading, "At terminals where the requirements do not exceed 200 tons a day, when the desired storage is not so great that auxiliary buckets are necessary and where a deep foundation is practicable, a two-bucket hoist is recommended." His reason was that he did not consider the two-bucket hoist suitable for large storage. It was moved to adopt the minority recommendation, changing "200" to "300," however; in this form the conclusion was adopted.

The last conclusion recommended, for plants larger than previously provided for, the trestle type where conditions permit, and where not permissible, a mechanical conveyor type. The minority recommendation was primarily for the mechanical conveyor plant. Some discussion of the relative economy of the two types ensued and the majority recommendation was adopted.

It was then decided to consolidate conclusions 6, 7, 8 and 9 with No. 5, making them sub-paragraphs marked a, b, c and d.

On the subject of Reinforced Concrete for Roundhouses, four conclusions were submitted. The first, providing that reinforced concrete should be used below the floor where it is cheaper than plain concrete, was adopted without much discussion.

The second, reading "The additional security against interruption to traffic warrants the construction of a roundhouse with a reinforced concrete roof," occasioned considerable discussion. Asked in what way the roof of the roundhouse might insure additional security against interruption to traffic, Mr. Coburn explained that the committee had in mind the question of fire. "Our idea was that the difference between the cost of the two types of houses shown was so slight that the matter should depend entirely upon the results to be gained from the use of each of the types; that while the figures showed that the reinforced concrete house was cheaper, still the advantages was so slight that there must be some other advantage to warrant the additional first cost, and we thought the saving from danger from fire was well worthy of that cost." It was then suggested that the words "from fire" be inserted after "traffic," which was done.

Mr. Schwitzer, of the Canadian Pacific, told of the troubles they had had with the reinforced concrete roofs on the roundhouses of this material on their line. "We put up several of these houses and came to the conclusion that they are a failure for the reason that steam makes such heavy condensation inside. We had to put slabs under the roof to prevent the bad effect of the moisture in extremely cold weather. Because of this, we have practically given up altogether the idea of concrete. We have had six or eight houses with the protecting slabs made of expanded metal and cement plaster. The fumes seemed to get through to the expanded metal and eat it out, and I expect it will be only a short time before the main roof itself is acted on in the same way. We also find it extremely difficult to make the roof water-tight."

It was suggested to omit the conclusion, but after some further discussion it was changed to read, "The additional security against interruption to traffic from fire warrants the serious consideration of the construction of a roundhouse with a reinforced concrete roof," and in this form it was adopted.

No. 3 read, "When the roof is concrete, the columns, except those supporting doors, should be of the same material." This was amended by striking out "except those supporting doors."

No. 4 was adopted as printed.

The committee asked that the topic of "best method for smoke removal, ventilation and heating of a roundhouse" be referred back for further investigation and report.

On the use of movable or fixed cranes the conclusion offered by the committee was: "Jib cranes attached to outer posts alongside of a number of pits in roundhouses, or, in the case of large roundhouses, a trolley hoist working around the outer circle, capable of handling two tons, should be installed in such roundhouses as may be designated by the motive power department as requiring such appliances for light locomotive repairs." The committee asked that this be substituted for the present paragraph in the Manual on the subject of air hoists and portable goose-neck cranes. The conclusion was adopted and the matter of the substitution referred to the committee.

On the last topic—best arrangement of windows and roof lights, and proper ratio of light area to floor surface—two conclusions were offered, as follows:

(1) The disadvantages of roof lights in roundhouses are so much greater than their advantages as to make them undesirable.

(2) Windows in the outer walls of roundhouses should be made as large as practicable and contain the largest glass or light area consistent with the requisite strength. In general, the lower sill should be not more than 4 ft. from the floor, and only sufficient space left between pilasters and sides of window frames, and girders and window heads, to properly secure the window frames. Windows or transoms as large as practicable should be provided over all doors where locomotives enter.

Both were adopted without change.

Iron and Steel Structures.—The report of the sub-committee on Impact Tests was presented first. There was no discussion

The first subject considered in the regular report was Classification of Bridges as to Safe Carrying Capacity. The five conclusions of the committee were included in the synopses of reports printed last week. Mr. Greiner (B. & O.), Chairman of the committee, in presenting the report said: "The committee considers this question of safe carrying capacity of bridges one of the most serious problems which have been placed before it. The determination of what is the maximum load which can be operated over an old bridge is a question of serious moment. We have had some difficulty in coming to any positive conclusions, that is, conclusions which can be shaped in such manner as to be worthy of presentation to the association. One difficulty is the manner in which different engineers are accustomed to analyze a structure. Some will take impacts in considering the unit strains, others will not; and when one engineer says that he will allow a strain of 15,000 lbs. per sq. in. and another one says 26,000 lbs., there is ambiguity and it needs explanation. In our report we have followed the analysis that is outlined in our bridge specifications, wherein unit stresses are based upon the assumption that impacts are being taken care of in the enlarged stresses. That will account for the apparently high unit stresses mentioned in our conclusions. In presenting these conclusions we do so with considerable hesitation. There is a fear that they may be misinterpreted or misquoted or misused. We have therefore prepared an additional conclusion, No. 6.

"(6) It is of the utmost importance that the carrying capacity of a bridge be determined only by a bridge engineer of sound judgment and experience in similar questions, and the foregoing conclusions are based upon this assumption."

The first three conclusions were adopted without much discussion. No. 4 read, "When the span is less than 200 ft., all controlling factors given in Article 2 good, the mathematical analysis made in accordance with the American Railway Engineering and Maintenance of Way Association specifications of 1906, using full specification allowances for impacts for regular service fast speed, and one-half of these impact allowances for slow speed, then, so long as the controlling factors remain good, unit strains in tension to the extent of 26,000 lbs. in structural open-hearth steel and 22,000 lbs. in wrought iron, will not, in themselves, be sufficient justification for suspending traffic or condemning the structure." The question was asked, what was meant by "slow speed," and this brought on a long discussion on the advisability of stating at what speed the reduction in impact allowances should occur. The committee thought it should be left to the judgment of the bridge engineer, this being one of their reasons for proposing conclusion No. 6. Some members thought the clause might be changed to make the reduction in impact allowance proportional to the reduction in speed. The paragraph was finally amended by striking out "slow" and making the clause read "for speeds not exceeding 15 m.p.h."

Conclusion 5 was adopted without discussion, and the new conclusion, No. 6, likewise.

The next topic was Classification for Operating Purposes, and the conclusion, recommending the acceptance of the plan outlined, was adopted.

The portion of the report on Inspection, Reports and Records was referred back to the committee for further consideration, at its request.

A topic considered by the committee, not mentioned in the report, was the length of flat spots on wheels. Chairman Greiner explained that the length of flat spots causing the rejection of a wheel by the rules of the M. C. B. Association is 2½ in. The effect of such a spot on a wheel under a 100,000-lbs. capacity car, moving at high speed, is very bad, and it has been recommended that the M. C. B. rule be changed to 1¾ in. The question has been considered by the Executive Committee of the M. C. B. Association and the subject referred to the Arbitration Committee of that association, with instructions to confer with a committee from the American Railway Engineering and Maintenance of Way Association. President Johnston designated the committee on Iron and Steel Structures to act in the matter.

A sub-committee was appointed, A. J. Himes (N. Y. C. & St. L.) being chairman, and he presented a progress report. At its conclusion he spoke of a design prepared by Prof. Benjamin, of Purdue University, for apparatus to determine the effect of flat spots. As the latter was present in the convention when the report was presented, the courtesy of the floor was extended to him for the purpose of describing the proposed method of test.

Ballasting.—The conclusion to this report, asking the adoption of the ballast sections for crushed rock, was accepted, after explanation by the chairman of the committee regarding the recommended change of slope from 1½ to 1, adopted last year to, 2 to 1

Wooden Bridges and Trestles.—This committee had framed a conclusion asking the approval of the Standard Specifications for Bridges and Trestle Timbers as good practice. But since its report was put in type, the announcement was received that on January 22 the Yellow Pine Manufacturers' Association adopted, with but slight modification, the Specifications for Structural Timber adopted September 1 by the American Society for Testing Materials. A committee was also appointed to confer with committees of the American Institute of Architects, the American Society for Testing Materials and of the Maintenance of Way Association for the purpose of reviewing the specifications and adjusting differences. This action indicates a desire to co-operate definitely in the effort to secure uniform specifications. Therefore the committee desired to withdraw its conclusion and asked that the work be allowed to go over for another year. The committee gave in the report the differences between its specifications and those reported by Committee Q of the American Society for Testing Materials. The list was as follows:

General Requirements Applying to Both Grades.

Committee Q allow dead timber to be used.

Committee Q have no specification regarding wind.

Committee Q allow sawing ¼ in. scant from given size, with loss in area of from 4½ to 10½ per cent.

Committee Q permit loose knots, except within 4 in. of the edge of stringers.

Committee Q permit knots in the corners of posts.

Grade No. 1.

Committee Q permit 5 per cent. less heart in stringers.

Committee Q permit knots over 2½ in. in stringers, if not within 4 in. of the edge.

Grade No. 2.

Committee Q require no limit to sap.

Committee Q do not give an alternative wane on two corners of stringers.

Committee Q allow knots up to 4 in. in 16-in. sides, and 3 in. in 12-in. sides, for stringers, caps and posts.

The convention was asked to discuss these differences in order that the committee might know its attitude relative to the various points of difference. The points were therefore taken up one at a time. Much time was occupied by this discussion. Dr. Herman von Schrenk, who is a member of the American Society for Testing Materials, as well as of the Maintenance of Way Association, was present, as was also Prof. Hatt, of Purdue University, and both gave full and valuable information on the points discussed. The net result of the discussion was that the convention expressed agreement with Committee Q on three of the five points under the first heading—General Requirements Applying to Both Grades—disagreeing on the first and fourth. It approved both points under the second heading, and disapproved the second and third points under the last heading.

The committee asked that the Revised Specifications for Piling be referred back for further consideration.

The matter in the report on Ballasted Floor Bridges was offered as information. The portion on Safe Unit Stresses was offered as a progress report, as was also the portion on the Preservation of Structural Timber.

A list of standard names for structural timbers was submitted, being the same as submitted last year. No change was made from the previous year, it having been decided from the year's investigations that no change was justified. In discussing the difficulty of distinguishing long-leaf, short-leaf and loblolly pine, Dr. Van Schrenk exhibited a number of samples of the last named, which, while true loblolly, in some cases were impossible to distinguish from other kinds of pines.

Two definitions were adopted, as follows:

(16) Ring Shake.—An opening between annual rings.

(17) Through Shake.—A shake which extends between two faces of a timber.

Track.—The first conclusion recommended that the elements of the split switch turnout from a tangent be computed according to the formulæ given in the report and as indicated by the table which had been worked out for various kinds of frogs. Objection was made that the formulæ contained errors; it was also suggested that the frog angle should be deduced from the sine rather than the tangent. A motion was therefore made that the frog angle be determined by twice the sine of half the angle divided into the radius; but after some discussion it was put to a vote and lost.

Mr. Cushing objected to the table containing such a large number of switch rails, there being seven. He therefore moved that the conclusion be referred back to the committee.

Mr. Stevens (P. & R.) thought the committee's method of getting the switch angle would introduce an appreciable error, as it assumed the switch rail to come to a point. There were other objections to certain features of the table, and after considerable discussion of these points Mr. Cushing's motion to refer back was adopted.

Conclusion 2 asked the adoption of the design of reinforced split switch shown in the report. Mr. Cushing thought it would be better if the committee prepared a specification rather than individual designs, and other members supported this view. The discussion was extended, and ended in referring the conclusion back to the committee.

Conclusion 3, asking the adoption of the frog design, was likewise referred back. The chairman of the committee called attention to the fact that the design showed a bolt at the end of the rigid wing rail, and he expressed the hope that members would incorporate this in their frog practice, as it would save money and much tightening of bolts. Some slight criticism of the design was offered before it was referred back.

Conclusion 4 was on the guard rail. The principal point of discussion was the clearance, which was put at 1⅞ in. The American Railway Association standard is 1¾ in., although many roads use 1⅞ in. Some members were in favor of making 1⅞ in. the standard of this association. It was pointed out, however, that this should not be done without conferring with the M. C. B. Association, as the latter's standard gage-points are made for a 1¾-in. clearance, and this, of course, is supported by the American Railway Association. A motion in favor of the 1⅞-in. distance was lost and the conclusion was referred back to the committee.

Nos. 5 and 6 were passed and No. 7 taken up. This had reference to the widening of gage on curves. The chairman explained that there was an error in the table calculations. The tables were therefore received as information. Mr. Ewing asked the committee what was the maximum excess gage it would be safe to have. The committee was unable to say, stating that it would be necessary to make some experiments on the effects of four-wheel trucks on widened gage before they would know.

Rail.—The committee asked the adoption of the conclusion to the report, which recommended the adoption of the form M. W. 1200 for reporting rail failures.

Mr. Cushing had made to the committee some suggestions for rearrangement of the form, and while these were not presented to the convention, he requested that they go into the Proceedings as a part of the discussion The conclusion offered by the committee was adopted.

Yards and Terminals.—The Recommended Principles of Practice for hump yards were taken up first. As the first ten of these were practically the same as already indorsed and published in the Manual, they were passed without discussion, except No 8, which provided for an air-brake testing plant in the departure yard Mr. Rhea (Penna. Lines West) told of a plant being put in the receiving yard of the P., C., C. & St L. at Logansport, Ind., at the request of the master mechanic, and they are well satisfied with it. After some explanation of the advantages derived, he made a motion that the conclusion be amended to include the receiving yard as well as the departure yard. The motion was adopted.

Conclusion 10, specifying the grades for the hump, was adopted, as were Nos. 11 and 12 Some members asked if the latter conclusion meant raising and lowering the track for winter and summer conditions. The chairman explained that it merely recognized that a higher hump is needed in winter, and where a hump is built for summer conditions it is necessary to raise it for winter conditions.

In No. 13, providing for a track scale, a space of 30 to 40 ft. was recommended as the distance it should be put from the summit. Objection was raised to this distance, some members thinking 90 ft. was better. A motion to strike out the reference to distance was carried, the conclusion then being adopted without other change.

No. 11, recommending that a No. 8 frog be the sharpest used in classification yards, was adopted.

The report stated that it had been suggested to the committee that 1,200 cars to be classified in 24 hours should be the minimum limit in a hump yard. Mr. Pfeifer (T. R. R. of St. L.), of the committee, who had made the suggestion, explained that hump yards require large switching crews on account of the great number of riders. A crew sometimes contains 18 or more men. Such a crew, to be economical, must be employed constantly. If there are fewer cars than that to be switched, the rate of switching will leave a large amount of idle time on their hands. His company has on its lines an ordinary gravity yard in which from 60 to 70 cars can be switched with a crew of three switchmen and an engineer and fireman. They have switched as many as 1,100 cars in one day, and the car breakage is not excessive. Having switched the cars that ought to be switched, a small crew can do some other yard work in addition to classifying, but there is no other kind of yard work which would require such a large crew. It was, therefore, as a measure of operating economy that the suggestion was made.

The conclusions on Yard Lighting were adopted without discussion, and also those on Freight Transfer Stations. However, questions were asked about the last one of the latter, reading, "where large amounts of freight are to be transferred, the use of power-driven covered traveling platforms, instead of fixed platforms, is suggested." The committee stated that, so far as they knew, no such installation had ever been made, except that something of the sort had been used as an emergency measure and worked well. It was therefore thought well to submit the idea to the association.

It was decided that this conclusion, and the one following it recommending freight handling machinery as being worthy of consideration, should be omitted from the Manual of Recommended Practice.

Roadway.—The conclusions on grade and curve improvement work inside cities, such as track elevation and depression, were considered first.

The first was on Organization. Objection was made to the provision of a special trainmaster and despatcher, as it was thought such matters could be handled better by the regular officers. The committee explained that it was the intention that the work should be handled entirely separately from the regular operation, assuming, of course, that it was large enough to justify such an organization; this had reference only to the territory covered by the work, as stated in the conclusion. The conclusion was therefore amended to have this part read: "A trainmaster, with a despatcher, in charge of the operation of traffic over the territory covered by the work in hand, may sometimes be required." With this change the conclusion was adopted.

No. 2 related to the handling of the work. J. A. Atwood (P. & L. E.) suggested that the paragraph should only distinguish between the work to be done by the company and that to be done by contract, omitting any reference in detail to the kind of work. He therefore moved to amend the conclusion by striking out such references, making it read:

"(2) The railroad company should handle with its own force all work which may interfere with the operation of the road. All other work which can be done without material interference with the operation of the railroad may be let by contract."

No. 3, reading "As far as practicable, all earthwork should be handled by machinery; that is, loaded by steam shovels and unloaded by plows, handled by cable unloaders and moved by spreaders," was amended by striking out everything after "machinery."

Objection was made to No. 4—"The best material to use for filling is sand"—on the ground that it was too sweeping to go into the Manual, which goes to all countries. And while it was admitted that sand unquestionably is the best material, it would be better to name the qualities which the best material should possess. Mr. Byers (Mo. P.) therefore moved to substitute for No. 4 the following: "The best material to use for filling is that which combines low first cost, ease of handling and stability."

This was adopted.

The last two were adopted without discussion.

Grade and Curve Improvement Work Outside Cities was next considered, there being nine conclusions. No. 1, reading "Establish the lowest gradient and lightest curvature which physical conditions and the present and prospective business of the road will admit," was adopted after changing "admit" to "warrant."

Nos. 2, 3 and 4 were adopted without change. No. 5, reading "Eliminate temporary bridges, etc., by the substitution of permanent structures in concrete and steel, wherever it can be done, having in view the formation of a continuous roadway on ballast," was amended by striking out everything after "structures."

No. 6 was accepted without change, and No. 7, which read "Provide separate tracks for work and traffic, wherever it can be done," was changed to read "Provide separate tracks for work and traffic where conditions warrant."

No. 8 was not changed. No. 9 was on organization: "The simplest organization is the best. Some one man should be in responsible charge of the work, with a staff of engineers under him, and enough supervisors to cover the work, who have full control of men, material and means for each section, with foreman and gangs wherever needed." The last nine words after "means" were changed to "necessary for the sections respectively under their charge," and the conclusion adopted.

Some criticism of the form of the conclusions was offered during the discussion. After their adoption by the convention the following resolution, offered by Mr. McDonald (N. C. & St. L.), was adopted: "Resolved that the committee be requested to recast the language of the conclusions so as to make them suggestive instead of mandatory, before publication in the Manual."

Masonry.—The committee had been instructed to revise the specifications for stone masonry and present them for final approval. As the changes made were slight, the specifications were indorsed by the convention without reading. No other matters in the report were considered.

Records, Reports and Accounts.—The conclusions on right-of-way maps were considered first.

The definition was adopted with one slight change in wording.

Conclusion No. 1 was adopted after adding the portion printed below in italics, and omitting the word "all" before "permanent."

(1) Right-of-way maps should show the state, county, township, town or city; the right-of-way alinement complete, *with particular reference to, and with suitable notation of, short and long stations;* the station plusses of the crossing of all important land or property lines and streets, with the distance to all permanent land or street corners; the angle which the center line of the road makes with property lines; the number of the right-of-way sheet; the points of the compass; the scale and date of the map; the boundaries of the several parts of the land owned by the company, and the width of the right of way, particularly at those points where the widths change; any additions of subdivisions of towns or cities, with numbers and sizes of lots and blocks and names of streets. It should also show all main tracks, side tracks and structures that were built in connection with the original construction of the road; the exact location of all crossings of steam, electric or other roads.

Conclusion No. 2 read: "On or near each part of the land on the right-hand side of each map should be shown the deed custodian's number; the name of grantor and grantee; mile posts, kind of instrument, date and book and page where recorded. This also includes reference to leases, franchises, ordinances and grants concerning the use of land." The words "references to" were inserted before mile posts.

No. 3 was amended by striking out the last six words of the following, as indicated by brackets:

(3) The original right-of-way map should be traced, and the tracing filed away for a permanent record of the conditions existing at the time the railroad was completed. The map from which this tracing is made should be corrected from time to time as changes are made in important tracks and structures which are of value as reference to the right-of-way boundaries, as well as any transfers of property made to and from the railroad company [and any important tracks or structures].

No. 4 was likewise amended by striking out the final six words:

(4) The property of adjacent railroads or of subsidiary and associated companies should be shown in different colors [for the purpose of ready distinction].

No. 5 was amended by striking out the portion shown in brackets:

(5) It is important to show on the original right-of-way map a profile of the same horizontal scale and of the same station numbers as the map, and of suitable vertical scale, which profile should show the original sub-grade, the location, character and size of opening of each bridge, waterway or under crossing and the original surface of the ground [the necessity for this being the knowledge of physical conditions at the time the road was built, often needed in defending litigation and settling questions arising from time to time].

No. 6 was adopted without change. An effort was made to have definite scales stated in this conclusion. The chairman of the committee explained, however, that, after a thorough consideration of the matter in the light of information concerning what scales it was practicable and impracticable to use in different parts of the country, it would be impossible to recommend a scale that would meet the views of a majority of the members.

The conclusions on track maps were amended as follows:

Definition: "Track Map.—A map used primarily for showing physical conditions, including tracks, bridges, buildings, water service and mains, leases, station facilities and all of the physical and operating features."

The word "existing" was inserted ahead of "physical conditions" and "other" substituted for "all of the" in the latter part.

Several changes were made in the first conclusion.

(1) Track maps should show all physical conditions pertaining to the construction and operation of the railroad and the limits of the right of way without reference to title or ownership. They should show all main and side tracks and their alinement, distance between them, capacity in car lengths; all buildings upon the right of way and adjacent to main or side tracks; bridges, culverts, water stations, coaling plants, turntables, shop buildings, water mains, electric light wires, fences, street car and other railroad crossings, and the angle they made with the railroad track; sewers, signals of all kinds and all physical conditions on the property. All structures on such maps should be located by chainage numbers and plusses.

"Physical" was struck out in the first line; "cars" was substituted for "car lengths"; for "electric light wires" the words "conduits, wire lines of all kinds and their supports" were substituted; in the last sentence "all" was changed to "important."

No. 2 was amended by striking out the portion shown in brackets:

(2) They should be corrected whenever any changes are made in any of the features shown thereon [and a corrected copy sent to the general office for record].

No. 3 was amended by striking out the words "and cities."

(3) It is recommended that a scale of 100 ft. to the inch be used for such maps except in territories and cities of large industrial development, where varying scales may be used to suit the local conditions.

No. 4 was amended by striking out "very" and substituting "meridian" for "north point."

(4) The map should show very plainly the north point, scale, original date and date corrected.

No. 5 was amended by striking out "always," "it is" and "to do so":

(5) The conventional signs adopted by the association should always be used where it is possible and convenient to do so.

Mr. McDonald (N. C. & St. L.) asked if on maps of 100 ft. to the inch the tracks should be shown in double or single lines. The committee had not considered this and were instructed to make a suggestion concerning it in their next report.

Under Individual Ledger Accounts there were two conclusions asking the adoption of the forms recommended. These conclusions were adopted, following suitable explanation by the chairman of the committee concerning the forms.

Ties.—There were two conclusions to this report which were adopted without discussion. They were:

(1) That the method for analysis of coal-tar creosote shown on pages 98-101 of Bulletin 96 be approved as good practice.

(2) That the method of determination of zinc in treated timbers shown on pages 102-105 of Bulletin 96 be approved as good practice.

The committee on Signs, Fences, Crossings and Cattle Guards and Economics of Railway Location made progress reports.

Car Surpluses and Shortages, March 4.

The following table is from bulletin No. 19 of the American Railway Association's Committee on Car Efficiency. It summarizes the car surpluses and shortages from October 30, 1907, every two weeks to March 4, 1908, inclusive, being similar to the table published in the *Railroad Gazette* of February 21, 1908, with the figures for February 5 revised to include reports later received.

The improvement in the general situation first noted on February 19, 1908, is continued. On March 4 there was a further reduction of 7,521 cars in the idle equipment, making a total decrease in the idle cars since February 5 of 28,936 cars, or 8.4 per cent. On February 19 there was a marked improvement in the demand for coal cars, but this appears to have been checked, and on March 4 there was a slight increase in the surpluses of this class of equipment. On the other hand, there is an encouraging reduction in the number of surplus box cars. There is a fair decrease in the surplus flat cars, while the surplus of miscellaneous cars remains little changed. It is worthy of note that every marked change in the situation since the maximum shortage of October 30, 1907, has first shown itself in the figures for box cars.

The greatest percentage of decrease of surplus equipment was in the Canadian group, although the largest numerical reduction was in the Northwestern group. Both of these groups report smaller surpluses of all classes of cars. On the other hand, there was a continued increase in the surpluses in the Southern, Central, Western and Southwestern groups. The Middle group, although showing less surplus box and flat cars, reports an increase of idle coal and gondola cars which more than offsets the decreases, making a net increase in the total surplus of all classes of cars for that section.

Surpluses and Shortages Bi-Weekly from Oct. 30, 1907.

	Number of roads.	Surpluses. Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Shortages. Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
March 4, 1908	162	103,905	27,232	139,223	44,632	314,992	943	19	600	57	1,619
February 19, 1908	161	113,776	30,088	134,217	44,432	322,513	697	141	249	162	1,249
February 5, 1908	158	112,046	30,312	156,634	44,936	343,928	737	281	15	67	1,100
January 22, 1908	161	124,622	27,328	142,338	48,292	342,580	392	132	79	135	738
January 8, 1908	163	149,664	23,087	127,138	41,874	341,763	457	34	42	120	653
December 24, 1907	158	87,714	14,740	64,556	42,300	209,310	187	81	191	265	724
December 11, 1907	153	48,977	9,888	27 462	33,012	119,339	2,506	420	746	848	4,520
November 27, 1907	160	16,246	3,645	10,028	10,429	10,348	11,908	868	2,961	2,224	17,964
November 13, 1907	164	4,103	1,208	2,365	4,525	12,201	37,473	3,066	10,914	5,550	57,003
October 30, 1907	161	786	600	1,285	1,275	3,946	61,592	3,546	15,987	9,632	90,757

The Strength and Endurance of Steel Rails.*

BY JAMES E. HOWARD,
Engineer of Tests, Watertown Arsenal.

In the use of steel rails, as with other materials of construction, interest is directed to the limiting values of applied stresses, their accurate definition, and how closely they may be approached with safety under those conditions of service to which the materials in question are to be subjected. In the constructive arts are found examples of steel exposed to stresses of different kinds and in varying degrees of intensity, but it is not recalled where there is greater diversity of action than is found in the case of steel rails. The whole gamut of conditions are here present in the same piece of metal; and an unusual feature is the fact that the stresses are received on so limited an area of contact on the rail head. The feature of intense local pressure between the wheels and the rail is an important one, and one which does not allow the adoption of those corrective measures which can be applied to other features of the rail question.

Tests have been made on rails at the Watertown Arsenal Laboratory in earlier years. At present a series is in progress which was begun in connection with the current study of ingots and derivative shapes. The laboratory is co-operating with, and is being aided by, members of this association and others.

In the earlier work of the laboratory, the tests comprised rails of domestic manufacture, some of the early English rails, and one or two examples of French and German make. Many of these had been in service. The tests showed that rails from the track were generally less tough when loaded so that the head was in tension; in fact, they were quite brittle, and fractured after comparatively little permanent deflection. By planing off metal from the running surface of the head, the rail was restored to a tough condition, and then bent well with either the head or the base on the tension side. Planing off one-eighth inch of metal was sufficient, but it was necessary to remove all of the affected metal, which included some from the sides as well as that from the top of the head. Restoration of toughness was also accomplished by annealing the rail, without planing off any of the metal.

This loss in toughness is due to the flow of metal under wheel pressures. It will, of course, take place promptly and quite easily in the softer grades of steel. From this point of view, a soft steel has the disadvantage of low strength and is not free from brittleness, in spite of the inherent toughness of the metal. The original properties of such steel are apt to be misleading and encourage greater confidence in its ductility than is warranted by its subsequent behavior. It does not follow, however, that the initially harder steels will not also become more brittle at the running surface of the head of the rail, since all grades of steel are probably affected in this manner by wheel pressures under present practice. It is not known whether present service conditions are such as to allow the metal at the surface of the head of the rail to retain its original tensile properties unimpaired until lost by abrasion and wear. In the harder rails, the depth of the affected metal is thought to be less than in the softer rails; still, the depth is appreciable and has an influence on the toughness of the steel.

Loss of ductility is due to the flow of the metal of the surface of the head and not directly to the high compressive stress between the wheel and the rail. Other tests have shown that high compressive stresses unaccompanied by relative displacement of the metal do not change the physical properties as evidenced by subsequent ten-

*A paper presented at the ninth annual meeting of the Am[illegible] R[illegible] Engineering and Maintenance of Way Association. Read [illegible] Bridge Engineer, Boston & Maine sion tests. High compressive stresses of this kind may be applied in tests by cubic compression, specimens being immersed and subjected to hydrostatic pressure up to 100,000 lbs. per square inch.

Alternate tension and compression tests have shown that overstraining in either direction lowers the opposite elastic limit, that is, a tension load applied in excess of the elastic limit has a detrimental effect on the compressive elastic limit, materially lowering the latter value. On making similar tests with rails, but loading them transversely instead of by direct tension and compression, it was found that the application of a high load—one causing decided permanent sets—resulted in lowering the elastic limit of the rail when it was reversed in position and loaded in the opposite direction. Examination of a rail 11 months later did not show a restoration from this disturbed state during the interval of rest. Repeated reversals resulted in lessening the magnitude of the deflection sets, over the first sets, an effect which would pass as a stiffening of the rail, in common parlance, although the modulus of elasticity of the steel is lowered by over-straining of the metal. Bringing the metal to a red heat brought about a partial restoration, but did not fully return the rail to its original condition as regards the development of sets. The effect on the surfacing of the track from overloading a rail is apparent from these results.

Since the cold straightening of a rail at the time of manufacture is another illustration of loading beyond its elastic limit, similar results to the above are certain to follow. A rail thus straightened is left with initial strains in equilibrium when the rail is without a load, but such as to develop sets in the track upon the application of very moderate loads. The opposing internal strains augment the effects of the wheel loads and facilitate early sets. Surfaces of metal first to cool from higher temperatures are left under initial compression, and this tends to further complicate the condition of the rail.

The lines of magnetic scale which leave the rail in the vicinity of the gagged parts show where the steel has been overstrained locally. Unless the metal is structurally unsound in the paths of such lines, no unfavorable results of the gagging would be immediately expected. The number and magnitude of repeated stresses necessary to cause rupture of the steel would be such as to relieve anxiety as to early failure of the rail from this cause, although this action, such as it is, is detrimental. While a given effect is more easily produced in a soft steel rail than in a hard one, on account of the difference in strength, yet a slight defect existing in the hard metal is of greater consequence than in the softer metal.

Seemingly minor and accidental causes may lead to early rupture. Some are so slight as the abrasion of the base by a spike or an indentation of the flange by a chance hammer blow.

In deciding on the cause of rupture, the line of fracture should be traced back to its beginning. Fortunately in steel fractures this may generally be done. A well defined nucleus marks the origin of a granular fracture, from which a fan-like or radiating pattern diverges. It is usually possible also to tell the order in which the fractures occurred, when more than one surface is presented, by inspecting the fractures and noting their appearances as above indicated. In this way rail fractures might be exhibited in which the first break detached a moon-shaped fragment from one flange, having its origin near the middle of the base, followed by a secondary fracture separating the other flange and extending up through the web and then through the head, fractures beginning at one edge of the flange, extending across the base and thence through the rest of the rail; fractures beginning at a bolt hole and extending each way until the fracture is complete, or fractures having their origin at the running surface of the head and extending downward through the rail.

The flow of the metal under wheel pressures is one of the most important of the causes of fractures. Whatever may be done to strengthen the rail in other respects, the fact still remains that the load is applied on a very limited surface of contact. This obstacle is insuperable and imposes a limit on the size of concentrated wheel loads.

The influences enumerated tend to develop fractures in rails structurally sound and with good physical properties, but it is recognized that rails are not always free from structural defects, although they may have satisfactory tensile properties. Some of these defects are serious and apparently have led to a considerable number of fractures in recent years. It has been found in a number of rails examined that longitudinal streaks are present in both the head and in the base, streaks of a different color from the adjacent metal as they appear when etched with tincture of iodine. Some of

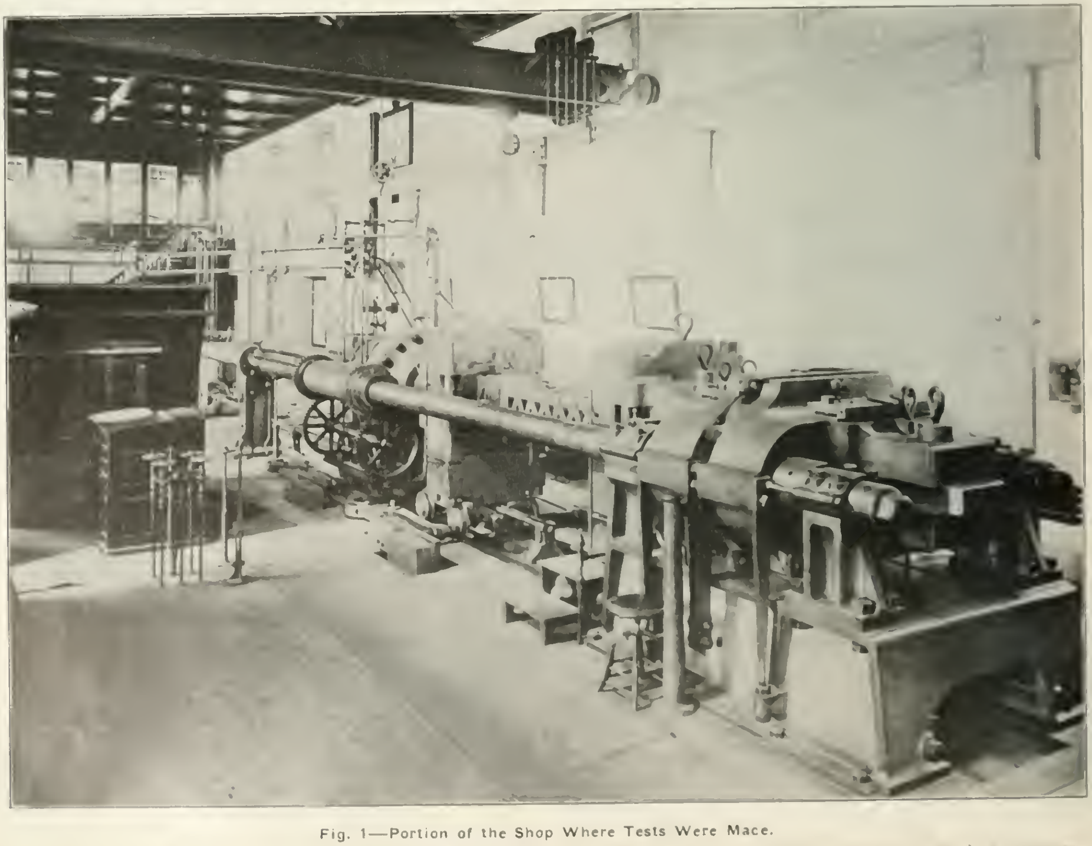


Fig. 1—Portion of the Shop Where Tests Were Mace.

In front is the old Emery testing machine of 800,000 lbs. capacity. There is a latticed column in the machine arranged for a test by compression.

the streaks are several feet long, others a few inches or only a fraction of an inch in length. They are of different widths, from a few hundredths of an inch to upwards of an eighth of an inch, and not infrequently have a fine hair line or crack along the middle. The cracks are commonly short, less than an inch, and in depth penetrating the metal but a few hundredths of an inch. They are, in some rails, quite numerous, and in planing the metal away for examination new hair lines appear in succession as those first in view are planed away. The steel fractures without elongation when ruptured by stresses applied at right angles to the direction of the cracks. That the streaks represent lines of weakness there is hardly a doubt, and their elimination, if practicable, is desirable and would be of advantage to the rails. The development of moon-shaped fractures may be traced to streaks or hair cracks in the rail at or near the surface of the base. It is of deep interest to discover the causes of these lines of structural unsoundness or lack of continuity and the means by which they may be avoided, if such is possible.

These streaks and fissures are not a recent development. They are found in rails of early manufacture, and even more pronounced than is general in rails of current make. Examination of a number of early English rails shows streaks and fine cracks. They have been found in rails of domestic make from different mills, and in a sufficient number to show that their presence is not restricted to any particular make. It does not seem, however, that all rails from the same mill are equally affected. There are wide differences among them, although it may be difficult to find those which are strictly sound throughout.

There is urgent need of information as to the state of the metal in the ingot and through each successive stage to the finished rail. In this inquiry, all the metal from the several ingots comprised in the series of tests should be available for examination. This has reference to the metal usually discarded from the ingot, and to crop ends of the rails, which should be comprised in the tests as well as the portions of the ingots made use of in the rails.

These rail tests are included in the general series of ingots and derivative shapes, previously mentioned, in which the laboratory is aided by the following committee: Major C. B. Wheeler, Commanding Officer, Watertown Arsenal (ex-officio); J. E. Howard, Engineer of Tests, Watertown Arsenal (ex-officio); William R. Webster, Consulting Engineer; Edgar Marburg, Professor of Civil Engineering, University of Pennsylvania; James Christie, Consulting Engineer; Charles B. Dudley, Chemist, Pennsylvania Railroad; E. P. Kenney, Metallurgical Engineer, Cambria Steel Co.; J. P. Snow, Bridge Engineer, Boston & Maine; A. A. Stevenson, Superintendent, Stan-

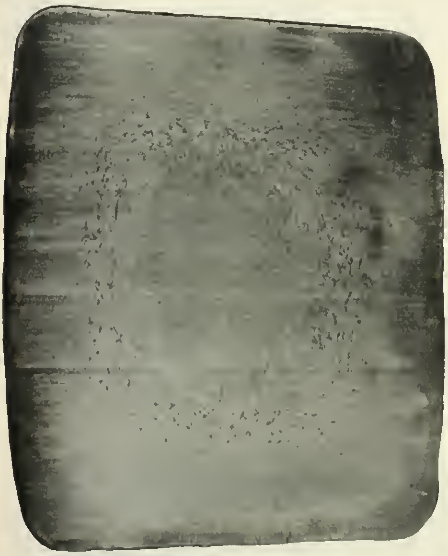


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 2. Section of an 8 in. x 8 in. bloom (view is foreshortened). The spotted circle of darker marking will be noticed. Bloom was reduced from ingot about 20 in. square. Section of the ingot before reduction was examined, but no markings such as are shown on the blooms were brought out by etching. Fig. 3. Subsequent stage in the reduction of a portion of same bloom, in the roughing rolls. Fig. 4. Still further reduction in the roughing rolls, markings in cross-section becoming a little more pronounced. Fig. 5. Cross-section of finished rail from same ingot. The familiar lines often seen in rails are shown on this section.

Fig. 6.

Fig. 7.

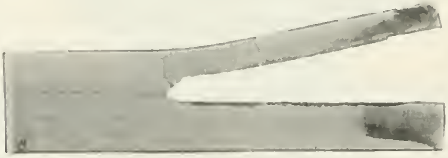


Fig. 8.

Fig. 9.

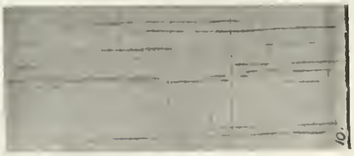


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 6. Cross section of 100-lb. rail. Familiar markings brought out by etching are here shown as in the earlier slide. To find out how bending qualities of the metal at these dark streaks and patches compared with the lighter portions of the metal, a thin section of the rail, taken in cross section was slotted off and bent along the lines of the dark streaks and over the patches. Fig. 7. Results of bending the thin section are here shown, but imperfectly because of the deflection of light. On bending these thin strips, fractures occurred more easily over the dark streaks and patches than over the white portions. The section of the web was bent about a vertical axis and rupture occurred along one of the dark streaks. The edges of the top side of the base were bent over where dark blotches occurred and fracture occurred in these blotches. The head was also bent about a vertical axis and it ruptured in the dark lines.

Fig. 8. Web of a rail in horizontal section, looking down on the central streak. The streak of dark metal extended through the depth of a piece of web which was cut off. Structural weakness along this dark streak was not enough, however, to allow the section to be split along the streak. The specimen was sawed into and on wedging the prongs of the forked-shaped end apart, the metal fractured transversely instead of splitting along the streak. Fig. 9. Shows some streaks and hair lines on the head of the 100-lb rail. Lines run longitudinally. Rail was prepared by planing off about 1/16 in. from running surface of head, smoothing the metal with file and emery cloth, and then etching with tincture of iodine. Fig. 10. Short section of base of same rail. Dark lines run longitudinally, as, in fact, all such lines run. Finer lines running crosswise are those left by the machine tool or the file. Fig. 11. Photograph of a part of the head of the rail shown in Fig. 21. Streaks here shown are typical white streaks. Along the middle of some of these streaks, hair lines or cracks are evident, in which there is plainly a separation of the metal. In all white streaks examined with a high-power microscope, cracks at some points are found. A well-defined crack will usually pinch out to a series of very short cracks, exactly in line, but perhaps only a few hundredths of an inch long. After these there may occur clusters of minute holes, four or five together, hardly discernible under 200 diameters. Following this, the white streak will show, looking like a pathway irregularly strewn with light-colored gravel. The white specks are not rounded, but seem to be little chips, which might be cut by the polishing grit and caught on the fibers of the adjacent steel. The white metal looks softer than the ordinary metal surrounding it. This, however, may be only an appearance. Fig. 12. Streaks in head of early rail made by the Landore Siemens Co. They appear to be of the dark variety. Fig. 13. Base of same Landore Siemens rail.

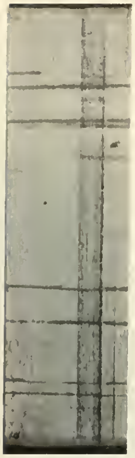


Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

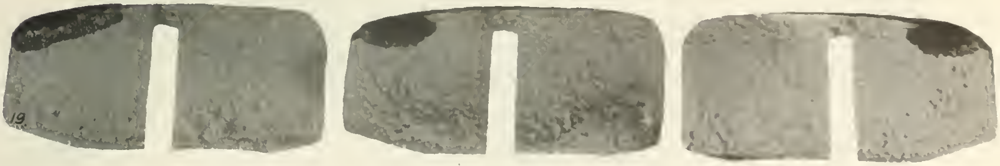


Fig. 19.

Fig. 14. Streaks in base of a John Brown rail (early English). This and preceding illustrations may be taken as typical of common longitudinal streaks. Though those selected show more streaks than others, streaks are certainly very common, and no rails have yet been found entirely free from them. Some rails which had given good service and had a good track record had fewer streaks than those which had failed in service. Moon shaped fractures appear to originate in streaks like those just shown in the bases of rails. Fig. 15. Fractured rail, 5 in. 75 lb., which failed in track after nine years of service. Evidently a moon-shaped fracture. A piece was first detached from the flange, followed by a second fracture through the other flange and the rest of the rail. A radiating structure will be noticed in the fracture. The center of radiation marks the origin of the fracture. The primary fracture was clearly the one extending not quite half the width of the base. Fig. 16. Rail fractured in testing machine. Shows how slight indentation of the metal may locate fracture when tested to destruction. A chance hammer blow had slightly indented the upper right hand edge of the flange. From this the fracture began. The radiating structure could be traced on the rail itself, but this is more obscure on the photograph. Fig. 17. Two pieces of rails, after testing. Both tests made from same rail, which had been some time in service. Effects of wheel pressures shown by flow of metal on the sides of the head. Tests show difference in strength which may be expected when a worn rail is loaded with the base in tension or the head in tension. The upper piece, loaded with the base in tension, sustained a maximum fiber stress of 146,700 lbs. per sq. in.; the lower piece, with the head in tension, ruptured with fiber stress of 110,900 lbs. per sq. in. Lower piece deflected only 4½ deg. and ruptured; other bent 21 deg., the test being discontinued without rupture. Illustrates serious damage to the rail from flow of metal under wheel pressures. Fig. 18. Rail in which the running surface of the head has been seriously affected by the skidding of engine wheels. Effect of the drivers is to cause flow of the metal of the head, and also cause the development of transverse fractures at the corners of the head. Fig. 19. Fractures of the head of [illegible] rails (Fig. 18); incipient cracks, due to effect of wheels, shown by dark spots at the corners of the running surface. These cracks appear to indicate the limit of heavy loads for rails made of carbon steel.

dard Steel Works, S. M. Vauclain, Baldwin Locomotive Works, F. W. Wood, President Maryland Steel Works.

A number of lantern slides, prepared to illustrate some of the current work of the Watertown laboratory were presented and are reproduced herewith.

After exhibiting the slides, Mr. Snow discussed the probable cause of rail breakages, saying: The specimen which I now show you is the one shown by the last slide exhibited (Fig. 21). It has been planed, as you see, to different depths in the head and in the base. The surface where the planing is shallow shows prominent white streaks; one portion of the head being that shown on slide No. 11. White streaks appear in the deeper cuts, but they are generally not in line with those above, showing that they are diffused throughout the metal. As we get deeper into the metal, however, white streaks become scarce and finally disappear, but in this particular specimen the deeper cuts show dark streaks. These are not so definite in their widths as the white streaks, but they penetrate the metal somewhat more deeply, and show in the end section of the rail, whereas the white streaks do not show in this location. White streaks with their accompanying cracks lead to flange breaks and, perhaps, to split heads. Dark streaks appear to be the results of segregation and lead to crushing of the head. In addition to these two kinds of streaks, there is another defect which is not in evidence on this specimen, but which is very common in the rails rolled during recent years. I have previously called the cracks found in white streaks "gas seams." I called the defects which I am now describing "rolling flaws." The cracks of the gas seams are strictly parallel to the line of rolling and are straight. The plane of the cracks is, also, at right angles to the surface of the metal. The seams called rolling flaws are parallel to the rolling in a general way, but are usually somewhat crooked. They are similar to the flaws called snakes in plates, but in the case of rails, they are practically straight. The planes of these seams are generally inclined to the surface of the metal and their sides are fluted and usually of a bluish color, similar to mill scale, indicating that they were oxidized while the metal was hot.

The crescent fractures that I have examined have almost all shown their origin to be one of these rolling flaws, although occasionally the origin seems to be a gas seam, but my observation leads me to think that by far the largest number of recent breaks are due to seams of the rolling flaw type. The older rails examined, while they show plenty of white and dark streaks, do not exhibit the defects which I call rolling flaws; this, undoubtedly, accounting for the greater prevalence of flange breaks and split heads in rails of recent make.

In view of the fact that in all of the crescent breaks which I have examined—and that is a good many—it has always been possible to discover a manifest flaw from which the break started, and from the fact that Mr. Howard in his paper claims that this class of breaks are due to seams which are in the rails when they leave the mill, I claim that the case is fully proved that flange breaks, and perhaps split heads, are due to incipient flaws existing in the rails when purchased. It is a remarkable fact that the rail tests prescribed in our specifications do not in any way tend to develop these defects. I wish to recommend that tests be prescribed which will show whether or not these flaws exist.

Perhaps I ought to rest my case here, as it is all that has been fully proved. The temptation is strong, however, to make guesses as to what causes these defects. I stated, in a paper printed in Bulletin No. 93, that in my opinion the flaws here called gas seams were due to gas bubbles in the ingot. I still think so, but the flaws which I call rolling flaws appear to me to be due to shrinkage cracks, or checks in the ingots, or tears in the bloom, or perhaps the gas holes which are so near the surface of the ingot as to burst out in the soaking pit, due to softening the metal, or afterwards under the pressure of the blooming rolls.

If we go a little farther and try to investigate the cause of gas bubbles in the ingot, we get on more uncertain ground. Professor Howe, of Columbia University, claims they are largely due to mechanical action, the shrinking of the interior of the ingot tending to cause tension in the plastic metal, thereby relieving the pressure and allowing the formation of gas bubbles. The metallurgist of the Chicago Steel Co., Mr. Von Maltitz, in a paper read before the London meeting of the American Institute of Mining Engineers,

Fig. 20.

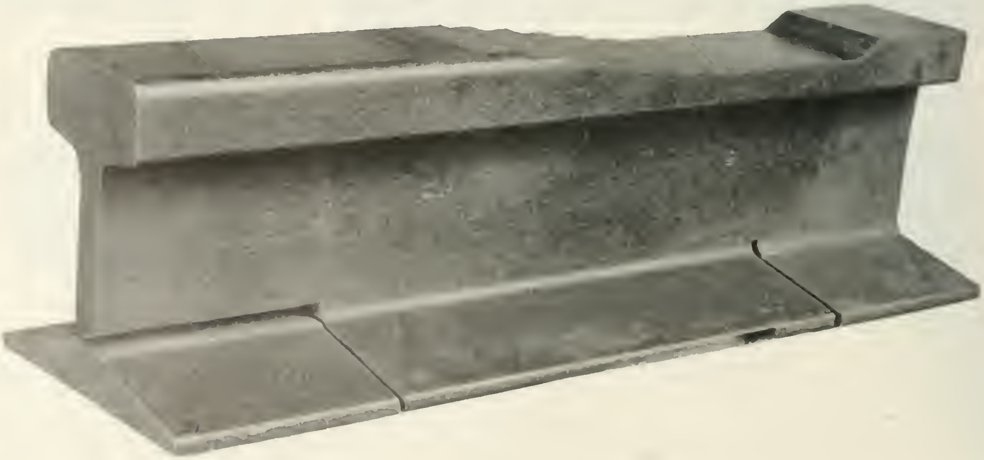


Fig. 21.

Fig. 20. View of crude side of a rail, showing moon shaped fracture made in testing machine. It was just beyond one which had been caused while rail was in track. The base of this rail showed characteristic streaks, such as were previously illustrated. Fig. 21. Piece of rail which has been planed down in successive steps, to show the presence of streaks at different depths in the head. The base of this rail was also examined and a section of the flange subjected to cross bending, the cross bending resulting in a brittle fracture along the line of a streak.

claims that they are wholly due to chemical and thermic action. Both of these investigators prescribe means of lessening the difficulty.

As to the cause of the cracks, etc., which lead to rolling flaws, the remedy is self-evident. Chipping ingots and blooms, as was formerly done, will remedy the shrinkage cracks, checks and gas holes. Less severe reduction in the blooming and roughing rolls will obviate tears, provided the metal is not unduly hot—short from excess of oxygen or sulphur.

Mr. Howard is on the trail of these defects. We ought to encourage him all we can to trace them to their origin, whether it be in the rolling, the ingot, the ladle or the bath.

William R. Webster spoke as follows on the work of the committee:

"Professor Marburg and I were called in to assist in this work by the ordnance bureau, and in order to make it representative work we had a meeting last October in New York, to which we invited about 40 engineers and manufacturers to meet Major Ruggles and Mr. Howard, of the Watertown Arsenal. Dr. Dudley, of the Pennsylvania Railroad, presided. Dr. Dudley was given authority by the meeting to appoint two committees, one committee on the compression tests and the other on the investigation of ingots, blooms, billets and slabs. The whole matter was brought up originally by a report of Mr. Howard to the ordnance bureau, suggesting an investigation of this kind and asking for a larger appropriation. The appropriation for this year's work is about $35,000, or about twice the amount received before. I am glad to say that both of the committees have fairly started on their work, and that there has been no red tape or anything of that kind to hinder us in the work. Some of the members of this association and some of the steel manufacturers are co-operating with us and furnishing freely samples of their material, including ingots and different finished products, and I have no doubt that other members and other manufacturers will call on them when they understand more clearly what they are doing at Watertown."

Mr. Howard sent me samples and wrote as follows:

"Mr. Snow will hand you a piece of the base of a rail which was fractured transversely and which shows a laminated streak of several hundredths of an inch in depth, and which occasioned a very short and brittle fracture. This piece was annealed before testing, for the purpose of seeing whether any reduction in brittleness could be effected by annealing the metal, but none resulted; that is, these streaks are a detriment, in spite of anything we can do toward softening the metal in which they exist.

"Another piece which Mr. Snow is kindly bringing out to you is a thin slice from the base of a 100-lb. rail. There were a number of streaks in one end of this sample. Bending transversely opened one of these seams you will see; the other end was also bent transversely and opened up some short cracks. When bent in the other direction, across the middle of the length of this piece, the bending qualities were much better and no fractures were caused. These two samples are the best I can do; they are not precisely what you may have preferred, but I did not have time to get out other pieces similar to those which we exhibited at the New York meeting."

A. A. Stevenson in discussing a paper by Mr. Howard before the American Institute of Mining Engineers at the February meeting, 1908, said:

"There is one very important point that I have not heard mentioned by Mr. Howard, and that is the question of the minimum amount of work. In the opinion of some of us there is too much work put upon steel at the present time and just as good results can be obtained by a lesser amount of work; in fact, maximum results may be obtained by a minimum amount of work on the material."

Planes of cleavage may be also developed by pressure in a material having no gas bubbles or other internal defects. The best illustration of this was given years ago by Professor Tindale in an article on the cleavage of roofing slates. He claimed that the planes of the cleavage in the slates were at right angles to the bedding and were caused by lateral pressure of the earth. To illustrate this he cast a cylinder of wax about 3 in. long and 3 in. in diameter and at the normal temperature compressed this cylinder to a cake about ⅜ in. thick. This was then cooled in a mixture of salt and ice and could be split like a piece of mica. In 1874 I repeated this experiment with similar results.

Many of us have known for years that there was a decided difference in the tensile strength and bending properties in transverse tests and longitudinal tests on pieces from universal steel plates; also that there was a much greater difference in similar test pieces cut from universal iron plates, but we did not appreciate the great difference in the strength and bending properties of the higher carbon rail steel as has been shown by Mr. Howard's paper to-night.

With this information before us it is not hard to account for rails with a shallow head failing by the side of the head breaking off in service in the plane of web, but it is the strongest plea for making a rail with a deep head and a good large fillet connecting the head to the web.

We are always going to have transverse weakness perceptible in steel rails and we should appreciate this in designing our rails and do the best we can with what we have to work with.

Preliminary Report of the Interstate Commerce Commission on Railroad Earnings.

"The preliminary report on the income and expenditures of operating railroads in the United States" for the year ended June 30, 1907, has been issued. It includes the results of operation of 894 operating companies, representing 225,584 miles, or approximately 99 per cent. of the mileage to be covered by the complete report.

There is given below the general summary of the earnings from operation and operating expenses of these companies for the year ended June 30, 1907, with comparisons for the eight preceding years:

Item.	Amount.	Proportion to total earnings.*	Per mile of line.									Increase, 1907 over 1906.
			1907.[1]	1906.[2]	1905.[3]	1904.[4]	1903.[5]	1902.[6]	1901.[7]	1900.[8]	1899.[9]	
Passenger service	$683,980,921	26.45	$3,032	$2,787	$2,647	$2,552	$2,492	$2,378	$2,194	$2,067	$1,928	$245
Freight service	1,826,209,111	70.62	8,095	7,403	6,710	6,519	6,539	6,056	5,741	5,466	4,895	692
Other earnings from operation	75,722,970	2.93	336	269	241	235	227	191	188	188	181	67
Unclassified earnings	....	.....	...	1	...	...	...[10]	...[10]	...[10]	1	1	1[11]
Total gross earnings	$2,585,913,002	100.00	$11,463	$10,460	$9,598	$9,306	$9,258	$8,625	$8,123	$7,722	$7,005	$1,003
Less operating expenses	1,746,097,122	67.52	7,740	6,912	6,409	6,308	6,125	5,577	5,269	4,993	4,570	828
Income from operation	$839,815,880	32.48	$3,723	$3,548	$3,189	$2,998	$3,133	$3,048	$2,854	$2,729	$2,135	$175

[1] 225,584 miles of line represented.
[2] 222,340 " " " "
[3] 216,974 " " " "
[4] 212,243 miles of line represented.
[5] 205,314 " " " "
[6] 200,154 " " " "
[7] 195,562 miles of line represented.
[8] 192,556 " " " "
[9] 187,535 " " " "
[10] Less than $1.
[11] Decrease.
* Per cent.

Exhibits at the Maintenance of Way Convention.

Each year for the past three or four years it has seemed that any further addition to the number of exhibitors at the Maintenance of Way convention would compel some change which would involve seeking new quarters. And still the number continues to grow and in some way they are crowded into the parlor floor and adjacent hallways and rooms of the Auditorium Hotel.

The Road and Track Supply Association held its annual meeting on Wednesday, March 18, and elected the following officers: President, George Stanton, Sales Manager, Cleveland Frog & Crossing Co., Cleveland, Ohio; Vice-President, W. F. Schleiter, Secretary, Dilworth, Porter & Co., Pittsburgh, Pa.; Secretary and Treasurer, J. N. Reynolds, Vice-President, The Wilson Co., Chicago; Executive Committee, John C. McKinnon, Secretary and General Manager, Kalamazoo Railway Supply Co., Kalamazoo, Mich.; J. H. Martin, Hussey-Binns Shovel Co., Pittsburgh, Pa.; William Goldie, Sr., William Goldie, Jr., & Co., West Bay City, Mich.; T. W. Snow, President, Otto Gas Engine Works, Chicago; Robert E. Belknap, Chicago Agent Pennsylvania Steel Co. and Maryland Steel Co., Chicago; Theodore Huss, Secretary and Treasurer, Lufkin Rule Co., Saginaw, Mich.

Following is a list of the exhibits:

Adams & Westlake Co., Chicago.—Samples of "Adlake" signal lamps and long-time burners.

Adreon & Co., St. Louis, Mo.—Model of "Security" combination rail brace and tie plate, main rail brace and switch-point slide plate. "Security" guard rail brace.

Allith Manufacturing Co., Chicago.—Full-sized door, showing application and operation of Allith adjustable door hanger.

American Casting Co., Birmingham, Ala.—Samples of "National" short length, light weight, cast iron culvert pipe.

American Flange Frog & Railway Improvement Co., Roanoke, Va.—Model of Graham flange frog.

American Guard Rail Fastener Co., Philadelphia.—The "Anchor" guard rail clamp; tie-plate guard rail fastener; pressed steel rail braces.

American Hoist & Derrick Co., St. Paul.—Photographs of "American" railroad ditchers.

American Nut & Bolt Fastener Co., Pittsburgh.—Samples of Bartley nut and bolt fasteners.

American Railway Tie & Girder Co., Pittsburgh.—Model of Duff continuous longitudinal steel track structure.

American Steel & Wire Co., Chicago.—Samples of steel wire fence; concrete reinforcement; rail bonds.

American Valve & Meter Co., Cincinnati, Ohio.—"Economy" switch stands, and model of track and switch showing operation of Anderson interlocking switchstand; Poage water columns and tank fixtures.

Asbestos Protected Metal Co., Canton, Mass.—Samples of asbestos protected metal for roofing and siding, and model of Robertson standard car roof.

Atlantic Equipment Co., New York.—Photographs of "Atlantic" st[illegible] shovels and [illegible] locomotive [illegible] steam and electric locomotives.

Atlas Railway Supply Co., Chicago.—Atlas rail [illegible] braces and tie plates, including the Atlas insulated and compromise joint; Atlas switchstand.

Automatic Nut Lock Co., Rockford, Ill.—Samples of nut locks.

Barker Mail Crane Co., Clinton, Iowa.—Full sized Barker mail crane.

Barrett Manufacturing Co., New York.—Roofing and waterproofing materials.

Battery Supplies Co., Newark, N. J.—Samples of primary batteries.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis.—Samples of malleable iron tie-plates and rail braces, also F. & N. anti-spreader and anti-creeper.

F. W. Bird & Son, East Walpole, Mass.—"Parold" roofing, "Hydrex" waterproofing and "Neponset" insulating paper.

Louis Blessing and Alfred Johns, Jackson, Mich.—Model of concrete tie, also adjustable nut locks.

S. F. Bowser & Co., Ft. Wayne, Ind.—Models of Bowser self-measuring oil storage tanks and pumps.

Jos. M. Brown, Chicago.—Samples of Stone lanterns, also photographs of Buckeye light.

Browning Engineering Co., Cleveland, Ohio.—Photographs of Browning locomotive cranes, railroad ditchers and revolving steam shovels.

Bryant Zinc Co., Chicago.—Samples of crossing bells, batteries, relays, etc.

Buda Foundry & Manufacturing Co., Chicago.—Paulus, Buda and Wilson track drills, switchstands, rail benders, car replacers, ratchet and friction jacks, hand cars, velocipedes and gasolene cars.

Cambria Steel Co., Johnstown, Pa.—Sample "100 per cent." rail joint and "100 per cent." insulated rail joint.

Philip Carey Manufacturing Co., Cincinnati, Ohio.—Samples of Carey cement roofing and magnesia pipe coverings.

Carnegie Steel Co., Pittsburgh, Pa.—Duquesne splice bar; steel cross tie; also samples of built-up steel tie after six years and ten months' service in main track of Lake Shore & Michigan Southern Railway; U. S. steel sheet piling; Friestedt steel piling; steel mine timbers and screw spikes.

Central Iron & Steel Co., Harrisburg, Pa.—Samples of "American" steel cross tie.

Chicago Portland Cement Co., Chicago.—Literature describing Chicago Portland cement.

Chicago Steel Tape Co., Chicago.—Measuring tapes and jointed leveling rods; "Eureka" tape splice.

Cook's Standard Tool Co., Kalamazoo, Mich.—Cook's collapsible rail drill and drill grinders; standard track jacks and Cook's combination steel and wood cattle guard.

Cortright Metal Roofing Co., Philadelphia.—Samples of metal roofing and model showing application.

Credelbaugh & Carter, Radnor, Ohio.—Concrete fence posts and molds.

Detroit Graphite Co., Detroit, Mich.—Samples of graphite paints.

Paul Dickinson, Inc., Chicago.—Dickinson smoke-jacks; models of Dickinson cast-iron chimneys and ventilators; composite wood and cast-iron fireproof smoke jacks.

Dilworth, Porter & Co., Pittsburg, Pa.—Goldie claw tieplates, Glendon flange tieplates and railroad spikes.

H. B. Dodge & Co., Chicago, representing Jas. G. Wilson Manufacturing Co., New York.—Models of swing and rolling doors.

G. Drouvé Co., Bridgeport, Conn.—Sample of "Anti-Pluvious" skylights; photographs of "Anti-Pluvious" skylights installed on Lackawanna station, Hoboken, N. J.

Duplex Metals Co., New York.—Sample showing "Monnot" process of welding steel and copper.

Eastern Granite Roofing Co., New York.—Samples of perfected granite roofing and sand surfaced roofing.

Economy Separable Switch Point Co., Louisville, Ky.—Model of "Economy" separable switch points and "Odenkirk" switch stands; "Clary" tie plate.

Electric Storage Battery Co., Philadelphia, Pa.—Samples of "Chloride" accumulations and "Exide" batteries for car lighting and signals.

Expanded Metal & Corrugated Bar Co., St. Louis, Mo.—Transparencies showing examples of concrete reinforcement with Johnson corrugated steel bars in bridge abutments, culverts, elevators, storage tanks, retaining walls; also model of reinforced concrete trestle having both deck and piles made of concrete.

Eyeglass Tool Co., Newark, N. J.—Eyeless picks and track tools.

Fairbanks, Morse & Co., Chicago.—Full sized No. 2 J inspection car; Barrett track jacks, rail drills, standpipes, wheels, etc.

Federal Cement Tile Co., Chicago.—Samples of "Indestructible" roofing.

Flexible Compound Co., Philadelphia, Pa.—Samples showing the application of "Flexible" waterproof compound.

Franklin Manufacturing Co., Franklin, Pa.—Samples of asbestos shingles, lumber and smoke-jack materials; model of "Century" asbestos smoke-jack for roundhouses (Gutellus patent).

Gartland Manufacturing Co., Marion, Ind.—Samples of picks.

General Fireproofing Co., Youngstown, Ohio.—Samples of cold-twisted lug bars for concrete reinforcing, expanded metal lath and diamond mesh fabrics and pin-connected frames for concrete girders and beam reinforcement; also "Trussit" metal for reinforcing light concrete roofs.

Gibraltar Manufacturing Co., Chicago.—Model of new structural steel "Gibraltar" bumping post, and "Gibraltar" mail crane.

Glazier Nozzle & Manufacturing Co., Indianapolis, Ind.—Model of "Glazier" universal nozzle.

William Goldie, Jr., Co., West Bay City, Mich.—Tie plugs.

Gordon Battery Co., New York.—Samples of Gordon primary cells.

Grip Nut Co., Chicago.—"Grip" nuts in various sizes.

Harrington Railway Safety Switch Device Co., Colorado Springs, Colo.—Working model of "Harrington" safety switch.

Hart Steel Co., Elyria, Ohio.—Samples of McKee flange and shoulder plates; also pressed point spikes.

Hayes Track Appliance Co., Geneva, N. Y.—Samples of "Hayes" lifting and pivot derails.

Hurley Track Laying Machine Co., Chicago.—Photographs, drawings and literature of the "Hurley" track laying machine.

Hurst Automatic Switch & Signal Co., Rawlins, Wyo.—Working model of "Hurst" automatic switch.

Hussey Binns Shovel Co., Pittsburgh.—Samples of shovels, spades and scoops.

Ideal Concrete Machinery Co., South Bend, Ind.—Model of concrete building block machine.

Illinois Malleable Iron Co., Chicago.—Small model of the "Bruyn" automatic swinging smoke jack.

Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Hand cars, velocipedes, track drills, track jacks, gages and levels; wheel with reinforced tread; Root scraper and flanger; Moore chuck; pressed steel wheels.

Kennicott Water Softener Co., Chicago.—Photographs of water softening plants, [illegible] storage tanks and towers.

Edwin R. Kent & Co., Chicago.—Photographs and models of [illegible] manganese steel frogs and crossings.

Keuffel & Esser Co., New York.—Samples of steel tapes, transits, surveying and drafting instruments, [illegible] and [illegible] transit.

Kinnear Manufacturing Co., Columbus, Ohio.—Model of Kinnear rolling door, roundhouse type.

Lackawanna Steel Co., New York.—Abbott track gage plate, Abbott track gage and tie plate, Abbott rail joint plate, Abbott reinforced rail and Abbott composite rail tie.

Lehon Co., Chicago.—Samples of [illegible] roofing.

Locomotive Appliance Co., Chicago.—"Smyth" cast steel and "[illegible]" clamp derailer for main line and side track; "Newton" wrecking frogs.

Lufkin Rule Co., Saginaw, Mich.—Metallic and linen tapes, steel rules, etc.

Mann-McCann Co., Chicago.—Model of railway spreader and grader; Mann smoke-jacks; Ravelin system of electric wiring for roundhouses; Chicago ventilator.

McClintock Manufacturing Co., St. Paul, Minn.—Samples in operation of McClintock mercury contact relay, full-sized electric automatic signal, switch indicators, circuit breakers; testing sets for relays.

Metal Ties Co., New York.—Full sized cast steel tie with wood block for rail support.

Mississippi Wire Glass Co., New York and Chicago.—Samples of ribbed, mazed and plain wire glass.

Morden Frog & Crossing Co., Chicago.—Model of track and switch showing "Unity" switchstand.

National Lock Washer Co., Newark, N. J.—Samples of "National" lock washers.

National Railway Materials Co., New York.—Samples of Murray anti-rail creepers, guard-rail braces and clamps, rail braces, etc.

National Roofing Co., Tonawanda, N. Y.—Samples of "Security" mineral asphalt roofing.

Newman Clock Co., Chicago.—Samples of Newman watchman's clocks, also railroad special clock for yards, depots, docks, etc.

Robert Ogle, Pueblo, Col.—Model of Ogle turntable derailer.

Otto Gas Engine Co., Philadelphia and Chicago.—Photographs of coaling stations, water tanks and cranes, sand blast and pneumatic tool car.

The Pennsylvania Steel Co., Philadelphia, Pa.—Models of "New Century" adjustable switchstand with double crank; Manard anvil-faced frog; photographs of steel bridges.

Pepple Metallic Railway Tie Co., Hillsboro, Tex.—Metal tie and safety mail catcher.

Percival Wood Preserving Co., Houston, Tex.—Samples of timber treated with "Diamond" preservative by the open-vat method.

Phillips Signal & Electric Co., Owensboro, Ky.—Blueprints, printed matter, etc., regarding Phillips automatic crossing, block and bridge signals.

The Frederick Post Co., Chicago and New York.—Samples of surveying instruments, drawing materials, etc.

D. & A. Post Mold Co., Three Rivers, Mich.—Full sized machines for making concrete fence posts (shaking device method).

Quincy, Manchester, Sargent Co., Chicago and New York.—Bonzano rail joint; Q & C insulated joint and compromise joint; Q & C Sampson rail bender; anti-rail creepers.

The Rail Joint Co., New York.—"Continuous" insulated rail joint, standard "Continuous," Wolhaupter and Weber joints, insulated rail joints and step joints.

Railroad Supply Co., Chicago.—Samples of Wolhaupter, Q & W and Servis tie plates; B. R. S. derailer; Wolhaupter shoulder flange tie plate; signal materials.

Railway Chemical Sprayer Co., Owensboro, Ky.—Photographs of chemical weed killing car.

Railway Specialty & Supply Co., Chicago.—Smith improved lock nut; P. & M. rail anchor; "Kopp" signal glass, bond wire protectors, arc damp lightning arrester; "Paine's" vise-grip rail anchor.

Raymond Concrete Pile Co., Chicago.—Small model illustrating Raymond method of placing concrete piles.

Railway Equipment & Contractors' Supply Co., Chicago.—Literature describing the "Giant" rail bender.

Arthur E. Rendle, New York.—"Paradigm" fireproof windows and skylights.

Ritter Folding Door Co., Cincinnati, Ohio.—The Ritter horizontal folding door for roundhouses, freight houses and warehouses.

Roberts & Schaefer Co., Chicago.—Photographs of railroad coaling stations, coal washeries and tipples.

Safety Switch & Semaphore Co., Battle Creek, Mich.—Switchstand operated by a semaphore for single-track use on main line for facing point switch.

Sandusky Portland Cement Co., Sandusky, Ohio.—Samples of Medusa waterproof compound, and snow white Portland cement.

Scherzer Rolling Lift Bridge Co., Chicago.—Album and miscellaneous photographs of Scherzer rolling lift bridges.

Scott Manufacturing Co., Racine, Wis.—Model of "Hercules" bumping post.

Sellers Manufacturing Co., Chicago.—Samples of Sellers anchor-bottom tie plates and splice bars.

Spencer Otis Co., Chicago.—Samples of "Economy" tie plates.

Standard Asphalt & Rubber Co., Chicago.—Samples of waterproof bridge coatings and mastic floors; also pipe dips and insulating materials; "Sarco" asphalt filler for brick paving; concrete and brick reservoir lining; new moisture and damp proofing for buildings.

Arthur L. Stanford, Chicago.—Model of Stanford rail joint; sample "American" track jack.

Strauss Bascule & Concrete Bridge Co., Chicago.—Working model of the Strauss trunnion bascule bridge; model of ribbed reinforced concrete bridge.

L. S. Thomas, Fairfield, Iowa.—Sample of the "Endless" rail, a new form of rail joint.

Tool and Railway Specialty Manufacturing Co., Atchison, Kans.—Leaflets illustrating the "Au-tra-kar" spike screwing machine.

U. S. Metal & Manufacturing Co., Chicago and New York.—Samples of "Columbia" lock nuts; full sized "Hillman" whistling post.

U. S. Wind Engine & Pump Co., Batavia, Ill.—Switchstands and semaphores; literature describing the new U. S. adjustable water columns, water tanks; model of "Mansfield" water column.

Universal Portland Cement Co., Chicago.—Samples of raw materials in various stages of manufacture.

Variety Manufacturing Co., Chicago.—The Cross horizontal folding door, and "Variety" steel rolling door; Cross compound lift up door.

Verona Tool Works, Pittsburg, Pa.—Track tools.

Vulcan Iron Works Co., Toledo, Ohio.—Photographs of Vulcan steam shovels.

C. H. Whall & Co., Boston, Mass.—Samples of Whall special railroad insulating fibre.

Wm. Wharton, Jr., & Co., Inc., Philadelphia, Pa.—Photographs and models of Wharton manganese steel frogs, crossings, switches, etc.; Wharton guard rail clamp.

Whiting Foundry & Equipment Co., Harvey, Ill.—Photographs of electric travelling cranes, transfer tables, turntables, roundhouse cranes and equipment.

Williams White & Co., Moline, Ill.—Blueprints of new automatic bucket hoist coaling station.

Jas. G. Wilson Manufacturing Co., New York.—Full sized sample of sliding swing door; also samples of rolling doors.

M. F. Wood, New York.—Harrington safety switch device.

Julian L. Yale & Co., Chicago.—Samples of "Universal" cast iron pipe.

The Metal Tie.*

BY DR. ING. A. HAARMANN.
Geheimer Kommerzienrath.

II.

Permanent way with metal ties is no longer a novelty. In the last 40 years it has had a checkered career. The first attempts at using metal for supporting the rails date back still further. We will only refer to them here for the sake of completeness.

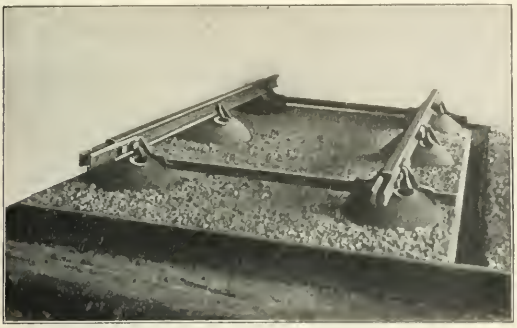


Fig. 21—Greaves Cast Iron Pot Ties; Alexandria-Cairo Line. 1854-1887.

During the period in which skill in rolling metal had not advanced to the point that enabled the rolling mill to put into proper shapes the tougher puddle iron, the Bessemer and open hearth steels, cast-iron attained some prominence as a tie material for railroads, especially in tropical countries where wood does not resist the climate and is attacked by white ants. Cast-iron pots (Fig. 21) were in use on the railroad between Alexandria and Cairo in 1854, and it was many years before they were replaced by creosoted wooden ties and by metal ties. The piece of track pictured was in service 20 years, using double-headed chair rails. The life of the tie is, however, greater than this. This system was abandoned, not because iron was used, but because of the difficulties of maintenance due to its construction. Flat cast-iron ties with a rectangular base were extensively introduced in East India in connection with flange rails fastened to jaws on the ties by means of wedges (Fig. 22).

For us, in Central Europe, the cross tie is the only one that is of moment in connection with a metal permanent way. It is interesting to note that the first trials, made over 40 years ago, scored a remarkably long life for the metal tie (Fig. 23). They were the "Cosyns" ties made of I-beams laid on their sides in the main track between Deventer and Zwolle in 1865, and, in part, are still in the track, having outlasted the rails several times over. Originally they were provided with wooden saddles (Fig. 24), which were later replaced by metal saddles. The small dimensions of these last furnished insufficient bearing surface, which was bad for the ties and caused distortions and fractures. Those of the ties which are still serviceable have been equipped anew with wooden saddles but of much larger dimensions. The deep bedding in the ballast, the firm position of the saddles between the flanges and the good bracing are acknowledged advantages of these ties, but they are lacking in stiffness and are too narrow, being only 8 in. wide. Each tie is 8 ft. 3 in. long, giving it 792 sq. in. bearing on the ballast.

*Address delivered at the meeting of the "Verein der deutschen Eisenhüttenleute," Dec. 8, 1907, at Düsseldorf. Reprinted from *Stahl und Eisen*, by permission.

After such a beginning, the introduction of the metal tie might have progressed more rapidly than was the case had not erroneous conceptions delayed its development. Metal permanent way was to cost no more than that with wooden ties. Low in cost, indeed, but much too weak, too light and therefore really too dear were the characteristics of the metal ties prominent at the end of the sixties in Germany. To this class belongs the Vautherin tie, laid in the line between Wittenberg and Leipsic, at first with rails resting directly on the ties, but afterwards, when wear had begun, supported on plates riveted to the ties (Fig. 25). Still, these small ties with their little clips stood the service for 17 years, from 1870 to 1887, of course not without suffering severely from wear, distortion, breaks and splitting (Fig. 26). I do not intend to pass in review the large number of different ties and methods of attachment that were tried more or less extensively or that were proposed as improvements. I will only bring forward the most important of these various designs (Figs. 27 and 28). Merely glancing at this selection of widely used ties, it is evident that railroad men and rolling mill men were too long under the impression that they could get along with a minimum quantity of metal, a mistaken notion not entirely overcome at the present time. The shape, indeed, was extensively varied, the lower edges were made thicker or thinner or were given a vertical or again a horizontal direction, but the original weight of about 65 lbs. was only slowly increased until a weight of 165 lbs. was reached, accompanied by a lengthening of the tie from 7 ft. 3 in. to 8 ft. 10 in.

The metal cross-ties developed from Hilf's longitudinal tie and from its variants were in part equipped with wedge fastenings, in part with clips and screws. A permanent way of this kind was in operation from 1889 to 1892 between Hagen and Haspe, on the old Bergisch-Mäkische

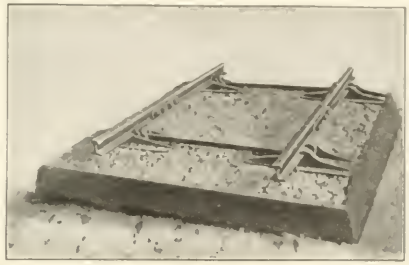


Fig. 22—Denham-Olpherts' Cast Iron Plate Ties; Rajputana-Malwa Line, Narrow Gage.

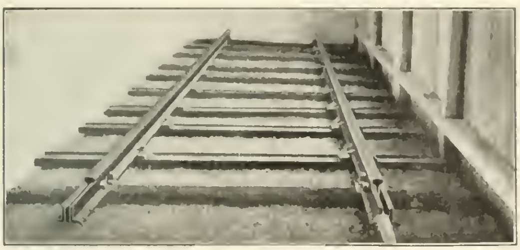


Fig. 23—Cosyns Ties with Saddles; Deventer-Zwolle Line, 1865-1907.

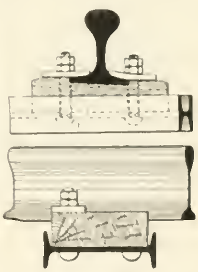


Fig. 24—Cosyns Tie with Wooden Saddle.

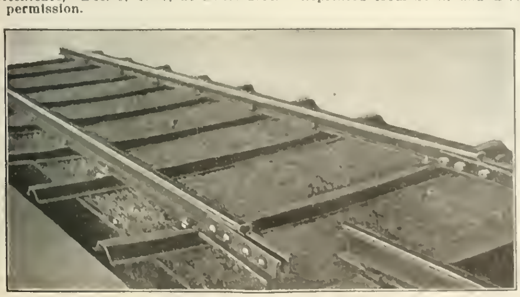


Fig. 25—Vautherin Ties with Clips; Wittenberge-Leipsic Line, 1870-1887.

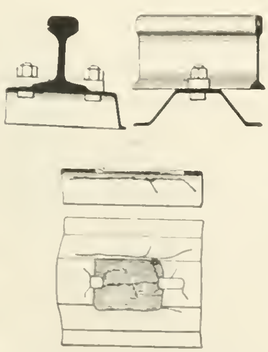


Fig. 26—Wear of Metal Tie Under Rail Seat; Wittenberge-Leipsic Line, 1870-1887.

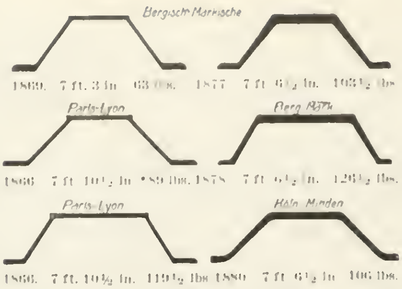


Fig. 27—Older Tie Sections.

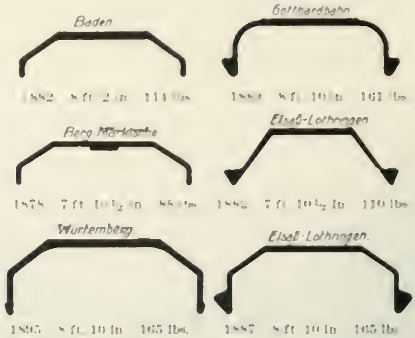


Fig. 28—Newer Tie Sections.

Railroad (Fig. 29). The small bearing surfaces occasioned excessive wear. As wedge fastenings did not get a firm hold, those by means of clips were developed and have come into general use.

The permanent way of 1896 of the St. Gotthard Railroad will serve as an example of the newest construction, in which the inclination of the rail is still obtained by bending the tie, while the gage is regulated by the use of different sizes of clips (Fig. 30). Inspection shows plainly that the rails and clips in the course of five years' service have begun to wear into the ½-in. upper surface of the ties.

In the Carnegie tie, used experimentally in the United States during the last few years, clip fastenings have also been employed, the rails resting directly on the ties (Fig. 31). But the clips are not utilized to relieve the side pressure on the bolts by dropping them into slots (Fig. 32). As the American rails are not inclined, but are placed vertically, bending the ties was not necessary. I have examined several stretches of track equipped with Carnegie ties, and am confirmed in my opinion, expressed in the *Railroad Gazette*,* that the derailment of February, 1907, at Mineral Point, which was accompanied by a shearing of the outer bolts, was not to be ascribed to the use of metal, as such, but to the defects indicated. Moreover, it seemed to me that the track with Carnegie ties rode smoothly but somewhat hard. This may be due to the narrow supporting surface, 8 in., and to the too great stiffness of the tie. To be sure, the stiffness is of advantage for static reasons, as it results in a well distributed, but in this case unnecessarily high, pressure on the ballast. The Carnegie tie (several samples taken from track have been kindly furnished me by the Carnegie Steel Co.) weighs 167 lbs., with a supporting area of only 705 sq. in. Structural improvements are under way, but it seems to me a mistake that, in introducing the steel tie in the United States so little use should have been made of the experience that has been gathered in Germany during the last 35 years.

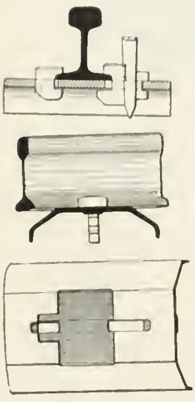


Fig. 29—Wedge Fastening, and Wear of Tie; Hagen-Haspe Line, 1889-1892.

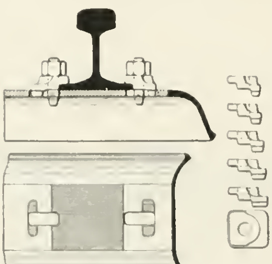


Fig. 30—Clips Recessed in Tie; Gotthard Railroad, 1896.

The Prussian railroads have, at different times, recognized as standard four different tie sections (Fig. 33). The first, introduced in 1881, was the box cross tie modeled after my abandoned longitudinal tie. Its form, however, proved ill adapted for the distribution of pressure, the horizontal flanges tending to curve upward, while the central space could not be solidly tamped. The next two sections, forms 51 and 52, appeared at about the same time, in the middle of the eighties. Form 51, 8 ft. 10 in. long and weighing 128 lbs., with 970 sq. in. bearing area, has enjoyed a preference up to the present day as a standard shape for main line. The fourth and wider section, form 50, originally designed for switches, weighs 167 lbs. and has a bearing area of 1,172 sq. in. In recent years it is coming into use for joint ties and in some cases for intermediate ties.

(To be continued.)

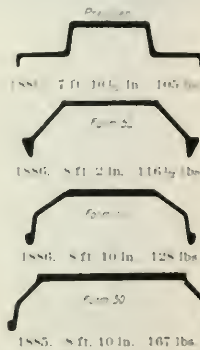


Fig. 33—Standard Tie Sections; Prussian State Railroads.

*Railroad Gazette, Sept. 27, 1907, p. 352.

Fig. 31—Carnegie Ties, 1906.

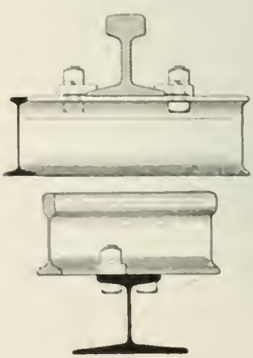


Fig. 32—Carnegie Tie, 1906; Clips Not Recessed in Tie.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XII.

The Leading Routes of Ocean Commerce.

Of vessel tracks upon the world ocean there is an innumerable and increasing multitude. Any one of several hundred ports may from time to time be visited by a vessel from any other of these ports. This movement over a certain track may be isolate, occasional or regular. Even the regular trade routes amount to hundreds, passing in all directions across all oceans between the frigid zones, and some routes invade even a portion of the Arctic ocean.

The routes of the ocean, like those of the land, consist of trunk lines and branches or feeders, which, leaving the main ocean thoroughfares, reach out to the islands or to the ports of the more isolated arms, gulfs and bays that indent the continents. These trunk routes comprise the real circulatory system through which passes the greater part of the commerce of all nations. The advantage of location possessed by the trunk routes causes them to draw to themselves through their feeders the great majority of vessels traversing the ocean.

The number of ocean routes has been more than doubled during the latter half of the nineteenth century by the use of the steamer. This newer type of vessel rarely followed the older route that had sufficed when wind and sail were the sole dependence of the navigator. The sailing vessel must depend upon winds, weather, currents and tides, and in order to take advantage of these factors it is often necessary to make detours to catch favorable conditions or to avoid the danger of being blown upon the shore. The steamer, with greater power of guidance and always desiring to save time and fuel, goes as nearly as possible in straight lines. Hence the two types of vessels rarely follow the same track, and there are, for a large part of the world's oceans, two distinct sets of routes: those followed by steamers and those followed by sailers.

The location of sailing routes differs from that of steamer routes because of the different methods of navigation. With the steamer every mile covered costs a certain coal consumption, so that the steamer routes, reckoned in miles, are almost always the most direct routes possible, deviations only being made to avoid rocks, ice, thick fog or very stormy locations. The steam navigator thinks of his voyage in miles because distance is the chief factor, but the sailing captain reckons his voyage by days because the varying winds may take his ship one mile or 200 miles in a day; or again, headwinds may make it necessary to "tack," or sail from side to side, so that 200 miles of sailing means but 100 miles of progress. Thus it comes about that sailing routes are decided not by the shortest lines, but by wind and other conditions over the seas traversed.

The force and regularity of the wind differ greatly in different parts of the ocean, and to avoid regions of calm or low winds or head winds, the sailing routes often make wide detours in mid-ocean, and owing to the peculiarities of a sailing ship these vessels rarely go to and fro between two given points by the same route, because the wind that speeds the departing retards the returning vessel. Further than this, the winds in many parts of the world change with the seasons, and the sailing routes of winter are different from those of summer. Owing to the lessened certainty of location and lack of freedom along coasts, sailing routes do not lend themselves so easily as steamer routes to the development in trunk routes and branches. Where such classification is possible it is decided more by wind influence than by common destination.

In this article there will be no attempt to describe or enumerate all the routes. For an economic discussion many routes which, from the standpoint of the navigator, are separate, may be grouped under one heading and treated as a unit, as in commercial service they really are.

Western Europe and eastern North America are the greatest manufacturing centers for the rest of the world, and are consequently the starting point or the ending point for the leading ocean routes because the great basis of international trade is the exchange between the regions producing manufactures and those producing raw materials and food. Since the leading commercial countries of Europe are on, or adjacent to, the English channel, that body of water may, in a partly figurative but almost literal sense, be considered as the origin of European routes and similarly New York bay of the American routes.

As North America is also the greatest exporter of food and of raw materials to Europe, the most important of the ocean trunk routes connects eastern North America with northwestern Europe. On this great thoroughfare is regularly employed more than a sixth of the world's ocean shipping, including the largest and fastest ships afloat.

For convenience we will call this the North Atlantic trunk route. It is not strictly accurate to call this a route, for it is a complex group of routes crossing and paralleling each other and converging to several foci, but they are surprisingly close together in mid-ocean. The Liverpool Steamship Owners' Association declared in an address to the British Board of Trade "that all vessels crossing the Atlantic to this country (Great Britain) from ports in North America take practically the same route from 60 W. longitude." This comes about because of the advantage of following the great circle route, which, curving to the northward, makes all vessels, whether from Halifax, New Orleans or Vera Cruz, follow close to the northeastward-trending coast of North America to the Grand Banks off Newfoundland before starting to cross the ocean. During the spring and summer months a somewhat more southerly track is followed, owing to the floating ice, and for this reason the St. Lawrence steamers are compelled to pass to the south of Newfoundland. During the ice-free part of the year, from September to April, the compact sheaf of routes is somewhat scattered, and for a short time St. Lawrence steamers pass to the north of Newfoundland with a considerable saving in distance.

These northern or great circle routes are so much shorter than the direct following of the parallels of latitude, that the route from Liverpool direct to Greytown, Nicaragua, is only 323 miles, one day's moderate steaming, shorter than the route by way of New York. Norfolk is a common coaling port for vessels passing from the Gulf of Mexico to Europe.

The sailing tracks for this route show how thoroughly this type of transport depends upon the whims of the air. It was found in the old packet days that the journey directly westward to New York was in time 50 per cent. longer than the journey eastward and that a long southern detour on the western voyages was sometimes a benefit from the point of time. The explanation of this as of all the other facts of sailing route location depends upon an understanding of the main fact of the world's wind circulation, which should therefore be briefly stated here.

The combined influence of the motion of the earth and the different temperatures in different latitudes produce a general wind system upon the surface of the earth and with greater regularity upon the oceans than upon land. This wind system is studied by the sailing captain as carefully as the coal question is by the owner of a line of steamers. The winds are most regular and reliable in the hot latitudes. The part of the Torrid Zone receiving the most direct rays of the sun gets hottest and is a region of calms because the highly heated air is rising. This rising air of the zone of calms is replaced by the air that blows in from north and south, the trade winds which sweep regularly over the torrid

Steamship Verdi; Lamport & Holt Line to Brazil and the River Plate.

zone and are deflected from north and south to northeast and southeast winds by the earth's rotation toward the east. In some regions, particularly off the coast of Spain, the trade winds extend to a considerable distance beyond the tropic, but this is unusual. Owing to the apparent northward and southward motion of the sun, the zones of the trade winds and doldrums also move several degrees north each summer and south each winter. In both the temperate zones the prevailing winds are westerly, though not so constant as the trade winds, being more liable to disturbance by cyclonic storms, during which for a day or two the wind blows from all points of the compass in turn.

The sailing routes of the Atlantic illustrate in a striking manner the effects of the prevailing winds. Between the northern states and the English channel the sailing vessel goes before the westerly wind and follows closely upon the steamer route. Returning there are two routes, a southern and a northern. The northern faces the west wind and involves much tacking back and forth. The southern route going southwest to avoid the westerly winds and get into the trades, passes along the coast of Spain, south of the Azores and Bermudas, and crossing in the latitude of Havana comes up northwestwardly to the middle Atlantic states. If the destination is the Gulf of Mexico, the recommended track is still farther south, passing into the Caribbean near Barbados and out through the Yucatan channel into the gulf. In the winter this southern route is made even longer because the vessel must go farther south to reach the trade winds. Even the vessel bound for New York may then go 150 to 200 miles south of the tropic of Cancer. At this season the seas east and northeast of Newfoundland are more favorable to ships because free from ice. The icebergs and ice floes are released from their frozen moorings by the summer thawing and float about the ocean during summer and autumn. The solid freezing of winter holds the next ice crop in place until the succeeding June. During this season vessels returning from North Europe are recommended to follow the northern route. From the North Sea they go around Scotland, those from the channel steer northwest from the Scilly Isles or southwestern Ireland, till latitude 54 deg. is reached, then from mid-ocean a southwesterly route is followed along the coasts of Newfoundland and Nova Scotia. This northern detour is taken to avoid the strong headwinds and storms which often rage during this season with great fury between 45 and 50 deg. north.

The route next in importance to the North Atlantic is the Mediterranean Asiatic trunk route, passing from the Straits of Gibraltar around the continent of Asia to Japan. This route, the great thoroughfare between the east and the west, has many feeders east of Gibraltar, and double termini in the Atlantic, one in the region of the English channel, one in America, chiefly New York, but partly also in the Gulf of Mexico. As it skirts the coast of Eurasia it is fed by a branch from every bay that indents that great land mass, and by other branches from Africa, the East Indies and Australasia. Important contributions come from Barcelona in Spain, Marseilles in France, Genoa and Naples in western Italy, Venice and Trieste on the Adriatic, Smyrna and Piraeus on the Aegean, Constantinople, Odessa and Batum on the Black Sea. At Alexandria the commerce of Egypt is received and at Aden a part of the trade of the Persian Gulf, East Africa and Bombay, the main line going on to Ceylon and Singapore. At Colombo vessels for Calcutta, Madras and Burmah turn northward into the Bay of Bengal and the Australian mail steamers turn southward across the Indian ocean; at Singapore the route, rounding the corner of Asia, sends a branch to Java and on to Torres Strait and east Australia, receives the traffic from Siam, Tonquin, the adjacent East Indian islands and some from Manila. The main route passes on to Hong Kong, Shanghai and Yokohama, Shanghai being the branching off point for the trade of Vladivostok, Port Arthur, Tien Tsin and other ports in North China and Korea, and latterly it is extended even to San Francisco, with more services promised for the Pacific coast of America.

This great route from the west to the east is the creation of the Suez Canal. Before the opening of that gateway of the seas it was entirely unprofitable for steamers to engage in the trade between the Orient and the Atlantic. The trade was then comparatively small, and the greater part of the present traffic is the creation of the new route, which is now as absolutely monopolized by them.

The rocks, reefs, narrow passages, calms and fitful winds of the Red Sea combine with towage and tolls at Suez and poor winds in the Mediterranean to absolutely block this route to sailing vessel traffic.

The Good Hope route is not such a coasting route, nor is it so well supplied with feeders. The peculiar shape of the west African coast, and the scattering character of its commerce, have brought about a duplication of steam routes in the Atlantic west of Africa. The coasting and local route follows the coast, settlement by settlement from Morocco to German Angola. The more important route, the South African route, sweeps boldly around the continent to Cape Town with occasional stopping of ships at the Cape Verde islands for coal. At Cape Verde or to the south of it two branches of it unite to form the route, one connecting with the English channel, one with New York bay. East of the Cape of Good Hope the vessels in the African trade stop at the British South African ports of Port Elizabeth and East London, most of them continuing to Delagoa Bay, but rarely farther. A few pass up the east coast of Africa. African ports are, however, the destination of but a part, less than half, of the vessels traversing the South African trunk route. The others go directly to Australia and New Zealand, often without touching Cape Town. From the United States to Australia the Suez Canal route is practically as long as the Good Hope route, and all the vessels naturally follow the cheaper and more open route around the continent. From England the saving by canal is about a thousand miles, not enough to make its use profitable for any but fast passenger and mail ships. The purely freight lines from Europe use the South African trunk route. The more important lines steer directly from South Africa to Adelaide, Melbourne and Sydney, and sometimes go on to Brisbane. Less important ones run directly to Freemantle, West Australia, to New Zealand, or to New Zealand via Melbourne or Hobart (Tasmania).

The Good Hope route divides with the Cape Horn route the honors of being the heaviest factor in the world's sailing traffic. They are typical sailing tracks. The inbound and outbound tracks differ, and there are also the seasonal variations, but these sailing tracks are more deserving of the title of a trunk route than any others in the world. The equatorial section of the outbound route is followed by all vessels from both Europe and America destined to the coasts of five continents bordering upon the Pacific and Indian oceans. The inbound routes to Europe and America are not at any time united so completely, although they have some of their divisions in common.

The outgoing routes converge in the equatorial section because they cannot safely pass Cape St. Roque without going with the trade wind that blows from the Canaries directly toward the point of South America. European vessels have a direct route from the English channel until they reach the trade winds off the coast of Spain or Morocco, before which they easily ride.

The vessels from the Atlantic coast of the United States would be delayed by the trade wind if they sailed directly toward Brazil. The quicker way for them to reach Cape St. Roque is to go with the west wind eastwardly across the Atlantic toward the Azores, then turn south and go with the trade wind. This route joins the European near the equator. From this point southward to the tropic of Capricorn vessels bound for the Indian ocean proceed directly south to avoid the southeast trade and catch the prevailing west winds which carry them across the South Atlantic to Cape Town and into the Indian ocean.

The inbound routes of the Atlantic are everywhere in different locations from the outbound. In returning from the Indian ocean the southern west winds are a hindrance and the navigator keeps as close to the Cape of Good Hope as possible, and sails northwest into the trade winds and on toward the equator. The American and European routes from the Indian ocean diverge from the Cape; the first named going almost directly to New York, thus crossing the northeast trade at a right angle, and having nearly the same angle to the Gulf Stream and the prevailing westerly winds north of Bermudas. The European routes in crossing the northeast trades are driven so far to the west that they enter the zone of westerly winds in the longitude of eastern Brazil and Greenland, and, passing to the west of the Azores, approach their destination from a westerly direction.

The Good Hope route gathers to itself almost the whole sail traffic of the Indian ocean. These routes have a distribution altogether different from that occurring in other oceans because the wind system of the northern half of the Indian ocean is unlike that of the other oceans, due to the disturbing influence of the continent of Asia. This enormous and largely arid land mass lies just to the north of the trade wind zone, and in summer it becomes so much hotter than the ocean to the south of it that the air rising from over the land draws toward the land an enormous southwest sea breeze blowing continuously from the equator toward Asia—directly reversing the trade wind during the summer months. These winds, bearing the name of monsoons, occupy the latitude of the northern trades, and by their force sweep across the greater part of the usual zone of calms, and in the season of the northern summer they exert some influence several degrees south of the equator. The southern part of the Indian ocean has a normal trade wind at all seasons and the northern part has in the winter months.

The sailing routes of the Indian ocean, the creation of these winds, unlike those of the Atlantic and Pacific, have somewhat the form of trunk lines and branches with separate systems inbound and outbound at the point of Africa. The inbound trunk follows the southern margin of the ocean from west to east. On this thoroughfare the navigator takes advantage of the steady west wind as long as possible before turning northward to the ports of Africa, Asia or the East Indies. Australian vessels complete the voyage before the west wind. Vessels turning toward Asia or the Sunda

Islands can sail by the trade winds directly north to the vicinity of the equator. Here the course, for points beyond the equator, must change to take advantage of the changing monsoons. The summer route to Bombay passes north close to the east coast of Madagascar, and goes with the southwest monsoon across the Arabian Sea. The winter route, avoiding the full force of the winter (northeast) monsoon, goes northward toward Ceylon and then turning northwest follows the west coast of India at right angles to the wind. The return routes for both seasons follow closely upon the latter route as far as the equator, and then, like all the returning routes of the Indian ocean, go west southwest across the southeast trade wind to the point of Africa, avoiding the westerly winds as much as possible. The routes to and from Calcutta show the results of exactly the same principles that entered into the location of the Bombay routes. They do not cover so wide an area because the Bay of Bengal is so much narrower than the Arabian Sea. Sunda Strait, the sailers' gateway to the East Indies, the Philippines and the coasts of East Asia, is below the monsoon zone, and has but one approach directly from the south and one outbound route, a direct line to the point of Africa.

The South American trunk route sweeps around the two longer sides of that continent from Cape St. Roque to Panama and on up the coast of America to British Columbia. Like the other trunk routes it is fed from two sources, Atlantic North America and Europe, the two parent streams uniting at Cape St. Roque. The greatest sources of traffic for this route in eastern South America are the Brazilian coffee from Rio Janeiro and Santos, and the grain and animal products of the La Plata ports. Many vessels, devoted only to the trade of the west coast, call at east coast ports only for coal, but discharge and receive cargo at many ports upon the west coast between Valdivia in southern Chile and Guayaquil, Ecuador. A few steamers continue this semi-coasting trade along the coasts of western Columbia, Central America, Mexico and the United States to San Francisco and Puget Sound. Other steamers round the continent of South America, but have no South American trade. Since 1901 a number of steamers have sailed from the Pacific ports of North America for European ports without doing a coasting trade en route, but all steamers in this trade are an innovation in a trade that has belonged exclusively to the sailer.

Steamship Obidense; Booth Line to Para.

At the Straits of Magellan the traffic of this route is swelled by vessels in the New Zealand trade, particularly those returning loaded toward Europe. With this exception, the South American trunk does not in its steam traffic receive long branches or feeders as does the Mediterranean-Asiatic in rounding the continent of Asia. The difference is more apparent than real. The Asiatic route skirts the heads of peninsulas, and is often hundreds of miles from the ports lying at the heads of the seas indenting the coast. The branch routes to these ports are evident. The coast of South America is so even that any steamer passing around the continent passes comparatively near to all the ports. The real effect of branches is preserved by the division of the territory among the steamer lines. Some call at the ports of one section of the coast and have no freight connection whatever with other districts. Some lines of west coast of South America steamers are as separate from the other traffic of the South American trunk as the Calcutta or Zanzibar steamers are separate from the remaining traffic of the Mediterranean-Asiatic trunk.

The sailing contingent on the South American trunk route keep safely out of sight of the steamer that hugs the coast to save miles. While the steamer creeps through the squally and tortuous Straits of Magellan the sailer puts in another thousand miles in enduring the buffetings of the western fury off Cape Horn. So steady and so strong is this wind that ships sometimes stand for weeks in almost one place and some have given it up and turned about to seek their Pacific destination by going around the world before the west wind that ramps about without ceasing across the antipodean seas.

The sailing routes of the Pacific are shaped by the same forces that operate in the Atlantic. The effect of the prevailing winds is distinctly marked in the north and south tracks. Northward from Cape Horn vessels run comparatively close to the coast and directly across the course of the west winds. When the ships bound for the Pacific coast of the United States reach the southeast trade they follow it to the equator, work as best they can directly north across the zone of calms and then at right angles across the northeast trade until they reach the westerly winds, before which they run directly to the land. This last characteristic is much more pronounced in the route from Australia. The remarkable curves in the northern and southern parts of this route giving it the shape of a letter S, are striking evidences of the value to the sailor of the westerly winds of the temperate zones. The sailing route from San Francisco to Cape Horn goes southward with the northeast trade, turns to the west to get a sailing angle across the southeast trade and then below the tropic gradually swings southeastward to the Cape with the westerly winds. From San Francisco to Australia this route is comparatively direct to the tropic of Capricorn, where a turn to the west is made to avoid the westerly winds until as near the Australian coast as possible.

The captain sailing around Cape Horn into the Atlantic desires to avoid the coastal wind and current that carried this ship downward and inside the Falkland Islands. Inbound, he steers far to the east of the Falklands, keeping in the prevailing west winds as long as possible, and then borne onward by the southeast trades makes a gradual curve toward the equator at mid-ocean. If the destination is America, a northwesterly route is taken at 10 deg. S., and north of the equator, the routes to American and European ports are similar to those from the Indian ocean, described above.

The Pacific ocean is peculiar in that it may in a sense be said to be uncrossed by any present or prospective Great Routes except the one calling at Hawaii. Despite the riches upon its shares, the Pacific may well be called a waste of water. Only upon or near its margin will great and promising trade routes arise, leaving its vast center to silence and to routes of secondary importance. It is difficult to realize that this one ocean embraces nearly one-half of the entire surface of the globe, that between the mainland of the American continent at the equator, in Ecuador and the opposite mainland of Asia, near Singapore, lies the distance of 12,000 miles, or 175 deg., almost half the distance around the world. Between these two equatorial points upon the spherical surface of the globe there are three connecting lines of practically equal length, one following the equator directly across the mid-ocean and two slightly shorter ones following the meridians (great circles) and passing respectively near the north pole and the south pole. As steamer routes follow great circles, the great size of the Pacific causes most of its routes to avoid its middle and skirt its margin. Routes from east to west must, to follow great circles, keep in high latitudes near the margin of the ocean to secure their shortest courses. A glance at Pacific traffic shows it to be on the margins.

The heaviest commerce in the Pacific waters passes up and down the coasts of East Asia and of South America, bound for the exits at Singapore and the Straits of Magellan. By far the most important route entirely upon the Pacific is that connecting North America and Asia, the American-Oriental trunk route. Like the North Atlantic route this is a composite one, and not so compact because of the irregularities produced by the calls of some lines at Hawaii, 2,000 miles below the line of shortest passage between Puget Sound and Yokohama. It is nevertheless proper to consider the North Pacific lines as one trunk route, since all the different courses are close together at the American end, and converge at Yokohama to follow the Asiatic coast to the ports of China or the Philippines. One line now sends steamers to Manila directly from Yokohama, having them call at Hong Kong and Shanghai on the return. It is probable that other lines now sailing no farther than Hong Kong will, if there is increase in Philippine industry, extend their service by making Manila the final destination. This fact of the shape of the earth and the great circle routes show the futility of the hope that Manila might become the Gateway of the East. It is the last port of the row.

On the American side the Asiatic lines have within recent years originated at six places: Manzanillo (Mexico), San Diego, San Francisco, Portland and Puget Sound, and before many years there will probably be other American ports added to the list, although the first two are now discontinued. Lines of vessels start from San

Francisco and call at Honolulu, although it lengthens the voyage more than 800 miles. From all starting points vessels also go directly to Yokohama, and usually by the northern or great circle route. From Puget Sound it is impossible to follow a perfect circle because of the Aleutian Islands, within sight of which the vessels pass in good summer weather. In the winter it is the practice of some captains to steer straight across the ocean or even to go south of the direct route to secure more favorable winds and weather. The great circle route is the one most commonly followed, unless calling at Hawaii, and from all points on the American coast, including Panama, this, the mathematically shortest route to any point in Asia, follows the coast line to California, passes close to San Francisco, closer to Puget Sound than to Hawaii, and thence northward to the latitude of Alaska before turning south and skirting the shore of Japan.

A route of less importance and far less promise than the Oriental is the Pacific coast, Australasian, the last of the steam trunk routes. This route, like the preceding, is composite and more definitely spread out than any other trunk routes. On the east is the course followed by the line plying between San Francisco and Auckland, New Zealand, via Tahiti, Society Islands; on the west that from Vancouver to Sydney via Honolulu and Fiji Islands. By a branching of the route at Honolulu, San Francisco is connected with Sydney, and by other branchings at Fiji and Samoa, British Columbia is connected with New Zealand.

This route across the Pacific has been found by experience to be the quickest mail route from Australia to Europe. The weather in the Pacific is usually reliable and favorable, and when the mail has reached San Francisco by direct steamer, it has the advantage of the fastest long-distance train service in the world to New York, and thence to Liverpool the fastest steamship service in the world. In competition with this is the route followed by the slower steamers crossing the Indian ocean, the Red and Mediterranean Seas, and delivering the mail to the railroad only at Brindisi, Italy, whence, with several days saving of time, it crosses the Alps to Paris and London. There are fundamental traffic reasons, however, why the Pacific coast-Australasia routes lack great promise for the future.

The winds of the North Pacific being essentially like those of the North Atlantic produce a very similar result in sailing tracks, except that all vessels follow the southern track going west.

This brief presentation of the world's ocean routes makes no pretence of being full or complete, but only to point out the main arteries of world commerce, leaving the minor tributaries and distributaries to be worked out by those who may have a special interest in the subject.

The avenues of commerce have been divided off into routes having separate names, but it should not be thought that each is separate from the others. The divisions have been made in part for convenience of description, for the routes are not entirely separate, but connect and overlap at various points into a unified system encircling of the world.

No trunk route with its branches can be considered as an independent unit of circulation with vessels limited to it, and going and coming in even procession with equal numbers inbound and outbound. As no country imports and exports equal quantities of freight, so no route has similar amounts of freight or the requirement for equal number of vessels going and returning. It is usually but not always true that the line steamers go and return by the same route. The irregular element is chiefly furnished by the chartered vessels or tramps which depart from the trunk routes at ports where more freight is imported than exported. They go seeking freight and join other routes at ports that ship more freight than they receive. By this process the Good Hope route is a heavy loser, and the South American and the Mediterranean-Asiatic are gainers. South Africa imports coal, flour, lumber and general manufactures and supplies—all of them being heavy and bulky articles. The leading exports are gold and diamonds, requiring no space worth mentioning. South Africa is, therefore, a dispersing for vessels charged with ballast and seeking freight. Some go to India for grain or jute, others to Burmah for rice, others to Java for sugar, some to Buenos Ayres for wheat, some are even compelled to go to the United States.

In Australia the same conditions are repeated. This commonwealth imports iron, lumber and general manufactures, and exports wool, hides and meat, all of them several times as valuable per ton as the staple imports. Sometimes there is a small export of wheat, but there is usually a large surplus of shipping that must fall back upon coal, which fortunately Australia possesses at Newcastle, 60 miles north of Sydney. With this cargo many vessels go to East Indian and Oriental ports—Batavia, Sourabaya, Singapore, Manila, Hong Kong. After discharging the coal they can sometimes reload directly, but often another though shorter ballast voyage must be made to secure a cargo of Java sugar, Manila hemp, Siam or Burmah rice or even Indian jute, grain and seeds. From Newcastle (Australia) other vessels, usually sailers, depart to Hawaii for sugar or to San Francisco, Portland or Puget Sound for wheat. Others, both sail and steam, carry coal cargoes to northern Chile for nitrate of soda. By these various routes a large proportion, possibly a half, of the vessels that go out on the South African trunk route return to the North Atlantic by another way.

China and Japan are likewise countries with a surplus of outgoing shipping, and Japan is an exporter of coal that is in common use as far south as Singapore, and it is sometimes sent to Hawaii and the Pacific coast of the United States. The surplus shipping of East Asia usually seeks cargo in the Philippines, Java or the United States, some vessels crossing the North Pacific and transferring themselves from the Mediterranean-Asiatic trunk to the South American by way of the American-Oriental.

Triangular voyages are often made in these transfers from route to route. Such a triangle in the North Atlantic is very pronounced.

Brazil exports coffee very largely to the United States, and as the return cargo is light, many of the coffee ships load in American ports for Europe and return thence with European goods to Brazil, completing a triangular voyage. Voyages of a triangle character are often made by tramp vessels, and many of them can be figured out from the examples given above, but none of the many triangular voyages are so plain, so unobstructed and so nearly equilateral or so systematically followed as the Atlantic triangle.

The balance among the routes will be very much disturbed by the opening of the Panama canal, which will give such an added opportunity for vessels to take shorter routes and to switch from route to route as indicated by the accompanying table of distances.

TABLE OF DISTANCES

To	New York via— Present route.	Panama Canal.	Saving by Canal.	New Orleans via— Present route.	Panama Canal.	Saving by Canal.	Liverpool via— Present route.	Panama Canal.	Saving by Canal.
San Francisco	I., II. 13,714	5,299	8,415	I., II. 14,114	4,698	9,416	I., II. 14,084	8,038	6,046
Yokohama	III. 13,564	IV. 9,835	IV. 3,729	III. 14,929	IV. 9,234	IV. 5,640	III. 11,640	IV. 12,574	IV. –934
Shanghai	III. 12,514	V. 10,885	V. 1,629	III. 13,879	V. 10,284	V. 3,595	III. 10,580	V. 13,624	V —3,044
Manila	III. 11,601	V. 11,585	V. 16	III 12,966	V 10,984	V 1,982	III. 9,677	V 14,324	V —4,647
Sydney	VI. 13,658	VII. 9,814	VII 3,844	VI 14,625	VII. 9,213	VII 5,412	IX 12,234	VII. 12,553	VII. –319
Melbourne	VI. 13,083	VII. 10,022	VII. 3,061	VI. 14,051	VII. 9,421	VII. 4,630	IX 11,659	VII. 12,761	VII. —1,102
Wellington	VIII. 14,333	VIII. 8,534	VIII. 5,799	VIII. 15,301	VIII. 7,933	VIII 7,368	X. 12,949	X. 11,273	X 1,676
Adelaide	XI. 12,575	XII 10,530	XII. 2,045	XI. 13,543	XI. 9,929	XI 3,614	XI 11,151	XI 13,269	XI —2,118
Guayaquil	I. 10,425	I. 2,864	I. 7,561	I. 10,823	I 2,263	I. 8,560	I. 10,722	I. 5,603	I. 5,119
Iquique	I. 9,221	I. 4,021	I 5,200	I. 9,624	I. 3,420	I 6,204	I. 9,591	I 6,760	I. 2,831
Valparaiso	I 8,461	I. 4,630	I. 3,831	I. 8,861	I. 4,029	I. 4,832	I. 8,831	I. 7,369	I 1,462
Coronel	I 8,130	I. 4,836	I 3,024	I. 8,530	I 4,237	I. 4,023	I. 8,230	I. 7,577	I 653

Routes, via:

I. Straits of Magellan.
II. Pernambuco and Callao.
III. Suez Canal.
IV. San Francisco.
V. San Francisco and Yokohama.
VII. St. Vincent, Cape of Good Hope, Adelaide & Melbourne.
VII. Wellington.
VIII. St. Vincent, Cape of Good Hope, and Melbourne.
IX. Suez Canal, Colombo, King George Sound, & Adelaide.
X. Suez Canal, Colombo, King George Sound and Melbourne.
XI. St. Vincent & Cape of Good Hope.
XII. Wellington and Melbourne.

One of the first of these developments is likely to be the establishment of a new current of round the world traffic for both tramp and liner.

It is now the custom for liners going out from Europe to China to end the voyage at Yokohama. But once in Yokohama, the most economical route for the return is by way of America, provided Panama were passable. The steamers could discharge and receive cargo at Hong Kong and Shanghai, and continue from Yokohama to San Francisco. The freight conditions in this part of the world would favor this practice because the trade from China and Japan toward Europe is much lighter than that going the other way. The steamers at Yokohama are, therefore, in straits for freight, and it would be natural for them to seek the abundant freights of California, and thus adopt the practice that is being, and has been long, followed by many sailing vessels that have discharged cargoes in the ports of East Asia. This prediction is further strengthened by the recent establishment of a line of steamers running from England to China and Japan, and then for the sake of a return cargo going on to Portland and Seattle, securing nearly a full cargo of wheat, returning thence to Asia, where such other cargo as may be secured is added, and the whole carried westward through the Suez Canal to Europe. The Hamburg-America Co. has a service across to San Francisco, and a contract to establish one to Mexico. With the Panama Canal in operation it is scarcely possible that these steamers would return to England by the longer Asiatic route. If the Suez Canal tolls should be as low as those at Panama (which is very unlikely) the use of the American route by regular lines from Japan to Europe would be probable, because the temptation of Pacific coast freight would continue strong and would certainly, as at present, draw many tramp vessels across the North Pacific.

(*To be continued.*)

The American traveler accustomed to make free with uncomplimentary remarks to train and station men must put a bridle on his tongue in Germany. A merchant with a monthly commutation ticket traveled on a certain express train from Duisburg to Bochum. His ticket read "good on all trains for which an extra charge is not made." Now a time-table sold on this line named this train as one on which commutation tickets are good. But when he was leaving the train the gateman held him up for 10 cents. After some heated discussion the passenger allowed himself to say: "You stupid fellow; you don't understand your own business." Now it turned out that the gateman did understand his business; and that it was by an error that this train was named in the time-table as available with commutation tickets. Arrest for insulting a public servant; 20 marks fine.

New Locomotives for the Atchison, Topeka & Santa Fe.

The Baldwin Locomotive Works recently completed an order for 49 locomotives for the Atchison, Topeka & Santa Fe. Seven of these are Pacific engines for passenger service, and 42 consolidation, for freight service. All have single expansion cylinders, piston valves, Walschaerts valve motion and smokebox superheaters. Ten of the consolidation locomotives are equipped for burning coal; the remainder, including the Pacific type engines, are arranged for burning oil.

The Santa Fe has been operating for some time a ten-coupled locomotive with a smokebox superheater, and its successful performance has resulted in the adoption of superheated steam at comparatively low pressure on these later engines.

The Pacific locomotives have 25 x 28-in. cylinders and driving wheels 73 in. in diameter, and, as the safety valves are set at 160 lbs., the tractive force is 32,600 lbs. The boiler is straight top, with sloping throat and back head, and tubes 20 ft. long. The barrel is built up of four rings, which have "Diamond" butt joint seams on the top center line. The firebox is radially stayed, and the front end of the crown is supported by two I-irons. All firebox rivets are countersunk on the inside. Washout plugs are liberally provided in the front tube sheet, back head and water legs; also on the lower center line of the barrel, along the water level, and in the outside sheet just below the firebox crown.

The superheater is the type developed by the Baldwin Locomotive Works, and illustrated in the *Railroad Gazette* of June 7, 1907. The final passage of the steam is through the tubes at the back of the smokebox, where the gases are hottest. The arrangement of the drums and tubes is shown in the engraving. The joints between the tube plates and drums are made tight with copper gaskets.

The cylinders are designed for double front rails, and are equipped with inside admission piston valves 13 in. in diameter. The steam chest center lines are 6 in. outside the cylinder center lines. The valves have a steam lap of 1⅛ in., and an exhaust clearance of ⅛ in. They are set with a constant lead of ¼ in. and have 6¼ in. maximum travel. The relief valves are the style used by the Pennsylvania on its piston valve locomotives. The live steam ports extend up to a horizontal face above the steam chest. The ports are covered by a plate, which, when the throttle is open, is held on its seat by steam pressure acting on its upper surface. Should the pressure underneath become excessive, the plate is lifted from its seat, and communication thus established between the two ends of the cylinder.

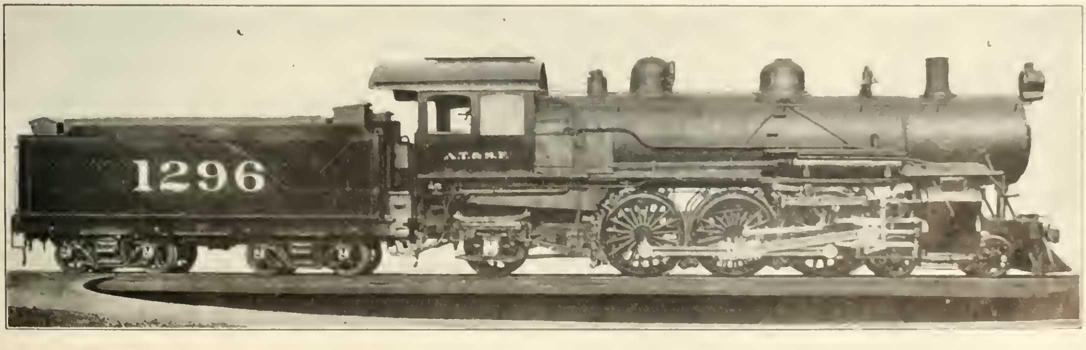
The location of the steam chests makes it possible to use a direct form of valve motion with all parts placed in practically the same vertical plane. Each link is supported by two cast-steel bearers which are bolted in front to the guide yoke, and at the back to a suitable support. The valve rod is carried on a bearer bolted to the top guide, and is rectangular in section

The front truck is swing bolster, with cast-steel saddle and three-point suspension links. The rear truck is the Rushton pattern with outside journals. The engine truck and tender wheels are steel-tired with cast-steel spoke centers and were made by the Standard Steel Works.

The tender frame is of 12-in. steel channels with wood bumpers, and the trucks have arch bar frames, cast-steel bolsters and triple elliptic springs. The tank has a water bottom.

The consolidation type locomotives have 24 x 32-in. cylinders, 57-in. driving wheels and 160 lbs. steam pressure, giving them a tractive force of 43,970 lbs. The details are in many respects similar to those of the Pacific locomotives. This is especially true of the cylinders, with their piston and relief valves, valve motion details, and many of the smaller fittings. The link bearings on the consolidation engines are bolted to the guide yoke, which also serves as a support for the reverse shaft bearings. The cast-steel details for both types include frames, wheel centers, driving boxes and spring saddles, cylinder heads, crossheads and foot plates. The

Consolidation Locomotive Built for Atchison, Topeka & Santa Fe, by Baldwin Locomotive Works.



Pacific Locomotive Built for Atchison, Topeka & Santa Fe, by Baldwin Locomotive Works.

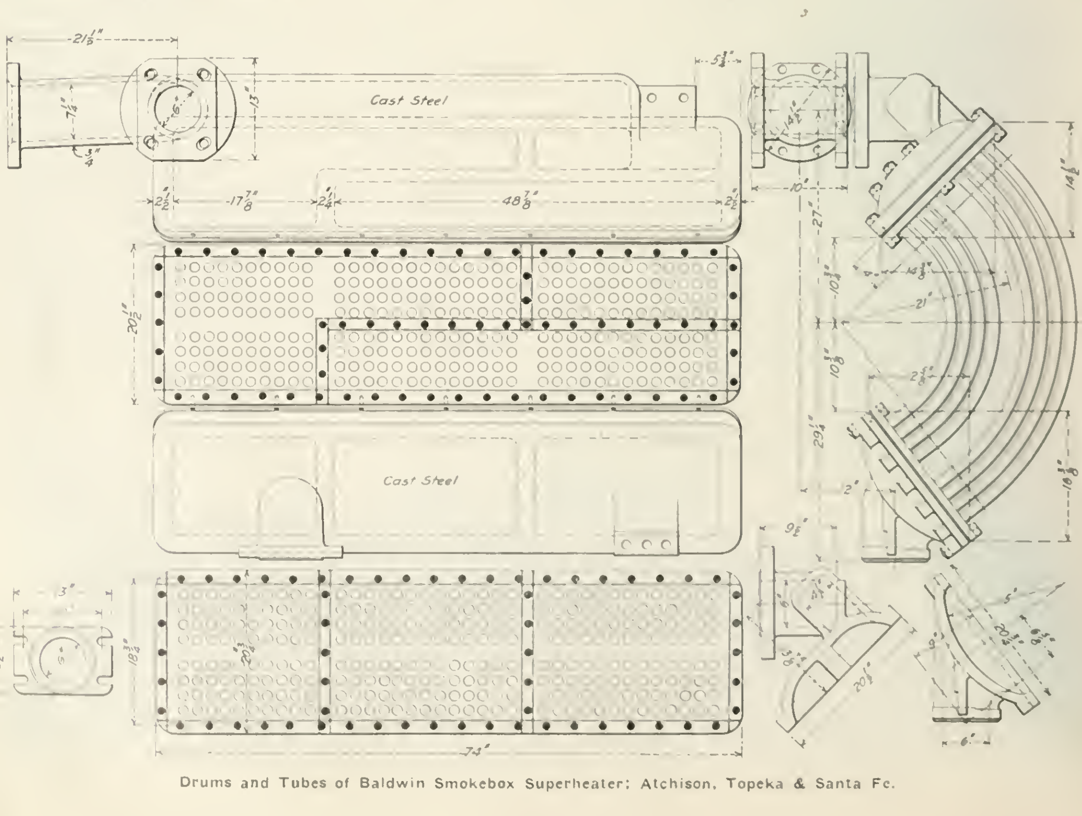
tenders for both passenger and freight locomotives are similar throughout.

The photographs and erecting drawings show the general features of the two classes, and the principal dimensions are given in the following tables:

	Pacific.	Consolidation.
Cylinders, diameter	25 in.	24 in
Piston, stroke	28 "	32 "
Boiler, diameter	72 "	78¾ "
Boiler, thickness of sheet	⅝ x 11/16 in	11/16 x ¾ in
Steam pressure	160 lbs.	160 lbs.
Fuel	Oil.	Oil.
Firebox, length	107 15/16 in.	95½ in.
" width	66 in.	71¼ "
" depth, front	75⅞ "	73⅛ "
" depth, back	67⅝ "	62⅛ "
" thickness tube sheets	9/16 "	½ "
Back crown sheets	⅜ "	⅜ "
Water space front	4½ "	4½ "
" " sides	5 "	4 "
" " back	4 "	4 "
Tubes, thickness	No. 11	No. 11
" number	273	355
" diameter	2¼ in.	2 in.
" length	20 ft. 0 in.	15 ft. 0 in.
Heating surface, firebox	190 sq. ft.	157 sq. ft.
" " tubes	3,202 "	2,773 "
" " total	3,392 "	2,930 "
" " superheater	759 "	600 "
Grate area	49.5 "	47.4 "
Wheels, diameter, driving	73 in.	57 in.
" " front truck	34¼ in.	29¼ in.
" " back truck	50 in.	.....
Journals, main, driving	10 x 12 in	10 x 12 in
" trailing, driving	9 x 12 "	9 x 12 "
" front truck	6 x 10 "	6½ x 10½ "
" back truck	8 x 14 "	.....
" tender	5½ x 10 "	5½ x 10 "
Wheel base rigid	12 ft. 8 in	15 ft. 6 in
" " total	34 " 5 "	24 " 6 "
" " engine and tender	65 " 0 "	58 " 3 "
Weight on drivers	140,400 lbs.	183,200 lb
" " front truck	54,950 "	29,200 "
" " back truck	37,400 "	.....
" total	232,750 "	212,100 "
" engine and tender	395,000 "	375,000 "
Tank capacity, water	8,500 gals.	8,500 gals.
Tank capacity, oil	3,300 "	3,300 "
Tractive effort	32,600 lbs.	42,970 lbs
Weight on drivers / Tractive effort	4.31	4.26
Total weight / Tractive effort	7.08	4.94
Tractive effort x diameter drivers / Heating surface	701.29	835.93
Heating surface / Grate area	68.52	61.81
Firebox heating surface / Total heating surface	5.60*	5.36*
Weight on drivers / Total heating surface	41.39	62.52
Total weight / Total heating surface	68.61	72.49
Volume of both cylinders, cu ft	15.91	16.76
Total heating surface / Volume of cylinders	213.20	174.82
Grate area / Volume of cylinders	3.11	2.83
Tube heating surface equated to firebox heating surface (Vaughan formula), sq ft	716.33	716.53
Totl equated firebox htg. surf., sq ft	906.33	873.53
Total actual heating surface / Total equated heating surface	3.73	3.35

*Per cent.

It is interesting to note that the steam pressure has been cut down from the 180 or 200 lbs. that is the prevailing practice in this country to a figure where boiler maintenance and repairs are more economically effected. This is also nearer the most economical figure for steam consumption as established by the investigations of Prof. Goss, although somewhat below that pressure. In the equating of the tube to firebox heating surface by the Vaughan formula, it will be seen that the figures are almost the same, being within a fraction of a foot, showing markedly the relation between tube length and number of tubes. In this case, the tubes of the Pacific engine are one-third longer than those of the consolidation, while the latter engine has 30 per cent. more tubes. The ratios do not, however, hold exactly, because of the larger diameter of the tubes in the Pacific engine; but the ratio is suggestive of the alternative offered the designer.



Drums and Tubes of Baldwin Smokebox Superheater; Atchison, Topeka & Santa Fe.

GENERAL NEWS SECTION

NOTES.

The Attorney-General of Nebraska has begun suits in the Supreme Court of the state to enforce the Sibley act reducing express rates 25 per cent.

According to a circular recently issued to stockholders in the Chicago Subway Co. the company now has 90 connections with freight producing points.

Western Colorado believes it can grow the finest potatoes in the world, and the Denver & Rio Grande is sending a special train around to give instructions in the art.

R. C. Richards, Claim Agent of the Chicago & North-Western, says that out of 110,000 claims presented last year for loss and damage the road paid 40,000 on the spot.

Proportional rates on grain and grain products from St. Louis to Trunk Line territory have been established by the Wabash, the Clover Leaf, the Alton and the Chicago, Peoria & St. Louis.

Owing to the action of Georgia lawyers in attempting to tie up the funds of the Southern Railway by garnishment and attachments for damage suits, the company has withdrawn its depository funds from the state of Georgia.

Nine railroads in the New England Car Service Association report that 93.6 per cent. of the cars handled in February, 1908, were released within the allowed limit of 96 hours. The proportion for September, 1907, was 92.6 per cent.

The Missouri Pacific has notified the Nebraska Railroad Commission that it will give to shippers of corn and wheat a rate to St. Louis equal to the local rates through Nebraska, and not compel them to ship by way of Omaha at a greater rate.

The Great Western Railway Company, of England, has established an office in the Times building, New York, to afford information to tourists who intend visiting the British Isles and to shippers. T. Kateley has been made General Agent for the United States.

Five special farmers' trains from the East and South came into Winnipeg on March 20. A continuously heavy movement of farming settlers from the United States is reported, most of the settlers coming from Illinois, Ohio, Indiana, Iowa, Nebraska, Minnesota and the Dakotas.

The New York City Public Service Commission on March 19 held that passengers on steam railroads within the city limits of New York need not pay the 10 cents excess fare charged them by the conductors of the train if they fail to purchase their tickets at the ticket office.

The chairman of the Michigan Railroad Commission is quoted as saying that the commission will be lenient for 60 or 90 days and will then be disposed to raise objection to the closing of small stations by railroads in the state in order to reduce expenses under the nine-hour law.

The Canadian Pacific announces that it will grant party rates for parties of ten or more traveling on a single ticket from points in eastern Canada to the Northwest, west of Winnipeg, and to Seattle, Tacoma and Portland on a basis of one fare for the round trip by the all-Canadian route.

The Interstate Commerce Commission has sent a communication to the House of Representatives in which it estimates that the supervision of railroad accounts under the present Interstate Commerce Act will cost the government $750,000 a year. How much it will cost the railroads, it does not estimate.

The Texas & Pacific has advised the Texas Railroad Commission that it will be unable to comply with the Commission's betterment requirements on account of the condition of the money market. Counsel for the road points out that improvements have been ordered which are unnecessary in a period of slight traffic.

The Interstate Commerce Commission has intervened in the controversy between the receivers of the Chicago Great Western and the employees of the road. The receivers have been requested to take no further action until the commission has had an opportunity to use its friendly offices to secure an amicable adjustment.

The Attorney-General of Wisconsin has advised the railroad commission that railroad companies operating in Wisconsin have no authority to charge more than 2 cents per mile for carrying passengers unless they make proper provision for refunding the excess charge. The question was raised by the application of a railroad for permission to require passengers who have an opportunity to purchase tickets, but fail to do so before boarding trains, to pay something in addition to the schedule fare.

Instructions have been sent to the station agents on the El Paso & Southwestern that they will be held responsible for bundles and packages checked from their stations as baggage when they do not come under the company's definition of the term, and that they will have to pay the express charges on such articles if reported by the express companies.

As a result of the ocean rate war, the North German Lloyd Steamship Co. reports annual earnings of $8,174,250, gross, as against $9,829,500 in 1907. The company has declared a 4½ per cent. annual dividend, as compared with 8½ per cent. last year, and has carried forward considerably less than half of the reserve that was carried forward in 1907.

What is known as the Hepburn bill, to amend the Sherman Anti-Trust law, was introduced in the House of Representatives on March 23. The bill provides, among other things, that corporations which file news of contracts and agreements with the proper federal authority are to have immunity from prosecution under the Anti-Trust law if these contracts and agreements are approved.

Following the meeting of the Transcontinental Passenger Association, the Harriman lines and the Atchison, Topeka & Santa Fe have given notice of independent action on tourist rates to the Pacific coast this summer. As against the 2-cent-a-mile basis advocated by the northern lines, the southern lines stood out for a basis similar to that applying to common points in Colorado. From Chicago the round trip rate to coast points between San Diego, on the south, and Vancouver, on the north, will be $72.50.

A bill has been introduced in both houses of the New York legislature to place telegraph and telephone companies and ferry and stage line companies under the jurisdiction of the Public Service commissions. A provision is also inserted in the bill to enable the New York City commission to proceed against the street railway corporations of New York for the forfeiture of rights they claim on certain streets in the downtown section if the commission decides that the corporations are exercising franchises without authority, or have abandoned or do not use all or part of their franchises. Provision is also made for giving the commission the power to audit accounts and to decide, after hearing, how outlays and receipts shall be charged and credited.

Pennsylvania Steel Coaches.

The first one of the 200 all-steel passenger cars ordered by the Pennsylvania last year has just been placed in service between New York and Philadelphia. This coach is 70 ft. long. Aside from the mahogany window sash and seat frames, there is no wood whatever in the coach. It seats 88 persons and weighs 53 tons. It is one of 25 being built at Altoona; the rest of the order was placed with the Pressed Steel Car Co. and the American Car & Foundry Co. These cars were described in the *Railroad Gazette* of June 14, 1907.

President Newman on the Railroad Situation.

The following comments are taken from an advance proof of the current annual report of the New York Central & Hudson River:

The tendency to regulate railroads and the details of their business has been shown in many federal and state laws, either enacted or proposed. The Interstate Commerce Commission and the public service commissions which have been established in a number of the states, have been given indefinite and almost arbitrary power. Hours of labor have been shortened by law, rates of fare have been reduced, liability for accidents has been increased, and in ways too numerous to mention, burdens have been placed on railroad companies which other corporations are not subjected to, and their ability to bear them has been lessened. While the enactment of just and equal laws is of the highest importance to railroads, much of the recent legislation has not been preceded by intelligent study or investigation and has been passed without reference to practical results. Uncertainty as to the effect of these new laws, and doubt as to how far regulation and special legislation as to railroads is to be carried, has without question been one of the causes which have unsettled the value of securities and helped to bring on the present period of depression.

The great expansion of business throughout the country during the period of prosperity which ended in October last brought to this company a rapid increase in the volume of traffic. There has been a continued growth in gross earnings for several years past, but this has been due to increase in the amount of business rather than to an increase in rates. Incident to good times, in order to handle the growing volume of traffic, facilities had to be quickly enlarged at great expense and the number of employees increased. Meanwhile wages and the cost of material rose to a level never before reached in recent years. When, therefore, late in the fall of 1907 depression set in, it was at once felt by this company as well as by all other lines, and gross earnings fell off suddenly and heavily. It was impossible to reduce expenses at once to correspond with the shrinkage in gross revenue.

Minnesota and North Carolina Laws Upset.

On March 23 the United States Supreme Court found the new railroad law of Minnesota and of North Carolina unconstitutional.

In the Minnesota case the controversy arose over the enactment of the 2 cent rate law and the excessive penalties that were provided against the railroads or their officers who refused to comply with its terms—$5,000 fine and five years' imprisonment for each refusal to sell a ticket at the rate named, and over the commodity rates, which were to have gone into effect June 1 last, reducing substantially the rates on certain merchandise and prescribing the minimum weights for carloads. Before that date, however, certain stockholders of the Northern Pacific road brought suit in the Federal Court for the District of Minnesota to enjoin the Attorney-General of the state from putting the rates into effect. That official appeared for the special purpose of objecting to the jurisdiction of the court, contending that it was without authority because the suit was in effect one against a state, prohibited by the Eleventh Amendment. This demurrer was overruled and an order was issued enjoining the enforcement of the rates until it could be determined judicially whether or not they were confiscatory, as claimed by the stockholders.

Attorney-General Young, however, paid no attention to the injunction, but the next day instituted in the state courts proceedings to compel the Northern Pacific to adopt the commodity rates prescribed. When this action was brought to the attention of the Federal Court, the Attorney-General was arrested and after a hearing, in which he again set up his immunity under the Eleventh Amendment, he was adjudged in contempt of the Federal Court, fined $100 and committed to the custody of the United States Marshal until paid and he should purge himself by withdrawing the suit from the state court. Instead he applied to the Supreme Court for a writ of habeas corpus for his release.

Justice Peckham, who delivered the opinion, said that the lower court was given jurisdiction in suits arising under the laws and the Constitution of the United States, and the question really to be determined was whether the acts of the Legislature, if enforced, would take property without due process of law, and the question might incidentally involve a question of fact; its solution, nevertheless, was one that raised a Federal question. The sufficiency of rates with reference to the Federal Constitution, he said, was a judicial question and one over which the Federal courts had jurisdiction, and had been settled by a long line of decisions.

Quoting from prior decisions that a law was invalid where it imposed a remedy so difficult to enforce as to be no remedy at all and that a rate was unconstitutional where the decision of the Legislature or its commission was conclusive as to the sufficiency of the rates, Justice Peckham said that a law which indirectly accomplished a like result by imposing such conditions upon the right to appeal for judicial relief as worked an abandonment of the right rather than face the conditions upon which it was offered or might be obtained was also unconstitutional. He continued:

It may, therefore, be said that when the penalties for disobedience are by fines so enormous and imprisonment so severe as to intimidate the company and its officers from resorting to the courts to test the validity of the legislation the result is the same as if the law in terms prohibited the company from seeking judicial construction of laws which deeply affect its rights.

For that reason the court holds the Minnesota freight and passenger rates to be unconstitutional on their face without regard to the question of the sufficiency of those rates. The Circuit Court, therefore, had jurisdiction and it was its duty to inquire whether the rates permitted by those acts were too low and therefore confiscatory, and if so held that the court then had jurisdiction to permanently enjoin their enforcement. It also had power while the inquiry was pending to grant a temporary injunction to the same effect.

Referring to the affidavits submitted in the case showing that the rates were confiscatory the opinion continues:

We have, therefore, upon this record the case of an unconstitutional act of the state legislature and an intention by the Attorney General of the state to endeavor to enforce its provisions to the injury of the company, compelling it at great expense to defend legal proceedings of a complicated and unusual character and involving questions of vast importance to all employees and officers of the company, as well as to the company itself. The question that arises is whether there is a remedy that the parties interested may resort to by going into a federal court of equity in a case involving a violation of the federal constitution and obtaining a judicial investigation of the problem, and pending its solution obtain freedom from suits, civil or criminal, by a temporary injunction; and if the question be finally decided favorably to the contention of the company a permanent injunction restraining all such actions or proceedings.

This inquiry necessitates an examination of the most material and important objection made to the jurisdiction of the Circuit Court, the objection being that the suit is in effect one against the state of Minnesota and that the injunction issued against the Attorney General illegally prohibits state action, either criminal or civil, to enforce obedience to the statutes of the state.

In the lower court, says the opinion, the case had proceeded on the theory that the rights of the stockholders protected by the Fourteenth Amendment would be violated if the rates were enforced.

A decision in the case, however, did not require a decision of the question whether the adoption of that amendment in any way altered or limited the effect of the Eleventh Amendment prohibiting a suit against a state.

The general discretion regarding the enforcement of the laws when and as the District Attorney deems appropriate is not interfered with by an injunction which restrains the state officer from taking steps toward the enforcement of an unconstitutional enactment to the injury of complainants. In such case no affirmative action of any nature is directed and the officer is simply prohibited from doing an act which he had no legal right to do. An injunction to prevent him from doing that which he has no legal right to do is not an interference with the discretion of an officer.

If the act which the Attorney-General seeks to enforce be a violation of the federal constitution the officer in proceeding under such enactment comes into conflict with the superior authority of that constitution and he is in that case stripped of his official or representative character and is subjected in his person to the consequences of his individual conduct. The state has no power to impart to him any immunity from responsibility to the supreme authority of the United States.

Justice Harlan dissented from the majority opinion, on grounds of states' rights.

Railroad Earnings; July, 1907, to January, 1908.

The report of railroad earnings to the Interstate Commerce Commission do not admit of a comparison with the earnings of previous years, but they are now beginning to be useful as a means of studying developments in the business of transportation for a number of months past. Gross and net earnings of practically all the railroads in the country by months, from July 1 to December 31, are now available, and the figures for January cover the earnings of 183,400 miles of road out of a total of something over 224,000 miles.

For the sake of accurate comparison the earnings have been reduced in the subjoined table to a per mile basis. The January figures are affected more or less by the fact that approximately 19 per cent. of the total mileage of the country is not included, but the portion included is so substantial that the gross and net earnings per mile are probably not far from what the complete figures will show. The net figures given represent the operating income after taxes. The operating ratio represents the proportion of strictly operating expenses, exclusive of taxes, to gross earnings:

	Gross.	Net.	Op. ratio.
January	$770	$153	78.4
December	863	198	73.5
November	983	262	70.1
October	1,117	339	66.8
September	1,048	314	67.0
August	1,079	345	65.2
July	1,022	304	67.2

Gross earnings reached their maximum in October, but net earnings were not at their highest in that month, having been $6 per mile or a little less than 2 per cent. under the net returns of August. Taking the October earnings to represent the high tide of railroad prosperity the falling off in three months, as shown by the January figures, was 31 per cent. in gross earnings and 55 per cent. in net earnings after taxes. The successive operating ratios indicate how slow the railroads were to reduce expenses proportionately to the loss of business.—*Wall Street Journal.*

Passenger Travel on the Great Lakes.

In the eighth inspection district, 11,915,345 passengers were carried by vessels during the season of 1907. The passenger traffic originating at Detroit, which forms a part of the eighth district, embraced 7,805,558 of these persons. The number of passengers carried out of Chicago by water was 1,967,994. The number of persons transported on the ferries enters into the total carried out of Detroit. In the entire district there was the loss of but a single life among passengers, and that was occasioned by the burning of a boat in Lake Michigan.—*Detroit Free Press.*

Report of United States Steel Corporation.

Gross sales and earnings of the United States Steel Corporation in the year ended December 31, 1907, were $757,000,000, against $697,000,000 in 1906. Net earnings were $161,000,000, against $157,000,000 in 1906. The balance applicable for dividends on the common stock or for new construction amounted to $79,000,000, or 15.6 per cent. on the common stock, as against $73,000,000, or 14.3 on the common stock in 1906. The total profit and loss surpluses of the corporation and its subsidiaries on December 31, 1907, was $123,000,000. This surplus stood at $98,000,000 a year earlier. The appropriations for new construction amounted to $54,000,000, as against $50,000,000 in 1906. There were 22,400,000 tons of iron ore mined during the year, as against 20,600,000 tons in 1906. The corporation sold 1,734,000 tons of steel rails in 1907, as against 1,983,000 tons in 1906. The average number of employees in service was 210,180, compared with 202,457, in 1906. The number of blast furnaces was 116, as against 97 in 1906.

Boycott Injunction Made Permanent.

The restraining order and injunction issued against the American Federation of Labor and its executive counsel, their agents, attorneys, servants, etc., at the instance of Buck's Stove and Range Company of St. Louis, by Justice Gould, of the Supreme Court of the District of Columbia in December last, were made permanent March 23 by Chief Justice Clabaugh. The signing of the decree was the result of agreement of counsel for both sides, although an appeal was taken by the Federation as a legal safeguard in case of possible developments in the future.

The decree is practically identical with that signed by Justice Gould in December. It restrains the Federation, its executive counsel, etc., from publishing the Buck's Stove and Range Company under its "We Don't Patronize," or "unfair" list, and prohibits them from boycotting or in any manner interfering with the stove company's business or with the sale of its product or of coercing or attempting to coerce any person, firm, corporation or the public from dealing in an unrestricted manner with the company.

Lectures on Railroad Electrification at the University of Michigan.

C. L. de Muralt, Consulting Engineer and Professor of Electrical Engineering at the University of Michigan, is giving a course of lectures to the senior electrical engineering students at Ann Arbor on the "Electrification of Steam Railroads." During the last term he has taken up such subjects as power station equipment, transmission and working conductors, motor characteristics, etc. He intends to supplement these by discussions of the technical and commercial features of the following subjects: "The General Electrification Problem"; "The Reasons for Electrification"; "The Operating Characteristics of Steam and Electric Locomotives"; "The Choice of Electric Systems"; "An Analysis of the Cost of Operation"; "The Field of Railroad Electrification: the Congested Terminal, the Mountain Grade, and the Trunk Line"; and "Preparation of an Electrification Project for a Particular Road," special attention being directed to such problems as the design of locomotives, the calculation of run sheets, the choice of speeds, study of the peak load, the location of substations, the economics of transmission and other collateral topics.

INTERSTATE COMMERCE COMMISSION RULINGS.

Rate Reduced on Coke from Colorado to Texas.

The Commission, opinion by Chairman Knapp, has announced decision in the case of the Amarillo Gas Co. vs. Atchison, Topeka & Santa Fe et al. The Commission held that defendants' rate of $3.35 per ton of 2,000 lbs. on coke in carloads from the Trinidad coal and coke district in Colorado to Amarillo, Tex., is excessive and unreasonable and should not exceed $2.90 per ton, the rate now in force for the transportation of soft coal between the same points.

Rates on Snapped and Shelled Corn.

The Commission, opinion by Commissioner Cockrell, has announced decision in the case of the Ocheltree Grain Co. vs. Chicago, Rock Island & Pacific. The complaint charged that an unreasonable rate was exacted on shipments of snapped corn, or corn in the shuck, the rate collected being 125 per cent. of the shelled corn rate. It was alleged that snapped corn is less valuable in proportion to weight, 72 lbs. making a bushel, than shelled corn, of which 54 lbs. make a bushel. At the hearing it appeared that the carrier had changed the rate on snapped corn to that on shelled corn. The Commission decided that the carrier, having changed the rate complained of, should keep its present rate on snapped corn in effect for two years.

Poor Location No Reason for Lower Rates.

The Commission, opinion by Chairman Knapp, has announced decision in the case of S. S. Quimby et al. vs. Maine Central and Washington County Railway. The complainants, situated in the eastern part of Washington county, Me., alleged that by reason of their location they cannot take advantage of the milling-in-transit privilege on corn, although their competitors at Bangor and Lewiston, Me., can do so, and therefore allowance of the transit privilege at Bangor and Lewiston constitutes undue discrimination against them.

The Commission declared that the disadvantage under which complainants labor is primarily due to their unfavorable location and that it is not the province of the Commission to overcome disadvantages of this nature by adjustment of transportation charges. If the privilege were denied to complainants and allowed to their competitors, the discrimination so practised might be unlawful; but no such claim was made.

Through Route and Joint Rate Ordered.

The Commission, opinion by Chairman Knapp, has announced decision in the case of the Merchants Freight Bureau of Little Rock, Ark., vs. Midland Valley and Chicago, Rock Island & Pacific. The complainant asked the Commission to establish through routes and joint rates for the transportation of cotton seed in carloads from points on the Midland Valley in Oklahoma, namely, Williams, Panama, Bokoshe, Keota, Stigler, Porum, Warner, Keefeton, Muskogee, Taft, Haskell, Elder and Tulsa, to Little Rock, Ark., via the Midland Valley and the Rock Island. The Commission decided that the failure of defendants to establish such routes and rates unduly discriminates against complainant in favor of manufacturers at Fort Smith, Ark., and Muskogee, Okla., and ordered defendants to establish a through route for the transportation of cotton seed in carloads from such points in Oklahoma over the Midland Valley to Hartford, Ark., and thence over the Rock Island to Little Rock, Ark., and to apply to such transportation joint through rates which as to each of said points of origin shall not exceed the present local charge of the Midland Valley from such shipping point to Hartford plus the present local charge of the Rock Island from Hartford to Little Rock.

Marine Insurance on Lake and Rail Shipments.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of Wyman, Partridge & Co. et al. vs. Boston & Maine et al. This decision is a novel one in that it discusses the question of marine insurance. It seems that prior to the opening of navigation in 1907, shippers provided marine insurance on their rail and lake shipments from New York City to Chicago and Minneapolis, but after that time such rail and lake rates were advanced and the cost of insurance was included in the rates.

The Commission decided that unless a railroad forming part of a lake and rail route sees fit to hold itself responsible for losses arising from perils of the sea, it should tender to the public a transportation contract which leaves shippers free to arrange for their own marine insurance. The bill of lading issued did not show definitely the rights of the shippers. The Commission held that the advanced rates are unreasonable and should be reduced unless the carriers issue bills of lading making them definitely responsible for loss by perils of the sea. The opinion contains a table showing the exact reductions recommended, but no order will be made until May 1, 1908. An order will then be issued putting in the reduced rates above named unless the defendants have previously tendered a contract of shipment under which the shipper receives the same protection which he formerly had under his policy of marine insurance, and make the necessary changes in their tariffs, if any are required.

New Suit Necessary to Get Lower Rate.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of the Merchants Traffic Association of Denver, Colo., vs. New York, New Haven & Hartford and 17 other carriers. The complaint alleged that the all-rail rate on cotton piece goods from New England points to Denver of $1.79 per 100 lbs., in any quantity, is unreasonable, and prayed that Denver be accorded a carload rate on such cotton fabrics. The Commission decided that the application for a carload rating be denied, but that the $1.79 rate is excessive and should not exceed $1.50.

This rate to Denver is not a joint through rate, but is made up of the local rate from New England to St. Louis plus the rate from St. Louis to Denver, or in some cases from St. Louis to Kansas City and from Kansas City to Denver. The Commission said that it might perhaps order a reduction of these several locals to such an extent as to bring the entire rate within the figure named by the Commission; but in that case the Commission would be passing upon a through rate from New England to Denver and no such rate is now in existence. The proper method to follow in cases like this, where no joint rate exists, is to cite before the Commission the proper defendants and pray for the establishment of a through route and joint rate. On a petition of that sort the Commission has power to do justice both to Denver and between the different participating carriers.

The complainant then offered the findings of the Commission and insisted that this ought to be sufficient to establish its right to an order, but the Commission held that the entire matter must be tried *de novo*. As no order could properly be made on the record in this case the complaint was dismissed.

The Commission's Authority in Oklahoma.

The Commission, opinion by Commissioner Lane, has announced decisions in seven cases, namely, A. T. Haines vs. Chicago, Rock Island & Pacific et al.; Kingfisher Mill & Elevator Co. vs. Chicago, Rock Island & Pacific and the Choctaw, Oklahoma & Gulf; Oklahoma Mill Co. vs. the same carriers; Schowalter & Company vs. the same carriers; J. P. Gist vs. the same carriers; Enid Ice & Fuel Co. vs. Chicago, Rock Island & Pacific, Enid Ice & Fuel Co vs. Fort Smith & Western, and W. B. Johnston vs. Chicago, Rock Island & Pacific.

The findings of the Commission in these decisions are: The Commission is the creature of statute and its authority is derived from the act of Congress creating it. Its function is to administer the Rate Law and not to enforce conditions found in federal or other charters. It is not its province to enforce compliance with conditions subsequent, found in railroad charters. Since the admission of Oklahoma as a state the Commission is without power to fix rates to be observed in the future within the present limits of that state.

Rates between points within the present limits of Oklahoma were held not unreasonable at the time shipments in question moved. The present rate of $1.85 per ton on shipments of slack coal from Weir and Midway, Kansas, to Goltry, Okla., is unreasonable and should not exceed $1.50 per ton. Rates between other points outside the present state of Oklahoma and points within that state held not unreasonable.

Coal Rates from Clinch Valley and Pocahontas Fields.

The Commission, opinion by Commissioner Lane, has announced decision in the case of the Raven Red Ash Coal Co. et al. vs. Norfolk & Western. Complainants are engaged in mining coal in the vicinity of Raven, a station in Virginia, on the Clinch Valley division of the Norfolk & Western. The question was whether the rate on coal in carloads from these mines to the eastern seaboard bears a proper relation to the rate charged from what are known as the Pocahontas and Tug River coal fields, which lie along the Pocahontas division of the Norfolk & Western for about 56 miles west of Graham, W. Va., the junction point of the two divisions. To reach the eastern seaboard, the movement from the mines is interstate, the coal being hauled through West Virginia. The rate on coal from mines on the Clinch Valley division to the eastern seaboard is 10 cents per ton more than from mines on the Pocahontas division. Complainants asked that the rate on coal from their mines on said Clinch Valley division to the eastern seaboard should be the same as that of their competitors in the Pocahontas fields, the distances being substantially the same.

The Commission was of opinion that complainants are entitled to the relief prayed for, and that their mines are entitled to the same rate on coal in carloads eastbound as is charged from the Pocahontas-Tug River coal fields, but held that no money damages should be allowed complainants on the shipments made. The Clinch Valley division for purposes of coal rates should be divided into two groups, one extending from Graham to a point 17 miles west of Raven and the other from Graham to Norton.

Joint Rate With Electric Railway Ordered.

The Commission, opinion by Commissioner Harlan, has announced decision in the case of the Cedar Rapids & Iowa City (Electric) Railway vs. Chicago & North-Western. This is a case where the Commission ordered through routes and joint rates to be established between an electric railway and a steam railroad. It appeared on complaint of failure by the steam railroad company to establish through routes and joint rates with the electric line between interstate points, that the shipping communities at points on the electric line between Coralville, Iowa, and Cedar Rapids, Iowa, do not enjoy the benefit of any reasonable or satisfactory through route from and to Chicago and other points reached by the defendant steam railroad.

The Commission held that through routes and joint rates thereover which shall not exceed by more than 10 per cent. the class and commodity rates of defendant between Chicago and common points and Cedar Rapids, should be established and maintained for the transportation of interstate traffic from and to Coralville and on all other points on the electric line intermediate to Cedar Rapids, to and from Chicago and other points on the line of the North-Western via the junction point between the two roads at Cedar Rapids. A former decision of the Commission in regard to the Chicago & Milwaukee Electric Railway was cited and affirmed and the distinction made between the transportation requirements of mere loading points serving one or more farms, as described in that case, and the more extensive requirements of small centers where general merchandising is done and the products of the countryside are concentrated for shipment and coal, lumber and other commodities are brought in to supply local needs.

The Baltic Pool.

The Commission, opinion by Commissioner Lane, has decided the case of the Cosmopolitan Shipping Co. vs. Hamburg-American Packet Co., North German Lloyd Steamship Co., Wilson (Hull) Lines and Scandinavian-American Line. The Commission's own digest of the case is as follows:

1. Complaint alleges that defendant steamship companies transport traffic under through bills of lading between inland points of the United States and foreign ports and are thereby subject to the jurisdiction of this Commission; that such defendants have made an arrangement for the pooling of eastbound export traffic moving by rail to Atlantic ports and thence by steamship lines to points in Denmark, Sweden, Norway, Finland and German points on the Baltic; that this "Baltic pool" arbitrarily determines the ultimate rates from such inland points of the United States to such foreign ports via the North Atlantic ports; and that the Hamburg-American Packet Co. maintains a monopoly of westbound and eastbound traffic forwarded on local and on through bills of lading between Germany and other continental countries and inland cities of the United States. The prayer is that the Commission declare the "Baltic pool" to be an illegal pooling of freights under the act, that the monopoly of the Hamburg-American Packet Co. be declared unlawful, and that general relief be granted. To this complaint defendants demur, on the grounds (a) that this Commission has no jurisdiction of the subject-matter, or power to proceed against defendants, and (b) that the complaint sets forth no matter which is cognizable by this Commission, or which it has been given authority to remedy. *Held*, That for reasons stated in the opinion, the demurrer will be sustained and the complaint dismissed.

2. This Commission has no jurisdiction as to shipments moving from ports of the United States to a foreign country not adjacent, when such shipments are not carried by rail, or by rail and water, from an inland point of origin to a port of transshipment. An inland movement of export or import traffic is a condition precedent to the attaching of jurisdiction.

3. The jurisdiction of this Commission is not to be determined by anything other than the language of Section 1 of the Act, and in this section is found a clear distinction drawn between interstate commerce and foreign commerce to a country not adjacent to the United States; and this distinction saves such foreign commerce from the effect of that provision of the section as to continuous carriage beyond the American seaboard.

4. The Commission may regulate interstate traffic, whether by rail or by a combined rail-and-water route, from point of receipt to point of delivery; but the Commission in its control over foreign commerce is limited to the regulation of such traffic, whether by railroad or by a combination of rail and water carriers, from and to the point of transshipment.

5. The Act provides no machinery by which its provisions can be enforced as to trans-Atlantic steamship lines; the absence of such provision can be explained only by accepting the interpretation that the Commission has no jurisdiction in the premises.

6. The pooling of traffic by water carriers is plainly a matter over which this Commission has no jurisdiction.

7. A rail carrier may control, and connect with, a line of steamships engaged in foreign commerce, with which it may interchange business as freely as with another rail carrier, and it may quote a combined rate for the through movement, the agent of the railroad company acting as the agent of the steamship company in so doing.

8. The Act provides that this Commission shall exercise jurisdiction over the inland portion of the haul, either to or from the foreign country; and it must logically and necessarily follow that the rate which must be filed with the Commission under Section 6 of the Act is the rate governing such movement. On foreign commerce the rate to be published with this Commission should be the rate to the port and from the port—an open rate, which any who desire to do so may use with equal advantage.

9. This position does not conclude the Commission against an examination into the relation which exists between the rail carriers of the United States and the defendant water carriers and condemnation of such arrangement, if the rail carriers to the seaboard are by any means whatsoever disobeying any provision of the Act or omitting to comply with its every requirement.

TRADE CATALOGUES.

Protective Coatings.—F. L. Melville, New York, maker of Anti-Rust, is distributing a circular giving prices and setting forth the advantages of this compound. It is for protecting machinery from rust during shipment. It is semi-liquid and the claims for it are that it is proof against salt water and steam, is always ready for use, will not thin and run off in hot weather, hard rains will not wash it off, it is free from grit, acid and vegetable or animal fats, will not tarnish the most delicate surface and can be removed by simply hard rubbing with waste or rags.

Reamers.—A pamphlet issued by the William J. Smith Co., New Haven, Conn., describes, with price lists, the Smith one-lock adjustable reamer. It is claimed that these can be accurately adjusted in a few seconds, and are as rigid as solid reamers. The blades are made in 14 sizes for reamers from ¾ in. to $3^3/_{16}$ in. in diameter. They are fitted with carbon steel or high-speed steel blades. The price lists include prices of each style and size, and of parts. Full dimensions are also given.

MANUFACTURING AND BUSINESS.

E. H. Rayburn, formerly Manager, in the South, for the Philip Carey Manufacturing Co., Cincinnati, Ohio, is now with the Franklin Manufacturing Co., Franklin, Pa.

Falls hollow staybolt iron, made by the Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, is to be used in the 30 locomotives being built by the American Locomotive Co. for the Paris-Orleans Railroad, France.

A. Johnston, Jr., for two years with the Van Deventer & Rider Co., Chicago, and before that for a number of years in the engineering department of the Chicago & Eastern Illinois, has opened an office as railroad fencing contractor at 152 East Lake street, Chicago.

D. R. Day, Secretary of the Northwestern Malleable Iron Co., Milwaukee, Wis., for the past 10 years, has been made Manager of the Union Malleable Iron Co., East Moline, Ill. The capacity of this company's plant has recently been doubled. The products include both agricultural and railroad material.

H. S. Moulton, formerly Superintendent of the Allison Car Works, Philadelphia, Pa., and more recently connected with the New York office of the Fitz-Hugh, Luther Co., Chicago, is now with the Empire Steel & Equipment Co., New York, the eastern agents for the Hicks Locomotive & Car Works, Chicago.

Arthur E. Rendle, New York, maker of Paradigm skylights and windows, has a new type of fireproof window, the special feature of which is the material composing the frame and casing. This is asbestos wood, a new building material which has been carefully tested and is said to be especially valuable where lightness combined with durability is desired. These windows are finished to represent any kind of wood and can be treated like any wooden or metal frame window.

The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., has received the following orders: Government of the Philippine Islands, 500 tons of corrugated bars, bought through Paul S. Carter, New York; Hiram Lloyd Contracting & Building Co., contractor for the new high school in St. Louis, 500 tons of corrugated bars; William A. Engeman, contractor for the reinforced concrete retaining wall to be built at St. George ferry landing, Staten Island, N. Y., as part of a plan for municipal improvements in the Borough of Richmond, 600 tons of corrugated bars.

James H. Baker, formerly President of the Solid Steel Tool & Forge Co., Brackenridge, Pa., has established an office at 316 Fourth avenue, Pittsburgh, Pa., as a forging engineer, making specialties of forging development, examination of plants, forging and special machinery, the design of forgings and castings, etc. Mr. Baker has been in the forging business for over 20 years. Last December he resigned from the Solid Steel Tool & Forge Co., which had, before that, absorbed the James H. Baker Manufacturing Co.; the latter has been organized in 1900. Several concerns previously founded by Mr. Baker are now merged in other companies.

Iron and Steel.

The New York Central & Hudson River has ordered 21,000 tons of rails from the Lackawanna Steel Co.

The Philadelphia & Reading is said to be about to ask bids on 16,000 tons of steel for track elevation work in Philadelphia.

OBITUARY NOTICES.

Walter L. Surran, Trainmaster of the Cumberland division of the Louisville & Nashville, with headquarters at Middlesborough, Ky., died on March 21 at Corbin, Ky.

James B. Hill, General Freight Agent of the Southwest system of the Pennsylvania Lines West of Pittsburgh, died on March 21 at Biloxi, Miss., at the age of 67. Mr. Hill was born on March 16, 1840, at Indianapolis, Ind., and was educated at Asbury University at Greencastle, Ind., from which he graduated in 1859. When he was 20 years old he began railroad work in the engineering department of the Atlantic & Great Western, now part of the Erie. He left the engineering for the traffic department and in 1868 became traveling agent of the Star Union Line. From 1877 to 1886 he was agent of the Pennsylvania Lines at Milwaukee and in the latter year was appointed General Western Freight Agent of the Pittsburgh, Cincinnati, Chicago & St. Louis at Chicago. On April 1, 1897, he was appointed General Freight Agent of the same road, a position which he held up to his death.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Mechanical Engineers.

The next monthly meeting of this society will be held in the Engineering Societies building, New York, April 14. The general subject at this meeting is to be "The Conservation of Our Natural Resources," which is now receiving unusual attention. The President of the United States has sent invitations to the Governors of the several states, and to the presidents of the national engineering societies, to confer in Washington on this important problem. The New York meeting will be addressed by four speakers on "Forest Preservation in its Relation to Water Power, Economy in the Utilization of Fuels, and the Attitude of the Engineer in Regard to These." Dr. Henry S. Pritchett, President of the Carnegie Foundation for the advancement of teaching, will discuss the "Relation of the Engineer to the Body Politic."

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

National Lines of Mexico.—M. M Reynolds, Comptroller, has resigned to go to another company.

New York Public Service Commission, Second District.—Charles H. Keep, Commissioner, has resigned to become President of the Knickerbocker Trust Company in New York City

Operating Officers.

Chicago, Burlington & Quincy.—F. H. Ustick, Superintendent at Aurora, Ill., has been appointed General Superintendent, with headquarters at St. Louis, Mo., succeeding George T. Ross, resigned. A. W. Brown, Superintendent at Ottumwa, Iowa, succeeds Mr. Ustick. Mr. Brown is succeeded as Superintendent by A. W. Newton, general inspector of permanent way and structures.

Delaware, Lackawanna & Western.—Edwin M. Rine, who is now Superintendent of the Morris & Essex division which includes all the New York end of the road and the Hoboken terminals, was born on September 4, 1868, at Brilliant, Ohio. After a school education he entered railroad service at the age of 18 on the Cleveland & Pittsburgh division of the Pennsylvania Lines West, as an operator. He was soon made a despatcher on the Pittsburgh & Western, now part of the Baltimore & Ohio. In 1889 he went to the South Carolina Railroad, now part of the Southern. After a year in the South he returned to Ohio as chief despatcher and later Trainmaster of the Baltimore & Ohio at Cleveland and at Akron. In 1899, the year in which Mr. Truesdale was elected President of the Lackawanna, Mr Rine came to the road as chief despatcher, later becoming Trainmaster, and Superintendent of the Scranton division. On March 1, of this year, he was transferred from the central part of the road to the eastern end.

Missouri Pacific.—William E. Brooks, who is now Superintendent of the Joplin division of the Missouri Pacific, with headquarters at Nevada, Mo., was born on October 9, 1866, at Abingdon, Va. He had no school education and at the age of 14 went to work in a construction gang on the Lexington division of the Chesapeake & Ohio. The next year, when he was 15, he was an operator on that road and the year following went to the Santa Fe as operator. In April, 1884, when he was less than 18 years old he was made despatcher on that road, a position which he held for four years. In 1888 he went to the Kentucky Central, now part of the Louisville & Nashville, as despatcher, and in 1889, also as despatcher, to the Missouri Pacific. Three years after going to this road he was made chief despatcher, a position which he held for 13 years. In March, 1905, he was made chief clerk to the Assistant General Manager, and in April, 1906, Inspector of Passenger Service. From June to September, 1907, he was Superintendent of the Northern Kansas division; from September, 1907, to March, 1908, Superintendent of the Omaha division, and is now, under the recent reorganization of the operating department, Superintendent of the Joplin division of the Missouri Pacific.

W. S. Crane has been appointed Car Accountant, succeeding A. R. Duncan, resigned.

New York Central & Hudson River.—The headquarters of P. E. Crowley, Assistant General Manager, are to be moved from New York to Albany.

Peoria & Pekin Union.—George W. Walliser has been appointed Superintendent, with headquarters at Peoria, Ill., succeeding H. G. Kruse, resigned to go to another company.

Traffic Officers.

Delaware, Lackawanna & Western.—A. S. Learoyd, Division Freight Agent at Newark, N. J., has been appointed Assistant General Freight Agent, with office at New York, effective April 1.

Lake Erie & Western.—See New York Central Lines.

New York Central Lines.—William F. Carter, District Passenger Agent of the Lake Erie & Western, at Lima, Ohio, has been appointed General Agent of the New York Central Lines at Toledo.

Union Pacific.—H. O. Wilson, General Agent of the freight department at San Francisco, Cal., has been appointed General Agent of the freight and passenger departments at Los Angeles. Mr. Wilson is succeeded by S. F. Booth, who will also be General Agent of the passenger department at San Francisco, Cal.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—William A. Nettleton, the new General Superintendent of Motive Power of this company, was born in 1863, at Hannibal, Mo. He graduated from the Sheffield Scientific School of Yale University in the class of 1885, and began railroad service in November of that year on the Kansas City, Fort Scott & Memphis. In 1888 he was a bridge inspector for Morison & Corthell and in the next year was with A. P. Boller as inspector of the bridge of the New York, New Haven & Hartford over the Thames river at New London, Conn. In that same year he returned to the Kansas City, Fort Scott & Memphis as Engineer of Tests, and held this position until 1892, when he served for a year as Superintendent of Terminals. In 1893 he was appointed Assistant Superintendent of Motive Power of this road, and two years later Superintendent of Motive Power, a position which he held for six years or until 1902. In 1902 he went to the Atchison, Topeka & Santa Fe as Assistant Superintendent of Motive Power. In 1903 he was engaged in special work, and in 1904 he went to the railroad which had taken over the road on which his early service was spent, the St. Louis & San Francisco, of which as well as the Chicago & Eastern Illinois he became General Superintendent of Motive Power. After four years service in this position he went to the Chicago, Rock Island & Pacific on March 1, 1908, as General Superintendent of Motive Power, with headquarters at Chicago.

William A. Nettleton.

New York Central & Hudson River.—The headquarters of John Howard, Superintendent of Motive Power, and of F. W. Brazier, Superintendent of Rolling Stock, are to be moved from New York to Albany.

Union Pacific.—George J. Hatz has been appointed Superintendent of Shops at Omaha, Neb., succeeding H. Stovel, deceased.

Special Officers.

Mexican Central.—B. C. Fleming has been appointed Advertising Manager.

LOCOMOTIVE BUILDING.

Butler Bros., Hibbing, Minn., have ordered 30 six-coupled switching locomotives from the Baldwin Locomotive Works.

The New York Central & Hudson River has ordered 136 locomotives of various types from the American Locomotive Co. The numbers of each type have not yet been decided, but included in the total will be 12 electric engines.

The Chicago, Milwaukee & St. Paul is building 30 simple six-wheel switching (0-6-0) locomotives at its Milwaukee shops. The specifications are as follows:

General Dimensions

Type of locomotive	Switching
Weight, total	127,000 lbs.
Diameter of drivers	50 in.
Cylinders	19 in. x 26 in.
Boiler, type	Straight top
" working steam pressure	180 lbs.
" number of tubes	235
" diameter of tubes	2 in.
" length of tubes	12 ft. 5 1/8 "
Firebox, length	7 " 7 1/8 "
" width	3 " 6 "
" grate area	25.8 sq. ft.
Heating surface, total	1,708 "
Tank capacity	4,500 gals.
Coal capacity	4½ tons

Special Equipment

Brake-shoes	Chicago, Milwaukee & St. Paul
Headlights	Adams & Westlake
Journal bearings	Hewitt
Piston rod packing	Edwards
Valve rod packing	Edwards
Safety valve	Richardson
Sanding devices	Leach

CAR BUILDING.

The Chicago Railways Co., as reported in the *Railroad Gazette* of January 10, has ordered 300 double-truck electric cars from the Pullman Co. and 50 cars from the Pressed Steel Car Co.

The Chicago, Milwaukee & St. Paul, as reported in the *Railroad Gazette* of March 13, is building 2,500 stock cars of 60,000 lbs. capacity at its Milwaukee shops. These cars will be 36 ft. 1¼ in. long, 8 ft. 6¾ in. wide and 7 ft. 5¼ in. high, inside measurements. They will have Bettendorf underframes. The special equipment includes:

Bolsters	Bettendorf
Brake-shoes	Congdon
Brasses	Hewitt
Door hangers	Climax
Trucks	Bettendorf

Three hundred cars of this lot will be double-deck, and the rest (2,200) will have water trough arrangement.

The Cold Blast Transportation Co. (Schwarzschild & Sulzberger), Chicago, has ordered 300 stock cars of 60,000 lbs. capacity from Haskell & Barker, instead of 200 refrigerator cars as reported in the *Railroad Gazette* of March 20. These cars are for May and June delivery, and will measure 36 ft. long and 9 ft. wide, inside measurements; they are to be built of wood with wooden center sills. The special equipment includes:

Bolsters	Haskell & Barker
Brake-beams	Haskell & Barker
Brake-shoes	Haskell & Barker
Brakes	Westinghouse
Couplers	Latrobe
Draft rigging	Williams & Priest
Wheels	Haskell & Barker

The Chicago, Milwaukee & St. Paul, as reported in the *Railroad Gazette* of March 20, has ordered 15 passenger coaches from Barney & Smith and three dining cars from the Pullman Co. The coaches will be 60 ft. long, 9 ft. wide and 9 ft. 10 in. high, inside measurements. The dining cars will be 70 ft. long, 10 ft. wide, over frame, and 15 ft. 6 in. high, over all. The special equipment for both will include:

Bolsters (for dining cars)	American Steel Foundries
Brake-beams	"Diamond" special
Brake-shoes	Congdon
Brasses	Hewitt
Curtain fixtures (for coaches)	Forsyth
Curtain fixtures (for dining cars)	Schroyer
Curtain material	Pantasote
Draft rigging (for coaches)	Westinghouse
Draft rigging (for dining cars)	Miner
Paint	Chic., Mil. & St. Paul standard
Vestibules	Pullman
Wheels (for dining cars)	Paige

The Atlantic Coast Line, as reported in the *Railroad Gazette* of March 20, has ordered, for the Washington & Vandemere, 100 felt insulated ventilated box cars of 60,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co., for April 15 delivery. The inside measurements will be 36 ft. long, 8 ft. 6 in. wide and 7 ft. 6 in. high. The over-all measurements will be 39 ft. long, 11 in. wide and 13 ft. 8⅞ in. high. Bodies and underframes will be of wood. The special equipment includes:

Axles	Steel
Bolsters, body	Cast steel
Bolsters, truck	Open hearth, I beam
Brakes	Westinghouse
Brake beams	Pennsylvania
Brake-shoes	Cast iron
Couplers	Tower
Door fastenings	National Malleable Castings Co.
Draft gear	Farlow Twin Spring
Dust guards	Harrison
Roofs	Murphy outside
Springs	Railway Steel Spring
Trucks	Company's standard, arch bar
Ventilators	Company's standard, on ends
Wheels	Maryland Car Wheel Co.

RAILROAD STRUCTURES.

BATTLE CREEK, MICH.—The Grand Trunk, it is said, will put up repair shops here.

BRANDON, MAN.—The Canadian Northern, it is said, will soon begin work on a large station here.

GRAND FORKS, B. C.—The improvements to be carried out here by the Canadian Pacific include a 15-stall roundhouse to cost $70,000, passenger station and office building, $49,000, and yard improvements $40,000.

HOMER, LA.—The Louisiana & Northwest is said to be planning to put up shops and other improvements here to cost about $100,000.

NANAIMO, B. C.—Work on the Esquimalt & Nanaimo includes putting up a steel bridge at Raymond's crossing, two between Duncans and Shawnigan Lake, also one at Chemainus over the Nanaimo river. The present wooden bridge over Cowichan river is also to be replaced with a steel structure.

SAN ANGELO, TEX.—The Kansas City, Mexico & Orient, reports say, will build roundhouses here in addition to the proposed combined passenger station and freight house.

TRENTON, N. J.—Commercial interests of Philadelphia and Trenton, N. J., are opposed to the plans of the Pennsylvania to a bridge over the Delaware river from West Morrisville, Pa., near Trenton, to connect with the freight relief line to be built under the name of the Pennsylvania & Newark, east to Newark, N. J., about 50 miles. The proposed structure is to have 11 spans, each 100 ft. wide, with two draws of the same width over the channel, and a height in the clear of 34 ft., with draws closed. Objection is made that the bridge will interfere with river navigation.

UTICA, N. Y.—The Public Service Commission, Second district, has approved the plans of eliminating the Genesee street grade crossings, in Utica, by putting up a steel viaduct 68 ft. wide over the New York Central tracks at a cost of about $370,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ABERDEEN & TOMBIGBEE VALLEY.—The subscriptions to the underwriting agreement to secure the bonds for building this line in Mississippi has been nearly three times over subscribed. As reported in our Construction Record the line is now being built from Okolona, Miss., southeast to Pickensville, Ala., all surveyed, and grading finished between Okolona and Aberdeen on 17.5 miles, also Columbus to Pickensville, 11.5 miles. W. T. McKee, Chief Engineer, Aberdeen, Miss.

BIENVILLE-QUITMAN.—Incorporated in Louisiana, with $100,000 capital, to build a line from Bienville, La., east to Quitman, 12 miles. D. C. Richardson, President, Bienville. The D. C. Richardson-Taylor Lumber Co., it is said, is back of the project.

BRINSON RAILWAY.—This company, incorporated to build from Savannah, Ga., northwest to Athens, 180 miles, last year finished the first 25 miles from Savannah to Springfield. The company has bought terminal property at Savannah, and will shortly issue bonds to extend the line to Sylvania, 32 miles. G. M. Brinson, President and Superintendent, Springfield, Ga. (March 13, p. 390.)

CAIRO & NORFOLK.—Incorporated in Kentucky, with $500,000 capital, to build a line from Port Jefferson and Bullard county, along the Mississippi river to Bristol, Va. Incorporators include L. W. Goode and E. E. Weston, of New York; F. R. Allen and C. B. Goode, of Mayfield; W. A. Usher, H. C. Neal and E. S. Beaumont.

CANADIAN PACIFIC.—Announcement is made that this company will open its Toronto-Sudbury line for traffic June 15. (March 13, p. 396.)

CANADIAN VALLEY RAILROAD.—Incorporated by residents of Mutual, Okla., with a capital of $2,000,000. Proposes to build from Fort Supply, Woodward county, Okla., southeast through the counties of Woodward, Dewey, Blaine, Canadian and Oklahoma to Oklahoma City, 150 miles. The estimated cost of the line will be $25,000 a mile.

CHEROKEE BELT & INTERURBAN.—Incorporated in Oklahoma with $500,000 capital and office at Tulsa, Okla., and at Kansas City, Mo., the company proposes to build a line from the Midland Valley Railroad to the Missouri, Kansas & Texas, through the counties of Craig, Tulsa, Rogers & Myers. Incorporators include F. O. Montel, of Kansas City; C. W. Butterworth, of Tulsa; and E. Pease, J. R. Caudley and A. E. Leahe, of Collinsville, Okla.

CHICAGO, LAKE SHORE & SOUTH BEND (ELECTRIC).—Work on this line, building from South Bend, Ind., west to Chicago, Ill., 71 miles, has all been finished except 13 miles between South Bend and Michigan City. Announcement is made that this section is to be opened June 13, and the entire line is to be in operation about July 1st. (March 13, p. 390.)

CHICAGO, MILWAUKEE & ST. PAUL.—The Pacific coast line has been extended from Terry, Mont., west to Lombard, about 337 miles, and this section was put in operation March 15. There remains about 118 miles to finish the line to Butte. Track laying, it is said, will be started at once both east and west from Lind, Wash., where the line crosses the Northern Pacific, and shortly thereafter at Plummer, Idaho.

CHICAGO, ROCK ISLAND & PACIFIC.—An officer writes regarding the report that this company has work under way on the entire line from Amarillo, Tex., west to Tucumcari, N. Mex., 110 miles, that track laying was started this month on the first 20 miles, which is all the work planned to be carried out on this line at this time. (Mar. 13, p. 390.)

COAL & COKE.—Rights of way are reported secured and work is to be started at once by this company, on an extension from Gassoway, W. Va., southeast via Sutton to Webster Springs, 40 miles. The plans include a tunnel three-quarters of a mile long through Elk mountain.

CROW'S NEST & NORTHERN.—A bill has been passed by the Canadian Parliament authorizing this company, recently incorporated in Canada with a capital of $2,000,000, to build a line from a point on the Canadian Pacific, just west of Crow's Nest, B. C., north to the summit or divide between the waters of the North Fork of Michel creek and the waters of Grave creek, via the west side of the North Fork of Michel creek to the confluence of the two north branches, thence by both branches to points near the divide. The bill also authorizes the company to build branch lines not more than 10 miles long. Construction work is to be started as soon as the weather permits, and it is the intention of the company to have the line finished before next winter. All the rights of way have been secured and surveys made. Contracts for grading, track laying, bridges, etc., are soon to be let. The line is to be built to market the output of the Crown Coal & Coke Company, and of the Michel Coal Mines, Ltd. The office of the company is to be at Crow's Nest, B. C. R. J. Belden, of the Crown Coal & Coke Company, Spokane, Wash., may be addressed. (March 6, p. 328.)

GRAND TRUNK PACIFIC.—This company has reached an agreement with the British Columbia Government, and plans are now under way to let contracts for additional sections east from Prince Rupert, B. C. A total of 300 miles will soon be under contract on the line between the Pacific and the Rockies. Active work is under way laying out the terminal city at Prince Rupert. Contract for the first 100 miles let to Foley, Walsh & Stewart, it is stated will cost about $10,000,000. This section extends from Prince Rupert to a point on the Skeena river, skirting the Pacific ocean for some 25 or 30 miles. Nearly all the excavation will be through rock and the work must be finished by September, 1909. About 2,000 men will be put to work as soon as they can be secured.

J. D. MacArthur, who has the contract for building 244 miles of line from a point east of Winnipeg east to the junction with the Lake Superior branch, has had 7,000 men at work on this section all through the winter. About 60 per cent. of the construction work is finished. The contract calls for a number of steel and concrete bridges.

LIMA & TOLEDO TRACTION.—See Ohio Electric Railway.

LOS ANGELES & SAN FRANCISCO SHORE LINE.—Incorporated in California, with $441,000 capital, to build a line from Los Angeles north to San Francisco. Surveys are said to have been made which give a line about 80 miles shorter than the Southern Pacific. John Cross, President and General Manager, Los Angeles.

LOS ANGELES HARBOR COMPANY.—See Los Angeles Harbor Railroad Co.

LOS ANGELES HARBOR RAILROAD COMPANY.—A company was recently incorporated in California under this name, also one under the name of the Los Angeles Harbor Company, each having a capital of $2,500,000. Rights of way have been secured for a proposed line from Wilmington, Cal., at Tidewater, to Los Angeles, about 25 miles. A. C. Bird, of Compton, formerly Vice-President of the Gould Lines in charge of traffic, is President of both companies.

MEXICAN ROADS.—The British syndicate which owns extensive coal fields at Furbero, Vera Cruz, is said to have given a contract to build a line from Furbero to Tuxpan, 80 miles. H. S. Armstrong, formerly at Monterey as Resident Engineer of the Mexican Central, is Chief Engineer. J. S. Nickerson, of Mexico, is also interested in the project.

Bids are to be asked for in June by P. O. Pruto, P. O. Box 138, Parral, Chihuahua, to build a line from Parral east to Jimenez, 60 miles.

OHIO ELECTRIC RAILWAY.—Work has been resumed on the Lima & Toledo, building from Deshler, Ohio, north to Toledo, 30 miles. The section from Toledo south to Waterville is almost finished and about 20 miles from Deshler north to Waterville is yet to be built. (March 13, p. 393.)

PECOS & BALMORHEA.—Application is being made by a company under this name for incorporation by residents of Toyah Creek valley to build a line from Pecos, Tex., south to Balmorhea, 50 miles.

Over $50,000 and the necessary lands for terminal facilities have been subscribed.

RUSTON, NATCHITOCHES & NORTHEASTERN.—Incorporated in Louisiana to build a line from Ruston north to Farmerville, about 25 miles. J. C. Nolan, President; E. L. Kidd, Secretary and Treasurer, Ruston.

SAN FRANCISCO & BAY COUNTIES RAILWAY (ELECTRIC).—See San Francisco, Oakland & San Jose Consolidated.

SAN FRANCISCO, OAKLAND & SAN JOSE CONSOLIDATED (ELECTRIC).—Under this name it is reported a company has been formed with a capital of $7,750,000 as a consolidation of the San Francisco, Oakland & San Jose, operating 25 miles of electric line connecting by ferry with San Francisco, Cal., and the San Francisco & Bay Counties Railway. The latter was recently incorporated to build an electric line from San Francisco south to San Jose. E. A. Heron, D. Searls and F. M. Smith are directors.

SAN FRANCISCO, OAKLAND & SAN JOSE (ELECTRIC).—See San Francisco, Oakland & San Jose Consolidated.

SPOKANE, PORTLAND & SEATTLE.—The section which was built last year from Kennewick, Wash., opposite Pasco, west to Vancouver, 220 miles, is expected to be opened by June. The extension to Spokane, 145 miles, is also to be put in operation this year. (March 13, p. 395.)

WESTERN & ATLANTIC.—Residents of Camden county, Ga., agree to furnish the right of way and terminal site at St. Mary for an extension of this road from Atlanta to the deep water harbor at St. Mary. Several counties along the proposed route, it is said, are now taking action to grant the necessary right of way.

RAILROAD CORPORATION NEWS.

BAINBRIDGE NORTHEASTERN.—Col. M. Wilkinson, of Valdosta, Ga., was on March 2 appointed receiver of this company by Judge Speer in the United States District Court at Savannah. The Bainbridge Northeastern is 18 miles long and runs from Bainbridge to within two miles of Swindell, both in Decatur county, Ga.

BRINSON RAILWAY.—The stockholders of this company, which was incorporated in Georgia in May, 1906, and has built 25 miles of road from Savannah, Ga., to beyond Springfield, are to meet on April 6 to authorize a bond issue at the rate of not more than $10,000 a mile for the first 100 miles and $15,000 a mile for the rest of the line. The road, as projected, is 180 miles long. See Railroad Construction column.

BROOKLYN RAPID TRANSIT.—It is reported that the firm of J. P. Morgan & Co. has become interested in the financial management of this company, which controls the elevated lines and most of the surface lines in Brooklyn, N. Y.

CHICAGO, INDIANA & SOUTHERN.—It is reported that the sale of $15,000,000 fifty-year 4 per cent. bonds of this company, guaranteed by the Lake Shore & Michigan Southern, is being negotiated with J. P. Morgan & Co.

CINCINNATI, HAMILTON & DAYTON.—Holders of the $11,558,000 4 per cent. refunding bonds may exchange these bonds at par up to July 15, for the new collateral purchase money notes. (January 10, 1908; p. 74.)

ERIE.—There are $5,500,000 discount notes, issued in April, 1907, which fall due April 8, 1908.

GRAND TRUNK PACIFIC.—This company recently offered $10,000,000 (£2,000,000) 4 per cent. securities in London, of which the underwriters are reported to have had to take between 50 and 90 per cent.

INDIANA, COLUMBUS & EASTERN TRACTION.—See Ohio Electric Railway.

INTERNATIONAL & GREAT NORTHERN.—Gross earnings for the week ended March 21, 1908, were 18 per cent. less than for the corresponding week in 1907.

KANSAS CITY SOUTHERN.—Gross earnings for February decreased 9 per cent.; operating expenses increased 7 per cent., and net earnings after taxes decreased 38 per cent.

LEHIGH & NEW ENGLAND.—See Lehigh Coal & Navigation Company.

LEHIGH COAL & NAVIGATION.—The stockholders of this company have the opportunity to subscribe to the $1,731,500 new stock at par to the amount of 10 per cent. of their holdings. The proceeds will be used for general improvements, which may include betterments on the Lehigh & New England Railroad, which is owned by the Lehigh Coal & Navigation Co.

MEXICAN SOUTHERN.—The narrow (3 ft.) gage line of this company runs from Puebla, Puebla, Mexico, to Oaxaca, Oaxaca, 367 miles, with a 50-mile tramway branch from Tehuacan north to Esperanza. The stockholders have recently been offered $500,000 (£100,000) 4 per cent. "first mortgage debenture" stock at 82. The proceeds are to be used chiefly to convert the tramway into a steam railroad with 3 ft. gage.

NEW ORLEANS TERMINAL.—Potter, Choate & Prentice, of New York, have offered at 98¼, to yield 7¾ per cent., a block of the $2,500,000 two-year 6 per cent. notes due April 10, 1909. These notes are guaranteed by the Southern and by the St. Louis & San Francisco and are secured by $4,000,000 first mortgage 4 per cent. bonds of the New Orleans Terminal Company, which bonds are also guaranteed by these two railroads. Besides its several terminal properties, the company owns 18 miles of belt railroad.

NEW YORK CENTRAL LINES.—The gross earnings, expenses and net earnings of the various New York Central Lines for the month of January, 1908, with the increase or decrease as compared with January, 1907, are shown below. These figures, for purposes of comparison, are compiled on the same bases as in the previous year and differ from those reported to the Interstate Commerce Commission under the present accounting rules.

	1908	Change	
New York Central & Hudson River			
Gross earnings	$6,636,494	Dec	$776,000
Expenses	5,571,069	"	608,221
Net earnings	$1,065,425	Dec	$167,779
Lake Shore & Michigan Southern			
Gross earnings	$2,932,442	Dec	$532,175
Expenses	2,211,044	"	356,158
Net earnings	$721,398	Dec	$176,017
Lake Erie & Western			
Gross earnings	$349,232	Dec	$64,270
Expenses	300,609	"	9,564
Net earnings	$48,623	Dec	$54,706
Chicago Indiana & Southern.			
Gross earnings	$248,640	Inc	$4,211
Expenses	162,827	"	5,973
Net earnings	$85,813	Dec	$2,761
New York, Chicago & St. Louis.			
Gross earnings	$775,238	Dec	$41,059
Expenses	665,120	"	12,215
Net earnings	$110,118	Dec	$28,844
Michigan Central.			
Gross earnings	$1,956,139	Dec	$322,688
Expenses	1,654,542	"	218,960
Net earnings	$301,597	Dec	$103,728
Cleveland, Cincinnati, Chicago & St. Louis			
Gross earnings	$1,821,799	Dec	$7,002
Expenses	1,524,448	"	66,197
Net earnings	$297,351	Inc	$59,195
Peoria & Eastern			
Gross earnings	$251,247	Inc	$9,481
Expenses	176,660	Dec	20,946
Net earnings	$74,587	Inc	$30,427
Cincinnati Northern.			
Gross earnings	$56,854	Dec	$17,334
Expenses	53,404	"	1,632
Net earnings	$3,450	Dec	$15,702
Pittsburgh & Lake Erie			
Gross earnings	$586,058	Dec	$506,060
Expenses	460,210	"	383,261
Net earnings	$125,848	Dec	$122,799
Rutland			
Gross earnings	$185,885	Dec	$9,010
Expenses	157,425	Inc	11,504
Net earnings	$28,460	Dec	$20,515

OHIO ELECTRIC RAILWAY.—A block of the Indiana, Columbus & Eastern Traction Company's general and refunding mortgage 5 per cent. bonds, due 1926 are being offered at 96. The mileage owned or leased is 115 miles of electric line in Ohio. The Indiana, Columbus & Eastern is itself leased by the Ohio Electric Railway which guarantees interest on these bonds. With connecting lines in Ohio and Indiana controlled by the same interest, the Indiana, Columbus & Eastern forms part of a system of 1,700 miles of electric line.

PERE MARQUETTE.—The First National Bank of Chicago is offering at par $900,000 6 per cent. equipment notes dated March 1, 1908, maturing up to and including 1911. These notes are part of the new issue which has been exchanged for the 5 per cent. equipment notes of the Eastern Equipment Company, which matured March 1, 1908. (March 6, 1908, p. 330.)

PITTSBURGH, CINCINNATI, CHICAGO & ST. LOUIS.—Operating expenses and taxes in February decreased more than gross earnings, so that there was an increase of $13,500 in net earnings.

TEXAS & PACIFIC.—Gross earnings for the week ended March 21, 1908, were 25 per cent. less than for the corresponding week in 1907.

UNITED RAILWAYS INVESTMENT COMPANY.—This company is to issue at least $3,000,000 6 per cent. serial notes maturing yearly up to 1917, as authorized in June, 1907, by the stockholders. The proceeds are to be used to pay the floating debt of the United Railroads of San Francisco.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

CONTENTS

VOL. XLIV., No. 14. FRIDAY, APRIL 3, 1908.

RECENT ELECTRIFICATION WORK.

It has been the practice at the New York Railroad Club for the past few years to devote one meeting of each season to the discussion of electrical matters, especially along the lines of the electrification of railroads that are or have been operated by steam. These meetings have invariably called out a large attendance and have been marked by a much more conservative estimate of the advantages accruing from electrification than has characterized the gatherings where the subject has been discussed by electrical engineers only. The evening of March 20 was devoted to this subject and was no exception to those that had preceded it.

As in the development of any other great work, it is at the point of realization that extravagance of statement and of claims ceases and the promoters are willing to let the results rest upon their merits. At present, as one speaker pointed out, conditions have reached such a point of perfection, and such great works have been executed, that it is merely necessary to refer to them to confirm a proposition. Previous work has been so well done that it has not been found necessary to introduce any very radical changes or improvements on what has been done before in the developments of the last year. Not that the last word has been said, or that, in the installations that have been completed, there has been no trouble—there have been endless annoyances and unlooked for difficulties that have made the lot of the engineers anything but a happy one. But these difficulties have been those of detail and not of fundamentals and principle, so that the way out is clear, and the means of avoiding similar ones in the future are measurably plain. Further than this, work has been carried to such a point that the operation of electric trains of the first-class calls for higher development of power than that in use on heavy traffic high speed steam-operated lines. The Interborough of New York was cited as an instance where, in the subway section, trains were equipped with motors aggregating 2,000 h.p., while for surface work on the electric zone of the New York Central 1,600 h.p. was provided in a single locomotive. The concentration of high powers is, therefore, no longer a thing of promise but an accomplished fact.

In the course of the discussion, with no set paper as a center, and with each speaker acting as a free lance, the old argument was again presented, to the effect that where such great improvements were made as in the case of the New York Central and Pennsylvania works in New York, if it is desired to compare the costs of steam and electric operation, the whole cost should not be charged to the latter, but the estimate should be based on what it would cost to provide for the same service with steam that will be rendered by the electric equipment. Attention was also called to the increased value of the "air" rights when electric operation is provided for. That is to say, in the construction of terminals it becomes possible to build large and high office buildings immediately above the tracks and thus utilize space that would be useless and valueless were steam to be used, with its accompaniment of smoke and gas.

Viewed, then, in the light of present achievement, the electrical engineer need not anticipate that he will have any more difficult problems to solve than those which have already been presented. They will differ, of course, for different conditions will require different solutions, and each installation of an electric plant will have to be governed by local surroundings in the future just as it has in the past. As for the cost of installation and operation the speakers had little to say. The presentation of possibilities had already been made and it was upon the expectation that these would be fulfilled that much of the present day work had been undertaken. Some of these installations were now working out their own salvation, and they promised well for the fulfillment of the prophecies that had been made regarding them. At any rate, they will now be judged solely on their merits, without extravagance of claim.

With the demonstrations that have been made, the electrical engineer is in a position to undertake any project that may be presented. Not all these projects will offer the inducements of commercial success, but when this is assured it is then merely a question of money to secure the plant. The electric traction engineer has the choice of five systems: the third rail, single-phase, three-phase, 1,200 volt direct current and gasolene-electric car.

This was the trend of the discussion, and it differed very materially from that of previous meetings, since it was a recital of things done rather than of claims for future possibilities. It was in view of this array that one speaker expressed surprise that the list of great works done or under consideration was not larger, but attributed it to the great first cost of many of the enterprises that had been proposed. Reduction of first cost is going to be the biggest problem confronting electrical engineers in the immediate future.

As for the great works that have been either completed or decided upon, the array is certainly imposing. There is the electrification of the New York Central and of the New Haven, with its base at the Grand Central Station of New York; the Pennsylvania's terminal well under way; the opening of the extension of the subway beneath the East river to Borough Hall, and the tunnel under the Hudson to Hoboken, with the probability of others to Long Island and Jersey City in the near future. Then there is the electrification of the Rochester branch of the Erie and of the West Shore between Utica and Syracuse; the Cascade tunnel of the Great Northern, and the line over the Bitter Root mountain on the Pacific coast extension of the Chicago, Milwaukee & St. Paul, over which heavy trains are to be hauled on a 1.7 per cent. grade, with a current generated by water power. Yet, with all these possibilities and probabilities of the future, there was not a word in the discussion regarding the demise of the steam locomotive, but it was stated that when the youngest man in the room was old and gray headed the steam locomotive would still be at work, and an estimate was made that if all the electrical manufacturing concerns in the country were to devote themselves exclusively to building electric locomotives for the next twenty years they would not, at the end of that time, have built as many as the number of the steam locomotives now in use.

The meeting was interesting, not only from the statements that were made regarding the achievements of the past year and the absence of all extravagance of claim, but as an exemplification of that broadness of vision that has come to the electrical engineer as the result of his contact with the steam engineer and his increased familiarity with the problems presented by heavy traffic, high-speed work.

HIGH STEAM PRESSURES IN LOCOMOTIVE SERVICE.

The Carnegie Institution of Washington has issued a book of about 140 pages containing the results of the experiments conducted by Prof. W. F. M. Goss at Purdue University on the high steam pressures in locomotive service. As is usual in the documents coming from this authority, the work is of the highest value as indicating the limitations of commercially profitable pressures in locomotive practice. In the summary of his conclusions the author shows that, as there is an increase of boiler pressure, there is a decrease in the amount of water consumed per indicated horse power and this same statement holds in the item of fuel consumption also. This would lead to the natural conclusion that the higher the pressure the more economical the operation. This is not, however, necessarily the case, as was so admirably shown at the meeting of the Master Mechanics' Association last year. As the pressure is increased the saving does not increase in the same ratio, being less for the same increments of higher pressure. Then, too, even that saving that has been indicated "depends upon the degree of perfection attending the maintenance of the locomotive," and the values obtained assume a high order of maintenance. If this is lacking, it may easily happen that the saving which is anticipated through the adoption of higher pressures will entirely disappear. The difficulties to be met in the maintenance both of boiler and of cylinders also increase with increase of pressure.

Dean Goss' results supply an accurate measure by which to determine the advantage of increasing the capacity of a boiler. For the development of a given power, any increase in boiler capacity brings its return in improved performance without adding to the cost of maintenance or opening any new avenues for incidental losses. As a means to improvement, it is more certain than that which is offered by increase of pressure.

As a scale of pressure is ascended, an opportunity to further increase the weight of a locomotive should in many cases find expression in the design of a boiler of increased capacity rather than in one for higher pressures. Assuming 180 lbs. pressure to have been accepted as standard, and assuming the maintenance to be of the highest order, it will be found good practice to utilize any allowable increase in weight by providing a larger boiler rather than by providing a stronger boiler to permit higher pressures. Wherever the maintenance is not of the highest order, the standard running pressure should be below 180 lbs. Wherever the water, which must be used in boilers, contains foaming or scale-making admixtures best results are likely to be secured by fixing the running pressure below the limit of 180 lbs.

A simple locomotive using saturated steam will render good and efficient service when the running pressure is as low as 160 lbs., under most favorable conditions, no argument is to be found in the economic performance of the engine which can justify the use of pressure greater than 200 lbs. The early tests were made with the first locomotive on the plant, but the pressures were limited to a maximum of 150 lbs. and the results are given in Prof. Goss' book on *Locomotive Performance* which was reviewed in the *Railroad Gazette* of May 3, 1907. In the new series the work was done at pressure of 240, 220, 200, 180, 160 and 120 lbs., a range which extends far below and far above pressures which are common in present practice.

As for the difficulties of operating under high pressure, the work with the experimental locomotive has shown that those difficulties which, in locomotive operation, are usually ascribed to bad water, increase rapidly as the pressure is increased. The water supply of the Purdue laboratory contains a considerable amount of magnesia and carbonate of lime. When used in boilers carrying low pressure, there is no great difficulty in washing out practically all sediment. The boiler of the first experimental locomotive *Schenectady No.* 1, which carried but 140 lbs. and was run at a pressure of 130 lbs., after serving in the work of the laboratory for a period of six years, left the testing-plant with a boiler which was practically clean. Throughout its period of service this boiler rarely required the attention of a boilermaker to keep it tight. Water from the same source was ordinarily used in the boiler of *Schenectady No.* 2, which carried a pressure of 200 lbs. or more. It was soon found that this boiler, operating under the higher pressure, frequently required the attention of a boilermaker. After having been operated for no more than 30,000 miles, cracks developed in the side sheets, making it impossible to keep the boiler tight, and new side sheets were applied. In operating under pressures as high as 240 lbs., the temperature of the water delivered by the injector was so high that scale was deposited in the check-valve, in the delivery pipe, and in the delivery tube of the injector. Under this pressure, with the water normal to the laboratory, the injectors often failed after they had been in action for a period of two hours. The interruptions of tests through failure of the injector, and through the starting of leaks at stay bolts, as the tests proceeded, became so annoying that, as a last resort, a new source of water supply was found in the return tank of the university heating-plant. This water was mostly distilled, and its use greatly assisted in running the tests at 240 lbs. pressure.

Probably some of the difficulties experienced in operating under very high steam-pressures were due to the experimental character of the plant, and would not appear after practice had, by a gradual process of approach, become committed to the use of such pressure but the results are clear in their indication that the problem of boiler maintenance, especially in bad-water districts, will become more complicated as pressures are further increased. Since, taking the country over, there are few localities where locomotives can be furnished with pure water, the conclusion stated should be accepted as rather far-reaching in its effect.

The tests developed no serious difficulties in the lubrication of valves and pistons under pressure as high as 240 lbs., though this could not be done with a grade of oil previously employed. With increase of pressure any incidental leakage, either of the boiler or from cylinders, becomes more serious in its effect upon performance.

In concluding this brief review of the difficulties encountered in the operation of locomotives under very high steam-pressures, the reader is reminded that an increase of pressure is an embellishment to which each detail in the design of the whole machine must give a proper response. A locomotive which is to operate under such pressure will need to be more carefully designed and more perfectly maintained than a similar locomotive designed for lower pressure, and much of that which is crude and imperfect, but nevertheless serviceable in the operation of locomotives using a lower pressure, must give way to a more perfect practice in the presence of the higher pressure.

The effect of pressure on boiler performance was a point upon which information was desired. The generation of steam at 120 lbs. involves a temperature of the water which is 50 degrees less than that which must be dealt with in generating steam at a pressure of 240 lbs., and, in general, it has been assumed that any increase in boiler pressure necessarily results in some loss of evaporative efficiency. It has been known that for the small ranges of pressure common in stationary practice, this difference is not great, but the facts have not been established with reference to locomotive performance, or for ranges as great as those covered by the experiments under consideration in any service. The results show that the lowest efficiency is obtained with the highest pressure, and performances under different pressures fall in order inversely with the pressure. The facts thus defined may be stated as follows:

The evaporative efficiency of a locomotive boiler is but slightly affected by changes in pressure.

Changes in steam-pressure between the limits of 120 lbs. and 240 lbs. will produce an effect upon the efficiency of the boiler which will be less than 0.5 pound of water per pound of coal.

Smokebox temperatures increase in all cases as the rate of evaporation is increased. The equations show that the effect of increasing the pressure from 120 lbs. to 220 lbs. is to increase the smokebox temperature 17 degrees; that is, an increase of pressure of nearly 100 per cent. results in an increase of smokebox temperature of approximately 3.5 per cent.

In the preceding statements is to be found an explanation of the constancy in the evaporative efficiency of the boiler under different steam pressures. The fact seems to be that the water in the boiler is about as effective in absorbing the heat of the gases when its temperature is 400 degrees (240 lbs. pressure) as when its temperature is but 350 degrees (120 lbs. pressure).

The data sustain the following conclusions:

1. The smokebox temperature falls between the limits of 590 degrees F. and 850 degrees F., the lower limit agreeing with a rate of evaporation of 4 lbs. per foot of heating-surface per hour and the latter with a rate of evaporation of 14 lbs. per foot of heating surface per hour.

2. The smokebox temperature is so slightly affected by changes in steam-pressure as to make negligible the influence of such changes in pressure for all ordinary ranges.

3. The equation $T = 488.5 + 25.66\ H$, where T is the temperature of the smokebox expressed in degrees F. and H is pounds of water evaporated from and 212 degrees per foot of heating surface per hour, possesses a high degree of accuracy.

Further, pressure has been found to have no effect upon the draft. For example, when the rate of evaporation is 10 lbs. per foot of heating surface per hour, the draft in front of the diaphragm is approximately four inches for all pressures. There is, in fact, no reason why the draft should vary materially with changes in pressure.

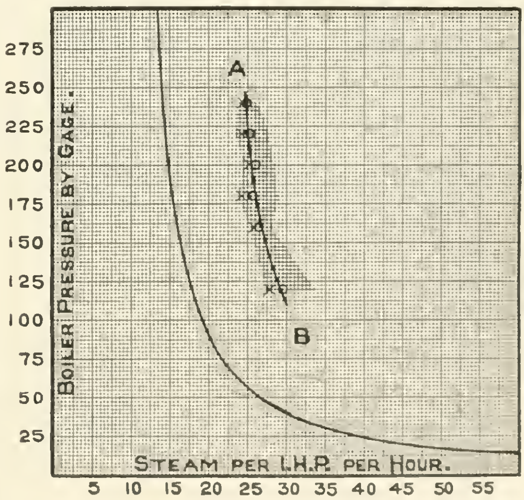
Attempts were made through an analysis of the smokebox gases to explain the variations in the evaporative efficiency of the boiler. The results, however, have not proven entirely satisfactory. That is, where the evaporative performance is abnormal, they do not permit the assignment of a definite cause. They do, however, entirely justify certain general conclusions. They show that the amount of excess air admitted to the furnace is never great, and in most cases it is very small—far below the limits which are thought desirable in stationary practice. They show, also, that the excess air diminishes as the rate of combustion increases. It is apparent, therefore, that the loss in efficiency arising from excess air is under normal conditions smaller than in most other classes of service. Moreover, while the supply of air appears limited, it is significant that the losses from imperfect combustion, as shown by the presence of CO, are also small, the actual amount varying irregularly between limits which are very narrow.

As already indicated in former papers by Prof. Goss, the steam consumption per indicated horse-power is less upon the locomotive than was formerly supposed. For example, it appears that at a pressure of 240 lbs. the engine, when working under a fully open throttle, gave a horse-power hour in return for the consumption of less than 24 lbs. of steam, and under any condition of speed or cut-off for which it was found possible to operate the engine under a wide open throttle the consumption never exceeded 26.3 lbs. At lower pressures involving the possibility of a wider choice in the condition of operating, the range is somewhat increased. Thus, at 120 lbs. pressure the minimum value is 27.5 and the maximum 33.8, a range which, while greater than that just referred to, is nevertheless extremely narrow as compared with the range incident to the operation of other classes of engines.

The most efficient point of cut-off for the lowest pressure is evidently that secured when the reverse lever is in the eighth notch, which is equal to 35 per cent. of the stroke. At 200 lbs. pressure the most efficient cut-off is that represented by the sixth notch, or 27 per cent. of the stroke, and the data do not disclose that a shorter cut-off than this under a full-open throttle is profitable for the engine experimented upon, even though the pressure be raised to 240 lbs.

The effect of speed on steam consumption shows that for all pressures above 160 lbs. the most efficient speed is 40 miles.

For purposes of comparison, the effect of pressure on performance has been defined by a line. In preparing to draw such a line the average performance of all tests at each of the different pressures was obtained and plotted, the results being shown by the circles on the figure. Points thus obtained can be regarded as fairly representing the performance of the engine under the several pressures only so far as the tests run for each different pressure may be assumed to fairly represent the range of speed and cut-off under which the engine would ordinarily operate. The best results for each different pressure, as obtained by averaging the best results for each speed at constant pressure, are indicated upon the diagram with a light cross. These points may be regarded as furnishing a satisfactory basis of comparison in so far as it may be assumed that when the speed has been determined an engine in service will always operate under conditions of highest efficiency. Again, the left-hand edge of the shaded zone represents a comparison based on maximum performance at whatever speed or cut-off. In addition to the points already described, there is located upon the diagram a curve showing the performance of a perfect engine with which the plotted points derived from the data of tests may be compared. This curve represents the performance of an engine working on Carnot's cycle, the initial temperature being that of the several pressures stated, and the final temperature being that of steam at 1.3 lbs. above atmospheric pressure. This latter value is the assumed pressure of exhaust in locomotive service.



Guided by this curve, representing the performance of a perfect engine, a line A B has been drawn proportional thereto, and so placed as to fairly represent the circular points derived from the experiments. It is proposed to accept this line as representing the steam consumption of the experimental engine under the several pressures employed. It is to be noted that it is not the minimum performance nor the maximum, but it is a close approach to that performance which is suggested by an average of all results derived from all tests which were run. Since its form is based upon a curve of perfect performance it has a logical basis, and since it does no violence to the experimental data its use seem justifiable.

An examination of all of the data obtained that are comparable shows that the values, especially if confined to the tests run with the reverse lever in the second, fourth and sixth notches, show but slight variation in the coal consumed per horse-power hour either with changes of speed or with changes in pressure. The fact, also, that the record shows but three out of 46 tests, representing a great variety of running conditions, for which the consumption exceeds

4 lbs., argues well for the efficiency of the locomotive in ordinary service.

The record of coal consumption shows that this performance is affected by variations in the evaporative efficiency of the boiler, due doubtless to irregularities of firing, but which are in fact unaccounted for.

An analysis of the general results obtained is summarized in a statement which may be accepted as a general definition of performance, assuming all irregularities to have been eliminated. Such a summarized statement may be expressed by the equation:

$$E = 11.305 - 0.221\ H$$

in which E is the number of pounds of water evaporated from and at 212 degrees per pound of coal, and H is the number of pounds of water evaporated from and at 212 degrees per foot of heating surface per hour.

It appears, also, from the data that the steam consumed by the cylinders varies for each different pressure with changes in speed and cut-off, and it has been sought to summarize the facts derived from the experiments into a single expression. This appears in the form of the curve A B, which is to be accepted as representing the performance of the cylinders under different pressures without reference to speed or cut off. Combining this general statement expressing cylinder performance with that already obtained covering boiler performance, it should be possible to secure an accurate measure of the coal consumption per indicated horse-power hour, for each different pressure which will represent the results of all tests at that pressure.

The steps in this process are set forth by the table.

Engine Performance Under Different Pressures.

Boiler pressure. 1.	Steam per I. h. p. hour, Values frm curves. 2.	B. t. u. given to 1 lb. steam feed water* 3.	Equivalent lbs. of water: Per I. h. p. hr. 4	Equivalent lbs. of water: Per lb. of dry coal. 5.	Lbs. coal per ind. h. p. hr. 6.	Coal saving, each increment: Pounds. 7.	Coal saving, each increment: P'r cent. 8.
240 lbs.	24.7	1,176.6	30.09	9.10	3.31	0.06	1.8
220 "	25.1	1,174.4	30.52	9.06	3.37	.06	1.8
200 "	25.5	1,172.0	30.94	9.03	3.43	.07	2.0
180 "	26.0	1,169.5	31.48	8.99	3.50	.09	2.5
160 "	26.6	1,166.8	32.14	8.94	3.59	.18	4.8
140 "	27.7	1,163.8	33.38	8.85	3.77	.23	5.8
120 "	29.1	1,160.5	34.97	8.73	4.00	...	...

*Temperature at 60 deg. F.

The values, especially those of columns 2 and 6, are of more than ordinary significance. They represent logical conclusions based upon the results of all tests. Comparisons between them will show the extent to which the performance of a locomotive will be modified by changes in the steam-pressure under which it is operated. They show in the matter of steam consumption (column 2) that—

Increasing pressure from 160 to 180 lbs. reduces the steam consumption 0.6 lb., or 2.3 per cent.

Increasing pressure from 180 to 200 lbs. reduces the steam consumption 0.5 lb., or 1.9 per cent.

Increasing pressure from 200 to 220 lbs. reduces the steam consumption 0.4 lb., or 1.6 per cent.

Increasing pressure from 220 to 240 lbs. reduces the steam consumption 0.4 lb., or 1.6 per cent.

In the matter of coal consumption (column 6) they show that—

Increasing pressure from 160 to 180 lbs., reduces the coal consumption 0.9 lb., or 2.5 per cent.

Increasing pressure from 180 to 200 lbs. reduces the coal consumption 0.7 lb., or 2.0 per cent.

Increasing pressure from 200 to 220 lbs. reduces the coal consumption 0.6 lb., or 1.8 per cent.

Increasing pressure from 220 to 240 lbs. reduces the coal consumption 0.6 lb., or 1.8 per cent.

These values are from actual tests. Those who are inclined to insist upon basing their conclusions upon observed data will perhaps find in them a satisfactory conclusion of the whole investigation. The results show how slight is the gain to be derived from any increment of pressure when the basis of the increment is above 160 lbs. But they do not in fact tell the whole story. In order to secure such results from a single locomotive it was necessary to employ a machine designed for the highest pressure experimented upon. Obviously, for the tests at lower pressure, the locomotive was needlessly heavy for its dimensions. If for the tests under each of the lower pressures the excess weight could have been utilized in providing a boiler of greater heating-surface, the difference in performance with each increment of pressure would have been less than that to which attention has already been called. It is for this reason that the results already quoted, while significant and concise in their meaning, are nevertheless to be accepted as insufficient when regarded as a relative measure of the value of different steam-pressures.

The final test of locomotive efficiency from the standpoint of the operating company is the amount of coal used per dynameter horse-power or, as it is more familiarly expressed, per ton mile hauled. The factor represents the combined performance of the boiler, the cylinders and the machinery of the locomotive. It connects the energy developed in the boiler by the combustion of fuel with that developed at the drawbar. From the data obtained it appears that the coal consumption per horse-power hour at 240 lbs. ranges from 3.35 to 5.01 lbs., while at a pressure of 160 lbs. the range is between 3.79 and 4.78 lbs., conclusions which are of interest from at least two points of view. First, because of the small difference in performances resulting from a relatively large change in pressure, and, second, because of the significance of the values quoted when accepted as a measure of locomotive performance. It is doubtful if any other type of steam engine exhausting into the atmosphere can be depended upon to deliver power from the periphery of its wheel in return for the expenditure of so small an amount of fuel.

From the discussion of the effect of increasing pressures compared with increasing boiler capacity it appears that there is a decided economical advantage in increasing the pressure when the basic pressure is low, but as this latter is raised, this advantage disappears until they are about balanced at 160 lbs., whereas there is no possible excuse for increasing the pressure beyond 320 lbs.

NEW PUBLICATIONS.

Boiler Waters. By William Wallace Christie. New York: D. Van Nostrand Co. 235 pages; 6 in. by 9 in.; 77 illustrations; cloth. Price, $3.00.

This book will be found to be a convenient reference for matters regarding the formation of scale, the corrosion of boiler plates and the foaming of the water. It is a compilation or collection of data on the subject that cover the principal impurities to be found in the usual run of feed waters, their effects upon the boiler and the means to be used to counteract such effects as may be injurious. The work opens with a statement of the impurities that are to be found, and then follows an outline of the methods to be followed in analyzing for them. In this no attempt is made to give instruction in chemistry, but there is a detail of the simple apparatus to be used and the methods to be followed to get quick results. The instructions are clear and concise and are such that a man of ordinary intelligence should, when prospecting for water, be able to ascertain whether that which is offered is fit for boiler purposes or not.

In treating of boiler scale, in the second chapter, there are a number of "awful examples" given of accumulations that have been removed from neglected boilers, and these are followed by a few rules that should be followed for the prevention and removal of such accumulations, with a statement of the effect of various scales on heat conduction and the evaporative efficiency of a boiler. The same method of example, cause and remedy is followed in the treatment of corrosion and foaming. The effects of oil and galvanic action are dealt with for the most part by extracts from other reports in which the results of investigations are summarized. A separate chapter is devoted to hardness, the means used in its determination and removal. There is also a chapter descriptive of the various feed-water heaters that are upon the market, and a closing one in the text on water softening or purification. There can be no summing up of conclusions, but the book opens the field for each individual to make inquiries along the lines of his own requirements guided by the experience of others. The last chapter contains a series of tables of the usual character on the conversion of metric to English measurements, on the properties of water and saturated steam, with a list of the chemical symbols of the substances entering into the subject. The book thus forms, as already stated, a valuable collection of data upon the important topic with which it deals and can be used as a guide by those who are having trouble with the waters used in their boilers.

CONTRIBUTIONS

Track Tanks.

Jersey City, N. J., March 16, 1908.

To the Editor of the Railroad Gazette:

I have read with interest the article on Track Tanks by Mr. Ross in your issue of March 13, and would like to add the results of some trials made on the Pennsylvania Railroad at Atglen, Pa., in October, 1906, under the direction of Frank Goodfellow.

The tanks at Atglen are on a curve and so are not directly comparable to those on tangent. During the trials, runs were made over a standard 19-in. trough and large ones, 29 in., both with and without lips, as shown in Figs. 1, 2 and 3. Trials were also made with a closed and semi-closed deflector and with a modified dipper, i.e., modified from the standard Pennsylvania Railroad dipper, as described in the *American Engineer and Railroad Journal*, November, 1896, and the *Railroad Gazette*, January 8, 1897. The

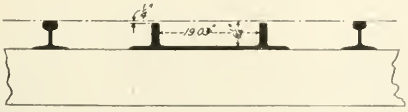


Fig. 1—Standard 19 in. Trough.

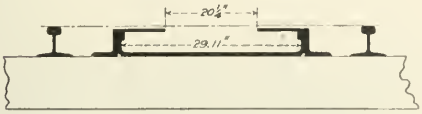


Fig. 2—Trough, 29 in., without Lips.

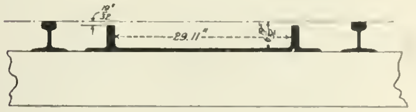


Fig. 3—Trough, 29 in., with Lips.

trials showed poor results or such slight increases in efficiency as to be more than counterbalanced by the increased complication.

Fifteen runs were made over each type of trough with the standard scoop; of these, three were made at each of the following speeds, 20, 30, 40, 50 and 60 m.p.h., and the results averaged, thus getting a fairly accurate figure. The results of the trials of the two 29-in. troughs show that the trough without lips is the more efficient from 32 to 48 m.p.h., while at all other speeds the trough with lips is better. In comparing the 19-in. trough with the results of the 29-in. one with lips, the latter is the better up to 30 m.p.h., while at all higher speeds the 19-in. one gives better results, as will be seen from the efficiency curve, Fig. 4.

From this it would seem to be good practice to install a 29-in. trough with lips on freight tracks, where the average running speed would be less than 30 m.p.h. This would be so from a motive power standpoint considering only the amount of water delivered to tender, but taking maintenance into account this would not do, as a larger quantity of water is thrown on the right-of-way, thus offsetting any gain due to larger tank fulls.

The speed for greatest economy was found to be 40 m.p.h., which makes the minimum splash with a correspondingly large

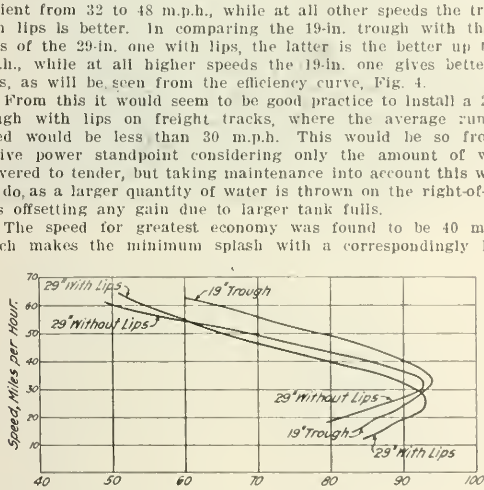


Fig. 4—Water to Tender Efficiency.

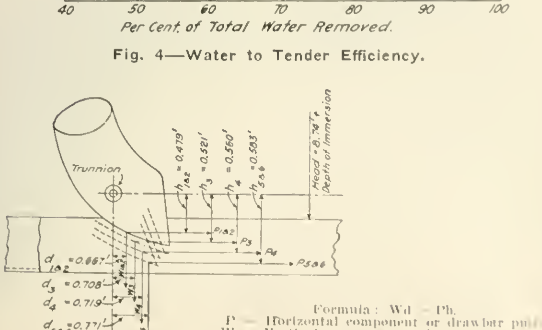


Fig. 5—Position of Dipper for Different Depths of Immersion.

amount to tender per foot of length of trough. A comparison of the results at this speed is shown in table 1.

Table 1.

		With lips,	No lips,
Trough	19 in.	29 in.	29 in.
Speed, miles per hour	40 miles.	40 miles.	40 miles.
Total water removed per lin. ft. of trough	.2892	.3355	.3156
" " to tender per lin ft. of trough	.2655	.2955	.2728
" " spilled per lin. ft. of trough	.0137	.0400	.0428
Per cent. water to tender	96.50	85.25	87.00
Per cent. water spilled	3.50	14.75	13.00

It might be of interest in passing to mention the action of the water in the trough when the dipper is lowered. To make observations of this, the special tender used was fitted with open flooring and a cage hung between the trucks from which an observer could get a good view of the action and, in most of the runs, photographs. At 30 and 40 m.p.h., the writer passed back from around the point of the dipper in a thin sheet about the width of trough, and fell about 5 ft. back of the tender, striking the disturbed water in the trough and splashing out at the sides. This action is not restricted to the trial tender but may be observed on fast passenger trains, the water flying back, at times, far enough to be thrown down by the forward trucks under the first car of the train. At 50 and 60 m.p.h. there was so much splash that the rear truck of tender was hidden from view, while looking down from the top the whole point of the dipper could be seen cutting the water with no appreciable frothing. As the speed diminishes, a wave action is set up in front of the dipper, the water being piled up until it falls over the sides. This wave increases in size up to the point where the velocity imparted to it is less than that necessary to overcome the resistance due to gravity and friction, when, of course, no more water is lifted.

A summary of the results shows conclusively that with the standard type of dipper the 19-in. trough is the more economical when all speeds are taken into consideration.

Some interesting calculations of the load on scoop and the resultant force on the drawbar for different depths of immersion were made from the results of the Bellwood trials in August, 1906.

Fig. 5 shows the positions of the dipper at different depths of immersion, the vertical distances are taken from the point of support or trunnion to the point of impact of the dipper and water, or the point where the water changes its direction and the horizontal distances are from point of impact to center line of trunnion.

From this, the results shown on Table 2 have been calculated from the moment about the trunnion. In the upper portion of the table will be found the calculations based on the weight of water delivered to tender, while the lower portion is based on total water removed from trough.

Table 2

	Calculated							
	From water to tender				From total water removed			
		Component P force at drawbar		Comp. W, load on dipper,		Component P force at drawbar		Comp. W, load on dipper
Test.	Speed, in m. p. h.	Pounds.	D. h.p.	lbs.	Speed in m. p. h.	Pounds.	D. h.p.	lbs.
1....	25.7	557.6	38.21	400.4	25.7	571.9	39.19	410.7
2....	29.3	700.3	54.71	502.9	29.3	791.0	61.80	568.0
3 ...	30.8	904.2	74.26	655.2	30.8	960.3	78.86	695.8
4....	39.9	1,430.2	152.19	1,010.2	39.9	1,487.9	158.14	1,050.7
5 ...	51.9	2,374.0	328.52	1,795.1	51.9	2,764.6	382.60	2,090.5
6 ...	58.3	2,935.5	456.32	2,219.5	58.3	3,494.9	543.22	2,642.5

From this it will be seen that at high speeds, 50 to 60 m.p.h., the load on the scoop is about a ton, while the corresponding calculated dynometer horse-power reaches from 450 to 550, or about one-half of the available horse-power of an Atlantic locomotive at that speed.

It is therefore good policy for enginemen of high-speed trains to slow before taking water and for those of low-speed trains to increase it, if possible, to get the greatest economy.

B. S. MURPHY,
Mechanical Inspector, Hudson Companies

What Are We Going to Do About Accidents?

March 28, 1908.

To the Editor of the Railroad Gazette:

With reference to the letter of "General Manager," which appeared in your issue of Feb. 28, there can be no doubt whatever that the frequency of train accidents is viewed by operating officers with great anxiety, and the necessity of raising the average of efficiency and intelligence in the ranks of employees, by the weeding out of careless and incompetent men, must be universally recognized. "General Manager" attaches considerable importance to surprise checking as a means of exposing carelessness and incompetency, but it should not be overlooked that there must be a moral force acting in support of any such system, which if properly sustained by the executive, over which "General Manager" presides, will induce among the rank and file a sense of personal pride in a service and create a standard of private honor rising very much higher than the principle expressed by surprise checking.

"General Manager" says that "it is unquestionably practicable to lessen the number of train accidents." I quite agree, and I think that the lines along which this is likely to be accomplished is in the direction of raising the moral standard of the men. Much can be done by the influence of example. Rules and precepts discouraging and prohibiting drinking among railroad men hopelessly fail in their effect if they are not supported by good example. The highest officers are concerned in this as well as superintendents and heads of departments, and if they do not realize that some sacrifice in the interest of discipline is necessary on their part, they cannot reasonably expect—taking human nature as it is—compliance with stringent instructions which the men know are based upon precept only and not on practice. I venture to think, for instance, that if the use of intoxicating liquor was abolished from official cars, it would, by the influence of example materially strengthen the efforts of departmental officers in removing the standing menace of drinking, which though happily reduced in every direction, still exists to a dangerous extent.

In every regulation dealing with personal conduct and attitude while an employee is on duty, or in and about the premises of a railroad company, the officers should take a distinct lead and set up the standard which they wish their men to follow on every possible opportunity.

"General Manager" suggests that the record of 100 per cent. of the men who were found obedient to the rules when surprised is false, and this circumstance just serves to illustrate my point. The weakness or strength of the moral fiber amongst men in a large organization will, generally speaking, be a reflex of the principles of general and departmental control. In "General Manager's" case, there is an obvious want of confidence in both departmental officers and men, and I suggest that with this spirit pervading his organization, too much should not be expected as the result of what is merely a mechanical check. Officers, and particularly superintendents, should have greater faith in their men and should more fully appreciate their own responsibility in cultivating a higher morality which is the real basis of efficiency and honest service, and which should make the suspicion which haunts "General Manager's" mind impossible.

Is he satisfied, that in exercising his authority in matters concerning the staff as a whole, he has given adequate consideration to this aspect of his administrative work? If a company stands square before the men who compose its working force, and the principles of control are transparently honest as they should be, there should be no room for suspicion and distrust. Nothing can be so prejudicial to the spirit of individual loyalty as an influence of this kind. Loyalty to a service shows itself in the spontaneous display of interest and energy on the part of employees, and this is the actual source of the general efficiency at which we are all aiming and which can only be successfully developed along the lines of mutuality between the management, departmental officers and the staff. If "General Manager" should quietly check up his departments in this direction, it is not unlikely that the feeling of distrust to which he has given expression would be found to have its source in a lack of co-operation or a laxity of principle for which his own policy may even be directly responsible.

I firmly believe that the great majority of railroad men are not only willing but anxious to strictly comply with the rules of safe operation, and as a general suggestion I would say that the district officers should meet the men more frequently than is the case at present. The nature, cause and prevention of every accident that occurs should be thoroughly explained either by means of printed descriptions or in conference. A man may fail at a critical moment, not as the result of neglect, but because he may be in doubt on some point which has not been made clear to him. The responsibility in such a case extends, I think, to the management. The officers find it necessary to confer frequently, and at a reasonable cost, it would be a sensible and profitable investment to provide facilities whereby the men could meet and discuss problems of everyday railroading assisted by some of the officers. By these means uniformity of practice could be secured and any conflict of opinion as to the interpretation of certain rules would be removed. A healthy individual interest would be excited and a way would be cleared for the subsequent adoption of a system of oral examinations, than which no better means of testing intelligence and efficiency could be devised.

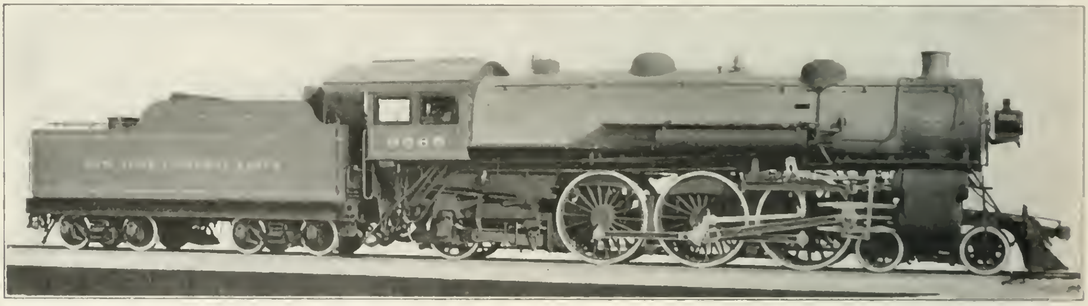
SUPERINTENDENT

Pacific Locomotive for the New York Central.

The Schenectady works of the American Locomotive Co. have recently completed an order of 40 Pacific type locomotives for the New York Central & Hudson River Railroad. These are the heaviest passenger locomotives ever built for this road and will be used in hauling through trains. At the present time these trains are handled by a $21\frac{1}{2}$ x 26 Atlantic type engine, having a maximum tractive power of 23,300 lbs. The reason for adopting the Pacific type in ordering new passenger equipment was that the Atlantic type engine did not provide the necessary adhesive weight for starting purposes to satisfactorily meet the requirements.

In general, the engines here illustrated are duplicate in design of a previous lot built last year by the same builders for the Lake Shore & Michigan Southern, which took the place of the Prairie type as the standard high-speed passenger engine on that road, and are now hauling all their important trains, including the Twentieth Century Limited. It is probable that this new class will become the standard type of heavy passenger power for all the New York Central Lines.

In working order these engines have a total weight of 266,000 lbs., of which 171,500 lbs. is carried on the driving wheels. The cylinders are 22 in. diameter by 28 in. stroke, and with driving wheels 79 in. in diameter and a working pressure of 200 lbs., the engines will develop a maximum tractive effort of 29,200 lbs.

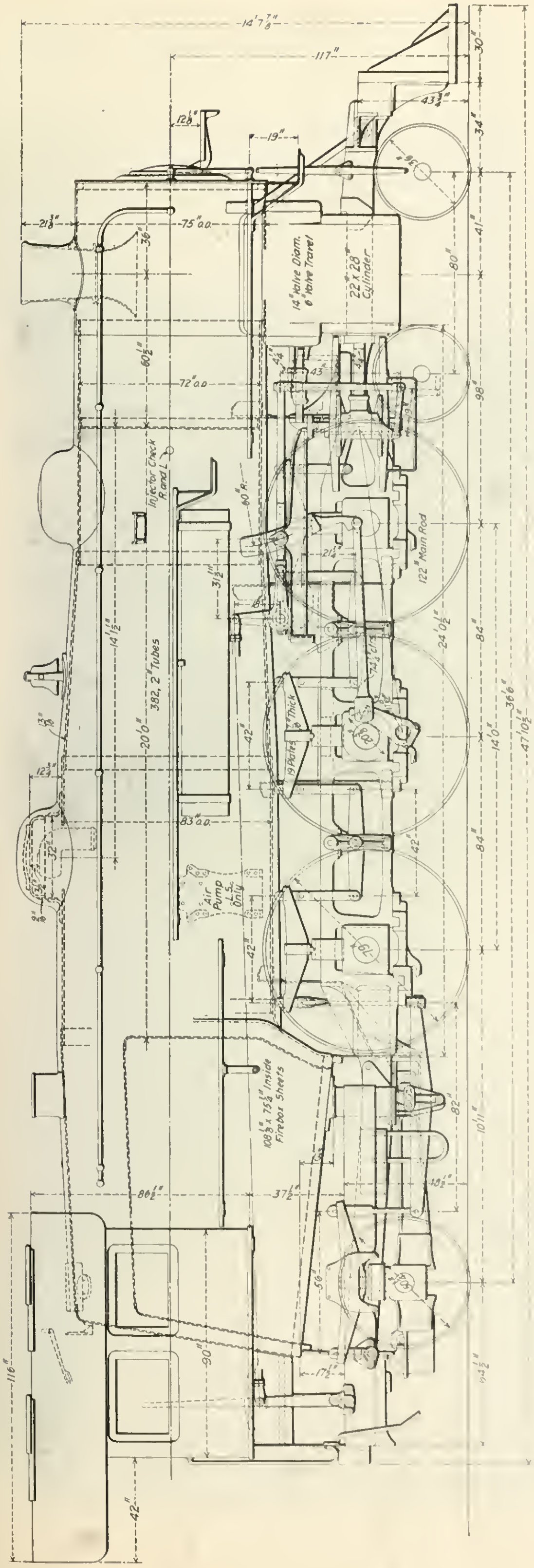


Pacific Locomotive; New York Central & Hudson River.

Especial attention was paid in working out the design to providing a boiler of the highest capacity, and it will be seen from an examination of the principal ratios given below that in this respect the design is considerably above the average Pacific type engine. The boiler is of the radial stayed type with a conical shaped middle ring and the outside diameter of the front ring is 72 in. It contains 382 tubes 2 in. in diameter and 20 ft. long, and provides a total heating surface of 4,210 sq. ft., of which the tubes contribute 3,982 sq. ft. and the firebox and arch tubes the remainder. The firebox is $108\frac{1}{8}$ in. long and $75\frac{1}{4}$ in. wide and has a grate area of 56.5 sq. ft.

In accordance with the present requirements in locomotive design the boiler is raised high above the frames, the top of the front course being 12 ft. $10\frac{1}{2}$ in. above the rails. This cuts down the space available for the dome, which is only $12\frac{3}{4}$ in. above the shell and also drops the throttle down so that its lower opening is about flush with the top of the shell. It will leave about 15 in. between the surface of the water, when it stands at the second gage, and the throttle, and this may be cut down as low as 11 in. with more water and the engine on a grade; while, with the surging of the water, when the engine is in motion the wave crest may come very close to the throttle itself. Attention is called to these points merely to show how allowances that were formerly considered the minimum have been cut down until they have practically disappeared under the stress of the later designs. Compare this clearance with that obtained with the old boilers with a high dome on the wagon top and the difference will be seen to be very marked. In the same way there is a tendency on recent designs to place the injector check well up to the front tubesheet. In this case there is but $8\frac{1}{2}$ in. from the center to that sheet, and this in spite of the protests that have been made that such close proximity tends to leaky tubes. Evidently that claim is not being substantiated.

Part of the engines built on this order have been fitted with



Pacific Locomotive; New York Central & Hudson River.

steel tubes and the balance with charcoal iron. At the firebox end the slope of the side-sheets is such that there is a chance for a free liberation of the steam over the entire surface with a direct rise away from the metal throughout the whole distance from the foundation ring to the crownsheet. The spread of the sheets is 75¼ in. at the bottom, drawing in to 62 in. at the springing point of the curve of the crownsheet. This gives an inward slope of 1 in 7 to the sheet. Again it may be well to contrast the conditions for steam liberation thus obtained with those of the narrow firebox set between the frames, where the waist of the firebox was drawn in as with corsets, and the steam trailed over the side sheets the whole distance from the point of its generation to the space provided for it over the crownsheet. With the wide firebox, the quality of the steam as it enters the steam space must be much dryer than was possible with the old firebox, and thus the necessity for the great height to the throttle no longer exists. Besides this, the film of steam over the sidesheets should be much thinner than before, resulting in cooler sheets and a reduction of the stresses on the staybolts.

In general design the engine embodies no especial novelties and the interest in it lies, for the most part, in its size, the smoothness of its lines and the pleasing symmetry of its proportions. Cast-steel is used for the parts usually made of that material, and the engine is equipped with the ordinary fittings in the way of high-speed brakes, etc. In some of the ratios it will be noticed, as we have said, that the results are somewhat higher than usual. Thus, the ratio of tractive effort to weight is 5.84, which is well above common practice.

The following are some of the principal dimensions of these engines:

Cylinder, diameter	22 in.
Piston, stroke	28 in
Wheel base, driving wheel	14 ft
" total	36 ft. 6 in.
" total, engine and tender	67 " 11 "
Weight on drivers	171,500 lbs
" total	266,000 "
" engine and tender	430,000 "
Heating surface, tubes	3,981.6 sq. ft
" " firebox	199.9 "
" " arch tubes	28.4 "
" " total	4,209.9 "
Grate area	56.5 "
Journals, driving axle	10½ in x 12 "
" engine truck	6½ " x 12 "
" trailing truck	8 " x 14 "
" tender (M. C. B. standard)	5½ " x 10 "
Boiler, diameter, first course	72 in.
Steam pressure	200 lbs.
Firebox, length	108¼ in.
" width	75¼ "
" thickness, crown, side and back sheets	⅜ in.
" thickness tube sheet	½ in.
" water space	4½ in.
Tubes, number	382
" diameter	2 in.
" length	20 ft.
Exhaust nozzles, diameter	5½ in. and 5¾ in.
Tank capacity water	8,000 gals
Tank capacity, coal	14 tons.
Valves, travel	6 in.
" lap	1 "
" clearance	⅛ in.
" lead	¼ in.
Wheels, diameter, driving	79 in.
" " front truck	36 "
" " trailing truck	50¼ "
" " tender	36 "
Tractive effort	29,200 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} \quad 5.84$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} \quad 9.11$$

$$\frac{\text{Tractive effort x diameter of drivers}}{\text{Heating surface}} \quad 550.0$$

$$\frac{\text{Heating surface}}{\text{Grate area}} \quad 74.5$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} \quad 4.74^{*}$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} \quad 40.7$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} \quad 63.1$$

Volume of both cylinders, cu ft 12.32

$$\frac{\text{Total heating surface}}{\text{Volume of both cylinders}} \quad 341.0$$

$$\frac{\text{Grate area}}{\text{Volume of both cylinders}} \quad 4.58$$

*Per cent

The East River Tunnels of the Pennsylvania Railroad.

The four tunnels of the Pennsylvania Railroad under the East river, connecting Manhattan Island at Thirty-third street with Long Island City, have now all been bored through, so that it is possible to walk under the river in any one of the four tubes. It was long the hope of the late Austin Corbin President of the Long Island Railroad, to have rail connection between Long Island and Manhattan but it was left to the great foresight and genius for railroad construction, operation and financing of the late A. J. Cassatt, President of the Pennsylvania Railroad, to carry through such a plan. The Long Island Railroad was bought by the Pennsylvania on the strength of the potentialities of its territory. Mr. Cassatt saw that Long Island, now scarcely profitable to a railroad, held great possibilities for development of traffic when directly connected with Manhattan Island. The tunnel extension to Long Island is part of the comprehensive scheme evolved by him and his right-hand helper in working out these great plans for the New York terminal improvements, Samuel Rea.

The East river tunnels of the Pennsylvania and the great air power plants which furnish the air pressure used in their construction were described in great detail in the *Railroad Gazette* of July 6 and July 27, 1906. The present article is in the nature of a brief general summary of the work, marking the successful completion of all four of the tunnel tubes. The photographs show excavation in rock, the face of one of the shields in rock, the erector at work putting steel plates in the tunnel lining, one of the great caissons, and the floating equipment used in the work.

The Pennsylvania East river tunnels begin in two steel caissons sunk between First avenue and the river front, Manhattan, and continue in a pair of tunnels driven from each caisson under the Manhattan ferry slips of the Long Island Railroad and the East river to a similar pair of caissons sunk on the water front at Long Island City, just south of the Long Island Railroad ferry slips on that side of the river. Thence they continue diagonally underneath the Long Island Railroad tracks, gradually converging and passing under Vernon avenue and meeting in one shaft at East avenue, Long Island City. The total length underneath the river, from caisson to caisson, is about 4,000 ft., and from the Long Island City caisson to East avenue, 2,000 ft. The work was divided into three working sites, 2,000 ft. of four tunnels being driven from each site. The divisions were as follows: 2,000 ft. from the Manhattan shafts to the center of the river, 2,000 ft. from the center of the river to the Long Island City shafts, and 2,000 ft. from the Long Island City shafts to the East avenue shafts. The total length of the four tunnels is 24,000 ft. The outside diameter of each tunnel is 23 ft. The tunnels are lined throughout with cast iron tunnel lining in rings 2 ft. 6 in. long, divided into 11 segments and a key, each ring weighing $11\frac{1}{2}$ tons and each segment except the key weighing about one ton. There were about 100,000 tons of cast iron lining used, and 1,500,000 bolts of $1\frac{1}{2}$ in. diameter used in fastening the segments together. The tunnels are to be lined with concrete 2 ft. thick. The vitrified conduits for carrying electric light and power cables, of which there are 1,000,000 ft., are built in benches on each side of the track. These benches form a sidewalk for passengers in case trains are stalled in the tunnel.

The construction problem presented at the time the plans for these tunnels were made was a new one. Their cost was problematical, and the estimates of the engineers, estimates and nothing more. One bidder on the contract proposed to build the tunnels by the freezing method; another made it clear by his proposal that he had no knowledge of the real nature of the work. The accepted bid was that of S. Pearson & Son, Ltd., of London, who had not only recently successfully driven the Blackwall tunnel with an outside diameter of 27 ft., under the Thames river in England, at that time the most difficult work of this sort ever carried out, but had been the contractors in 1889-1890 for the tunnel under the Hudson river from Hoboken to Morton street, New York, the first sub-aqueous tunnel ever driven by the shield method.

One of the Caissons at Long Island City.

This tunnel, which was on February 25, 1908, opened to travel by the Hudson & Manhattan Railroad, had before 1889, been pushed 2,000 ft. out from the New Jersey shore of the Hudson river, where the heading had been abandoned and the tunnel had caved in. In order to regain the heading of this old tunnel, a great canvas balloon filled with hay and clay was dropped from a floating derrick into the cavity. This kept the water out long enough so that it was possible to regain the tunnel, excavate the silt and build a chamber in which, under an air pressure of 42 lbs. to the square inch, the shield was erected. This, because shield tunnelling was then a new art, was probably the greatest and most daring feat in the history of subaqueous tunnel work. This shield was advanced and cast iron lining built behind it for between 2,000 and 3,000 ft., and it was being advanced at the rate of 10 ft.

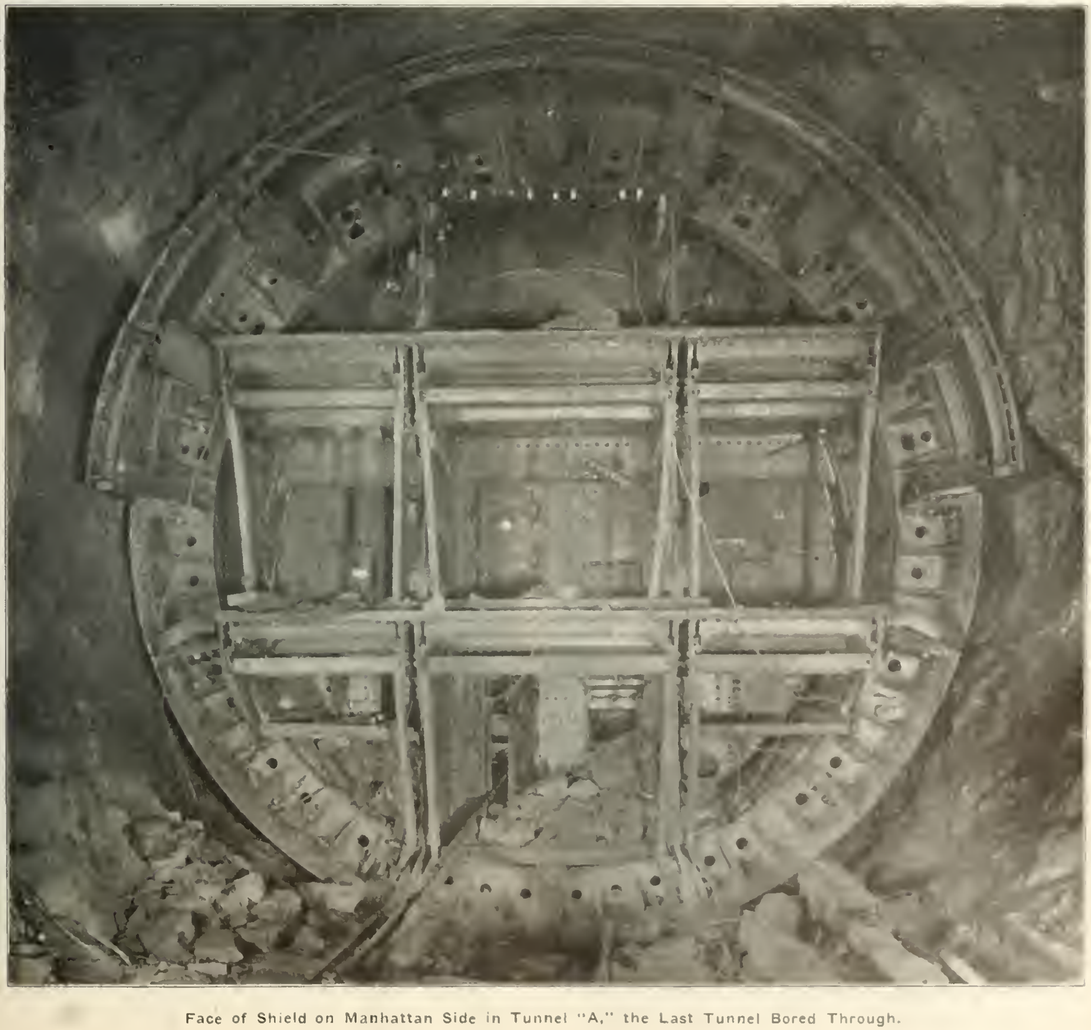
Floating Equipment—Dredge, Tug and Scow.

a day when the company which was carrying on the enterprise failed and the contract was abandoned, to be taken up again in recent years by the Hudson & Manhattan Railroad. The old shield left in the tunnel in 1890 was used to finish the work in 1907. The boring in 1890 was done by E. W. Moir, now Vice-President and Chief Engineer of S. Pearson & Son, Incorporated, which is the name of that branch of the firm which is carrying out the East river tunnel contract. The fact that the wide experience of Mr. Moir and of his firm in subaqueous tunneling was available, as well as the fact that the reputation of S. Pearson & Son, Ltd., as successful contractors—successful both for themselves and for their employers—was generally recognized throughout the world, made this firm the most desirable bidder on this difficult contract.

Excavating in Rock.

In March, 1904, when the contract for the East river tunnels was let, there was only one small tunnel tube under the East river. This was known as the East river gas tunnel and ran under Blackwell's Island, being sunk so deep that it was almost entirely in solid rock, though some seams of soft, decomposed rock were met with, which necessitated the use of very high air pressure. The two Battery tubes of the Interborough Rapid Transit subway to Brooklyn had been well started on the Manhattan side, but as the formation there was entirely rock these had given no experience of the formations to be expected under the main part of the East river. Subsequently the Belmont (Steinway) tunnel was pushed through, advantage being taken by William Barclay Parsons in its construction of the Man o' War's reef, a continuation of the Blackwell's Island reef, on which a shaft was sunk. From this shaft, tunnels were driven in each direction to meet the shields coming from Manhattan and from Long Island, thus virtually cutting in half the time necessary for completion. There was no such favorable formation of which the Pennsylvania tunnels could take advantage.

The trial borings in the bed of the East river showed that the strata on the lines of the tunnels were rock on each side of



Face of Shield on Manhattan Side in Tunnel "A," the Last Tunnel Bored Through.

the river, sloping down so that the tunnels would emerge into a full face of boulders and quick and beyond which would be reached silt and quicksand without boulders. The Man o' War's reef in the middle of the river stands up against the quicksand in such a way that the roof of the tunnels comes sometimes 10 ft. above the reef and sometimes only 1 ft above, but it is seldom that there is sufficient rock in the roof to form a safe cover for the workmen. The problem, therefore, was to tunnel by a shield through a mixture of quicksand and rock and through quicksand alone.

In trying to keep the air pressure high enough to overcome the head of water and quicksand at the bottom of the tunnel, there was a constant risk of blowing off the roof of quicksand and allowing the water to pour in from above. If the pressure was lowered sufficiently to prevent blowouts, the quicksand flowed from under the shield and between the joints of the tunnel lining and allowed the tunnel to settle, and after the pressure was raised high enough to prevent this the roof was blown off and the tunnels flooded.

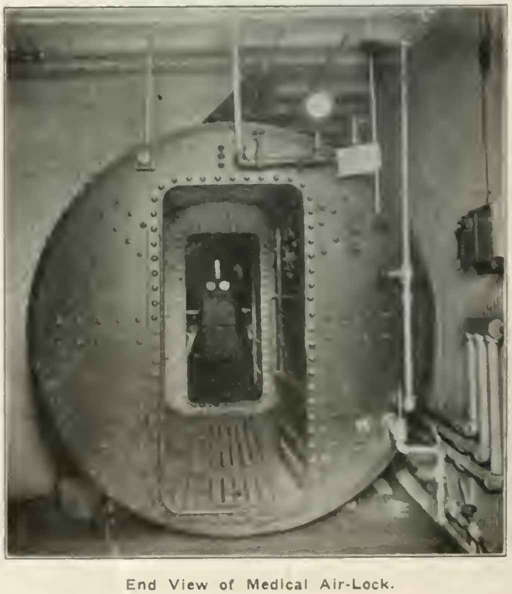
Mr. Moir foresaw and guarded against this danger by specifying that permission should be gained from the War Department for dumping clay in the river bed to a sufficient depth to allow the air pressure to be raised without causing blowouts. The necessity of this can be realized from the fact that at certain points the tunnels have only 7 ft. of quicksand between them and the water of the river. After the full permit was obtained for dumping the clay, no flood of water occurred in any of the eight subaqueous headings. This clay blanket deposited in advance of the shields, combined with the continuous grouting made with a quick setting concrete over the iron lining, did away with many of the dangers of this delicate tunneling work. The clay came from Haverstraw, N. Y., and was dumped from scows whose position was located by transit men in the high towers of the coal unloading plants of the Long Island Railroad on the Long Island shore and of the New York Edison Company in Manhattan. A total of about 500,000 cu. yds. of clay was deposited on this work. Now that the tunnels have been finished, this clay is being dredged off the river bottom and sent out to sea.

As the shield advanced and the iron lining was erected, cement and lime grout was forced out through grout holes in the cast iron lining to fill up the annular space left outside the lining of the shield and also the roof cavities left in the rock excavation where it had been blasted. For this purpose 250,000 barrels of cement and lime were used. The joints between each segment were caulked with lead or rust caulking to make the tunnels water tight before the concrete lining was placed.

One of the accompanying photographs shows the "medical air lock." On March 20, 1908, the workmen and staff of S. Pearson & Son, Inc., presented to Mr. Moir a brass model of this air lock about 2 ft. 6 in. long by 9 in. in diameter, complete in all particulars. This model was inscribed as follows: "Presented to Mr. E. W. Moir, the maker of the first medical air lock on the old Hudson tunnel, 1890, by grateful 'sand hogs' on the Pennsylvania East river tunnels, New York, 1908." The medical air lock is an air pressure hospital where men attacked with the bends (caisson disease) after coming out into the open air may undergo recompression, which has been found to be the only practicable means of

Erecting Plates in the Tunnel Lining; Looking Toward Shield.

Erecting Plates in the Tunnel Lining; Side View.



End View of Medical Air-Lock.

relief. In the building of these tunnels there have been three cases of men who, to all intents and purposes, were dead, but after recompression in the medical air lock fully recovered. There have also been cases of men who were paralyzed but were entirely restored to their normal condition after recompression. There are six of these medical air locks for use of engineers and workmen in the tunnels, each one being fitted with a double chamber so that the doctor in charge can pass in and out to his patients without interfering with or interrupting the air pressure of the inner room with the hospital beds. The air lock has compressing and decompressing valves, thermometers and pressure gages.

The chief engineer of this project for the Pennsylvania Railroad is Alfred Noble, who has been responsible for the design and construction of the tunnels. He has been assisted by a board of engineers appointed by the railroad, which originally consisted, besides himself, of Brig. Gen. Charles W. Raymond, chairman; Gustav Lindenthal, Charles M. Jacobs, William H. Brown and George Gibbs. C. L. Harrison is principal assistant engineer and has had particular charge of the alinement of the tunnels.

One of the accompanying portraits is of Sir Weetman D. Pearson, President of S. Pearson & Son, Inc., and also of S. Pearson & Son, Ltd., London, probably the foremost contractor in the world. The second photograph is that of Henry Japp, Director and Managing Engineer of the New York branch of the firm. He was the first engineer, four years ago, for the contractors on the East river tunnels, and has been constantly in charge of the work ever since. The third photograph is of Mr. Moir.



Sir Weetman D. Pearson, Bart., President. Henry Japp, Director and Managing Engineer. E. N. Moir, Vice-President and Chief Engineer.

The Executive Officers of S. Pearson & Son, Incorporated.

Electric Night at the New York Railroad Club.

The annual "electric night" of the New York Railroad Club was on March 20. For several years the March meeting of the club has consisted of several short discussions by well-known engineers who have been in charge of important electrical development.

The first speaker was L. B. Stillwell, Consulting Electrical Engineer for the Hudson Companies and the Interborough Rapid Transit Co. He compared the passenger traffic of the Interborough lines with that of steam railroads, showing that the annual passenger mileage in the subway was greater than that on the New York, New Haven & Hartford or on the New York Central, twice that on the Erie, and about the same as that of the Pennsylvania Lines East. The average daily car mileage of the elevated lines and the subway together is 326,357 miles, and the two systems, together, carry an average of 1,519,000 passengers a day. The horse power of the motors on the cars of a subway train aggregate 25 per cent. more than that of a New York Central electric locomotive. Mr. Stillwell then gave some details, illustrated by lantern slides, of the following recently completed under-river tunnels in New York City.

BELMONT TUNNEL.

This tunnel, which is also known as the Steinway tunnel, was built by the New York & Long Island Railroad in the interests of the Interborough-Metropolitan Co. It runs from East 42d street, Manhattan, under the East river to Long Island City. On the Long Island side there is a loop, at which point the cars come to the surface, some of them traveling further east. The operation of this tunnel is to be unique, in that ordinary surface cars are to run through it. For this reason there is a contact rail on the roof of the tunnel. It is a T section, weighing about 20 lbs. to the yard, and is bolted to brackets, which are adjustable. Where the tunnel is tube construction, these brackets are bolted to the flanges of the rings; where the roof is concrete, they are fastened to bolts sunk in the concrete. The rail is supported every 9 ft. A special pantograph trolley is used. This is quite compact, because of limited clearance; it can be compressed so as to be used when the minimum distance between the roof of the car and the contact rail is 8 in. It is similar to that used on the New York Central. On September 24, 1907, the first car was run through the north tube, being only two days after the workers on the tunnel proper had finished their work enough to get out of the way. This was the first car to move under the East river from Manhattan to Long Island under its own power.

EAST RIVER EXTENSION OF THE INTERBOROUGH.

Because of limited space, a special design of third rail is used in this tunnel. It is an inverted U section and is placed 26 in. from the gage line. This distance is criticised because it may not be far enough away to allow cars of other lines to be interchanged in case it is desired, in future, to operate cars of the New York Central, the Long Island Railroad, etc., over the Interborough. [The New York Central distance is $28\frac{1}{4}$ in. and the Long Island $27\frac{1}{2}$ in.] A special design of bonding is used. The slugs of the bonds go through the rail vertically, there being two plugs, arranged tandem, at each rail end.

For pumping out water in the East river tunnel, there are five sumps. There are now six 6-in. pumps, there being two pumps in the sumps at the bottom of the dip, each having 600 gal. capacity per minute. These sumps are in chambers 7 ft. x 14 ft. placed between the tubes. The pumps discharge through individual pipes to sewers in Manhattan and Brooklyn.

The piston action of trains is sufficient for normal ventilation. If three trains were stalled in one tunnel, people in the middle train would not suffer discomfort for an hour. An auxiliary ventilating plant, however, is installed for use in such emergency. There are air flues at each end of the tunnel, through which air is forced in in the direction of traffic at the rate of 43,000 cu. ft. per minute against the assumed normal pressure in the tunnel. However, this rate will probably be affected by the direction of the prevailing winds. The operation of the ventilating system is controlled by the despatcher at Bowling Green. At each manhole there is a telephone, a fire extinguisher and a fire hose, which can be coupled to the water lines running through the tunnel.

HUDSON & MANHATTAN.

The grades in this tunnel run as high as 5 per cent. All the cars used are motor cars (in the Interborough subway, motor cars and trailer cars are alternated in making up a train), and by reversing the motors the cars can be surely held on any grade.

Hugh Hazelton, of the Hudson Companies, described the construction of the Hudson & Manhattan cars (*Railroad Gazette*, June 14, 1907). The Hudson & Manhattan when finished will have 19 miles of track. Of this, six miles are now in operation, and six more are excavated and ready for bench walls, and are expected to be in operation by the end of the current year.

In the Hoboken terminal there are two station tracks for each incoming track, so that one train can come in and discharge passengers as another is being loaded. This will make possible a $1\frac{1}{2}$-minute headway. There are separate loading and unloading platforms in all three terminals. The lights are operated by alternating current direct from the power house, or by direct current from the third rail. This rail, which is similar to that in the Brooklyn extension of the Interborough, is low in manganese and carbon. Its conductivity is one-eighteenth that of copper. The protection over the rail is of jarrah wood, from Australia. The boards are 2 in. x 9 in. x 9 ft. It is heavier and a little harder than oak. Its particular value lies in its fire resisting qualities. It will stand the flame of a blow torch for 11 minutes before burning through, as compared with oak, eight minutes, and pine about two minutes. Also, jarrah wood will not keep on burning after the torch is taken away. The tunnel is lighted by two rows of lamps, spaced 60 ft. apart on each row. They are alternate, so that there is a light every 30 ft. The power house is at Washington and First street, Jersey City. There are two 3,000-k.w. generating units. At present, however, power is being acquired from another source.

J. M. Waldron, Signal Engineer of the Interborough Rapid Transit, described the signal system of the Brooklyn extension. This was described in an article in the *Railroad Gazette* of February 28, 1908.

NEW YORK CENTRAL.

W. J. Wilgus spoke of the advantages of electrification as found from the experiences of the New York Central. Since July 1, 1907, all New York Central trains have been electrically operated to and from Grand Central Station. The system has proved successful from the operating, the engineering and financial standpoints. There are a number of "by products" of the electrification of steam lines. With electric operation, it is possible to make use of the "air rights" of the corporation; that is, to build office buildings over terminal yards. The New York Central property at the Grand Central Station terminal is worth $50,000,000 more under electric operation than under steam operation, taking into account this possibility of erecting revenue producing buildings on it. Under electric operation, also, money is saved in the lighting of yards and terminals. As long as propulsion current is there, it is easy to provide additional current for these other purposes. The New York Central, in this way, will save $200,000 a year. There is also plenty of current available for labor-saving devices at freight terminals; for example, the operation of float bridges, unloading machinery, etc. A power house is designed so that it can take care of peak loads. Between these points of maximum requirements, power for other purposes can be turned out at a cost about equivalent to the cost of burning coal under the boilers. Another advantage is the economy of switching by electricity. Mr. Wilgus knows of one yard in which $114,000 a year was saved in this way. Also, when there is a continuous current-carrying conductor along the road, it is possible to use other devices, such as automatic stops. The use of automatic stops makes it unnecessary to have more than one man at the front end of the train, since in the electric locomotive or the front car of a multiple unit train the second man has nothing to do except stand ready to take the motorman's place in case of trouble. Automatic stops also take the place of surprise checking to correct careless overrunning of stop signals.

NEW YORK, NEW HAVEN & HARTFORD.

W. S. Murray, Electrical Engineer of the New York, New Haven & Hartford, emphasized the fact that the steam locomotive was in no danger of being relegated to the scrap heap. The bases for determining the relative efficiency of different systems of motive power are reliability of service, fixed charges and operating expenses. One pound of coal burnt at the Cos Cob power house is equivalent to two pounds burnt in a steam locomotive. The same ratio applies to the locomotive mileage of steam and electric locomotives. The mistakes in the design of the New Haven electric engine are not fundamental. The troubles the road has had are due to the fact that electrification was only partial, this situation bringing in problems which the New York Central, with its complete electrification, did not have. The company has on file orders for multiple unit cars, but these will not be placed until the electric locomotive has been perfected. A few experimental multiple unit cars have, however, been ordered.

ELECTRIFICATION IN 1907.

George Gibbs gave the following list of what had been done during the year in electrification and other important developments in electric traction: The New York Central began full electric operation in New York City on July 1, 1907, the New York, New Haven & Hartford (the first alternating-current electrification of a steam road in this country) July 22; part of the West Shore, June 15, this being particularly interesting as giving an opportunity to compare the results of direct competition with trolley lines; Rochester division of the Erie, June 18; Belmont tunnel, September 24; Brooklyn tunnel, January 27, 1908; Hudson & Manhattan tunnel, February 25. Other electrification projects definitely decided on are: The Cascade tunnel of the Great Northern, and the line over the Bitter Root mountains on the Pacific coast extension of the Chicago, Milwaukee & St. Paul. This line is 54 miles long and the grades on each side of the summit are 1.7 per cent. Current is to be generated by water power. An advantage of electrification in timbered country is that danger of forest fires is lessened.

Walter C. Kerr, Vice-President, Westinghouse, Church, Kerr & Co., said that he wondered that so little had been done in actual electrification. A deterrent is the great first cost of the electrifications which have been proposed. The electrification of tunnels is particularly attractive. Another field is the electrification at terminals in large cities. Those of this class which have been completed or are under way all connect with tunnels, e.g., the New York Central, the New Haven, the Pennsylvania, etc. The other fields for electrification are branch lines and heavy mountain grades. Everybody admits that electrification is theoretically advisable, but the first cost is the great hindrance. It is now time to reduce costs, not only of electric apparatus, but the other costs entering into such installations. When a new road is built to be operated by electricity, from 15 to 20 per cent. of the cost is for electric material. When a steam railroad is electrified, 75 per cent. of the cost is for electric material. The turbine has cut in half the cost of generating power. Heating and coal handling also cost less than before. These savings are offset by the increased cost of labor and material; and this increase makes still more necessary the economy in handling just mentioned. There has been much technical advancement, what we need now is attention to costs.

ELECTRIC ENGINES OF THE SPOKANE & INLAND.

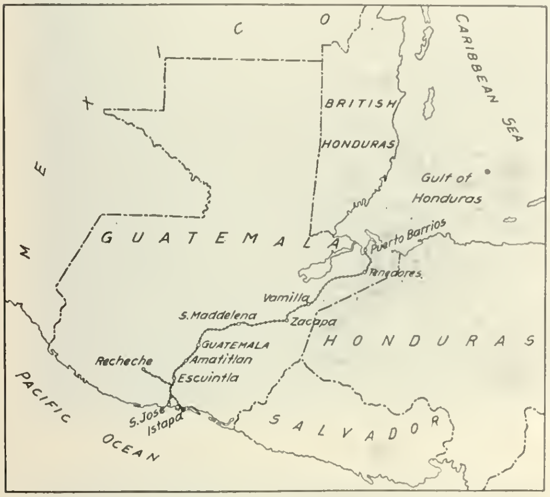
B. G. Lamme, of the Westinghouse Electric & Manufacturing Co., spoke of the freight locomotives of the Spokane & Inland. Direct current is used in Spokane and 6,600 alternating current outside of the city. There is a 2-per cent. upgrade eight miles long leading out of the city. Beyond that the country is level, supposedly, but really so rolling that 40 per cent. of the line is on a 1½ per cent. grade. The first order was for 21 passenger motor cars and eight freight locomotives. The nominal rating of the locomotives was 600 h.p., there being four motors of 150 h.p. one-hour capacity to each locomotive. The engines have two swivelled trucks. The maximum tractive effort is 15,000 lbs., and continuous effort, 7,000 lbs. On the first grade out of the city the motors heated so that their efficiency for overcoming following grades was reduced. On these first locomotives the cooling fans were geared to the motors; on the later ones they were equipped with fans operated separately. In the first locomotives, the fans, of course, moved slowly and supplied less air to the motors at just the times when the motors needed cooling most. At one point on the line the locomotive has to stop for a turnout on a steep grade. The conclusion drawn from the experience with these locomotives was that a one hour rating will not do. So in the later locomotives, the tractive effort rating was made 16,000 lbs. continuous and 25,000 lbs. one-hour or maximum rating. The one-hour rating will not do for long distance hauling. The steam locomotive develops a certain maximum power and keeps it up indefinitely. The electric locomotive has no maximum except the maximum of the power house. Its tractive effort must be adjusted to the heating of the motors. Therefore for freight service the basis of the system should be continuous tractive effort, with an emergency high rating. The new locomotives on the Spokane & Inland are satisfactory; the old ones are also, but they cannot haul such heavy trains. The speaker was recently asked how soon he believed the steam locomotive would be supplanted by the electric locomotive. He therefore did some figuring. He decided that if all the electric companies in the country began now to build nothing but electric locomotives, letting all their other work go, it would take from 10 to 20 years to replace the number of steam locomotives now in service, taking no account of the additional steam locomotives that would be built in the interim.

William McClellan, Consulting Engineer, said that the electrical engineer has shown that electric locomotives and multiple unit cars can do all the work which steam equipment does. The difficulties which have been already surmounted in the tunnels under the North and East rivers, New York, and in the New York Central and the New Haven installations, are worse than any that will be met in the future. Cost prophecies will be fulfilled. Electrification can provide greater capacity than can changes of location, including deep cuts, etc., on steam railroad mountain divisions. Recent progress in steam locomotive design is due in great measure to the competition of electric equipment. The question as to what system to use, i.e., d.c., a.c., etc., as well as the cost, is the reason why more electrification has not been carried out. The systems are as follows: Third rail, single-phase, three-phase, 1,200-volt d.c. and the gasolene electric car. Anyone of these may be best and everybody is afraid to definitely choose one, as it may later prove to be the wrong one. The electrical engineer is likely to be too technical. He needs the broader view which he gets by working with the steam railroad engineer. When the electrical engineer gets broadened, the necessity of which is becoming more generally recognized, much will be done.

The passenger traffic through the Simplon Tunnel has fluctuated greatly and was largest in August, 1906, the third month of its operation. In that month 42,622 passengers were carried through the tunnel. The number fell to 14,545 in November of that year, and to 10,106 in the following January. The largest number in any month since has been 34,500. The freight traffic has grown rapidly but is still small. The largest in 1906 was 5,658 tons in October. For the first five months of 1907 it was about 44,000, swelled by a blockade of the Mont Ceni route. Since May it has been 5,000 to 6,000 tons per month. The first year the gross earnings were $190,000.

The Guatemala Railroad.

The republic of Guatemala has until lately been as far away commercially from Europe and the eastern United States as the Hawaiian Islands, because access to the city of Guatemala, a beautiful city of 100,000 inhabitants, the capital and the center of almost the entire trade of the country, has been possible only from the



Map Showing Location of Guatemala Railroad.

Pacific side. On that coast Guatemala has no harbors, therefore vessels have to lie in the offing and handle freight and passengers to and from the shore by lighters and small boats. The chief commodity exported, coffee, is as yet mostly produced on the west slope of the Cordilleras between the city of Guatemala and the Pacific ocean. This has hitherto been lightered to vessels, then carried 1,000 miles south along the coast to Panama, there transferred to the Panama Railroad and carried across the Isthmus to Colon, two to four weeks being required for this part of the trip. At Colon a transfer to vessels on the Atlantic side had to be made. In addition to the expense of lighterage and transportation there has

Azacuajulla Viaduct; Guatemala Railroad.

been a heavy loss on coffee carried by this route through exposure to water in the numerous transfers and through bleaching and deterioration resulting from its long carriage in a hot climate. A similar disadvantage has attended all of the other business of Guatemala in and out. The only available routes for passengers between Guatemala City and the eastern United States and Europe have been by the way of San Francisco or Panama, and the time involved between Guatemala City and New York has been three weeks at least and usually more.

This unfavorable situation of Guatemala has always been a heavy handicap on development of its trade. With the purpose of bringing the country within easy reach of the world the government of the republic about 35 years ago took steps toward construction of a railroad from the Atlantic side to the capital, nearly 200 miles, and had succeeded up to 1896 in building 134 miles of line from Puerto Barrios, the principal harbor on the Atlantic coast, toward the city of Guatemala. However, when the difficult mountain section was reached, funds gave out and work was suspended. Several unsuccessful attempts were subsequently made to complete the line. Finally in 1904 a concession was granted to Minor C. Keith, Vice-President of the United Fruit Company, and Sir William C. Van Horne, Chairman of the Board of the Canadian Pacific Railway, both of whom had had much experience in building railroads in the tropics, the former in Costa Rica and the latter in Cuba. They

Rock Cut East of Azacuajulla.

associated with them General Thomas H. Hubbard, President of the Guatemala Central Railroad, the 75-mile road which connects the city of Guatemala with the ports of San Jose and Istapa on the Pacific coast, and immediately set about the work of construction. The Guatemala Railroad was finished on January 10, 1908.

The new work was among the summit peaks of the Cordilleras and was attended with many difficulties, among which were numerous deep ravines which had to be crossed by great bridges, some of which are shown herewith. There are also numerous shorter through truss bridges, and masonry arches have been freely used. At many points protection walls of masonry topped by rubble work are built to protect the road against the mountain streams. All tunnels are lined throughout with masonry. The whole work was made permanent throughout no wood was used except the creosoted cross-ties. While the new work was going on, the old section of the line had to be almost entirely rebuilt to bring it, for economy in working, up to the standard of the new section. The railroad is now in operation and Guatemala is relieved of her handicap.

Freights which before required from two weeks to a month to be handled between Colon and the city of Guatemala may now be handled between that city and Puerto Barrios in one day, and passengers may now reach Guatemala City from New York inside

Las Vacas Viaduct, Near the City of Guatemala.

Callejon Viaduct; Guatemala Railroad.

Trapich Fill; Mountain Section of Guatemala Railroad.

Plantation Track of the United Fruit Company on the Guatemala Railroad.

of a week instead of from three weeks to a month. Moreover, new and fast steamers are being built by the United Fruit Company to shorten the time between Guatemala City and New York via New Orleans to four and a half days.

The opening of this new line will give a great impetus to the development of Guatemala, which already has a population of 1,700,000 and great natural resources in its rich soil, its forests and its mines. It is expected that the entire coffee trade of Guatemala will very soon be turned through Puerto Barrios, and the great bulk of the import and export trade will immediately be handled that way.

An important source of revenue to the railroad will be the carriage of bananas, the plantings of which now being made by the United Fruit Company along the road already require 40 miles of plantation railroad tracks. The banana plantation of the United Fruit Company now extends for 28 miles continuously on both sides of the main line of the road. The extent of this industry is realized by few people in the United States. Some idea of it can be conveyed by the statement that the United Fruit Company employs 125 steamships in this trade. The low lands of Guatemala extending back from the coast on the Atlantic side are perfectly adapted to growing bananas, and Puerto Barrios has the advantage of being a day to a day and a half nearer to New Orleans and the other principal distributing markets than Port Limon in Costa Rica, which has hitherto been the chief source of supply.

A branch line to the frontier of Salvador is projected which would pass through the most important mining district in the country, where gold and silver mining has been carried on for nearly a century, although on a small scale owing to the impossibility of bringing machinery across the mountains.

The successful carrying out of Guatemala's great railroad enterprise has been mainly due to the energy, foresight and courage of President Estrada Cabrera, whose keen interest, liberal support and fair dealing are spoken of by the men who built the road in the warmest terms. They state that from the beginning to the end of their work, peace and quiet have prevailed in Guatemala and that the sensational reports which have from time to time been published in the United States and Europe have been almost wholly without foundation. During this time the troubles between some of the other Central American states have made President Estrada Cabrera's position a most difficult one, but with admirable wisdom and tact he has kept his country clear of all complications.

The Attendance at the Maintenance of Way Convention.

Secretary Fritch, of the American Railway Engineering and Maintenance of Way Association, has prepared an analysis of the attendance of the recent convention, which shows it to have been fully representative of the engineering departments of American railroads. The total number of members who registered during the meeting was 281, an increase over 1907 of 70. This figure is larger than that given in our report of the convention last week due to the fact that a number of new members who were voted in during the convention have properly been included in the total attendance. There were present 51 chief engineers, nine assistant chief engineers, 32 engineers maintenance of way, 11 principal assistant engineers, 19 bridge engineers, 26 division engineers, 25 assistant engineers and 15 signal engineers. Ninety-one railroads with a total of 166,429 miles were represented. The following list gives the complete classification of the members in attendance.

Presidents	3
Assistant to president	1
Vice-presidents	3
General managers	3
Assistant to general manager	1
General superintendents	2
Division superintendents	5
Chief engineers	51
Assistant chief engineers	9
Engineers maintenance of way	32
Principal assistant engineers	11
Bridge engineers	19
Division engineers	26
Engineers bridges and buildings	2
Assistant engineers	25
Inspecting engineers	7
Resident engineers	7
Locating engineers	2
Terminal engineers	4
Inspectors of maintenance	2
Engineers of construction	3
Signal engineers	15
Chemists	4
Chief draftsman	1
District engineers	2
Designing engineer	1
Tunnel engineer	1
Superintendent of track and roadway	2
Supervisor of timber preservation	1
Rail inspector	1
Maintenance of way accountant	1
Railroad architect	1
Editors of railroad journals	2
Professors of universities	8
Master carpenter	1
Civil, consulting and contracting engineers	21
Total	281

Re-Lining Long Curves by Running Trial Curves.

BY R. W. WILLIS,

Engineer Missouri District, C., B. & Q.

The following method of re-lining curves takes the place of running out tangent intersections or meandering the curve. It is to be used on long curves. In most offices there are old notes which give the original degree of curve. For the trial curve, use the curve shown in these old notes, unless the degree of curve is such that it should be spiraled. In such a case, the degree of the trial curve should be increased so that the difference between its external and the external of the curve shown in the original notes will be about one and one-half times the offset which would have to be made from the tangents in putting in a spiral. This ratio depends somewhat on the length of the curve.

Take a point on one of the tangents (on an offset tangent if the curve is to be spiraled) as near the P. C. as possible. The curve is very liable to run off the bank after 500 ft. or more have been run; when this happens, measure the distance from it to the center of the track, divide by the sine of twice the deflection angle and move the P. C. ahead or back accordingly as the curve ran off the inside or outside of the track. The trial curve run from the corrected P. C. will not in most cases be more than 3 ft. from the tangent when it reaches the P. T. At the turning points, which should be made every 500 ft., put a tack in a tie either ahead or back of the turning point so that a line to the tack from the turning point will be parallel to the tangent from which the curve was started. By stretching a string from the turning point to the tack, a new turning point, as explained later, can be located without setting up the instrument.

Near the end of the curve, take a line parallel to the track and passing through the last station on the trial curve; the total deflection angle is equal to half the angle between this parallel line and the tangent to the trial curve, added to or subtracted from the deflection angle for the last station, according to whether the central angle of the curve has been increased or decreased.

It usually takes 10 or 15 minutes to get this total deflection angle. The central angle should check to within a minute of the angle which would be found if tangent intersections were run out. The trial curve can usually be run very quickly; that is, as fast as the men can chain accurately and the transitman make deflections. When the P. T. has been set, measure the distance from it to the center of the existing track, or to the offset tangent if the curve is to be spiraled. Divide this distance by the sine of the central angle. The quotient gives the amount which the P. C., the turning points and the P. T. must be moved to be in their true positions. They are moved on lines parallel to the tangent from which the curve was started, and the movement is ahead or back according as the P. T. of the trial curve fell inside or outside the tangent.

This gives points on a true curve every 500 ft., so that in setting stakes it is not necessary to set a stake more than 250 ft. from the instrument. The tacks must be accurately placed in the stakes. The instrument does not have to be set up oftener than if the curve were run by the usual method. If it be found necessary to change the degree of curve so as to fit the track as close as possible, it can be easily and quickly done by figuring exactly how much the external of the trial curve should be shortened or increased. A point is then set for a fore-sight on the external by measuring from the center point on the trial curve, and from the trial curve it is easy to establish the P. C. and P. T.

On very long curves, any desired point can be fixed by the following method: Multiply the radius of the curve by the versed sine of the angle on the trial curve between the central point of the curve and the point to be established; also multiply the radius by the versed sine of the corresponding angle on the existing curve. Taking the difference between these two products, and allowing for the difference in length of the external of the trial curve and of the desired curve, any point can be established by measurements from the trial curve. If a Searles spiral is used, the trial curve should be started at the end of the spiral next to the curve. The point should be found by taking the offset from the tangent for the end of the spiral so that the point would fall slightly inside the center of the track, depending somewhat on the degree of the curve.

The objections to the usual method of re-lining curves are: the time required, and the fact that while the curve will fit the track at the center point, it may not fit it at any other point, at least not to the best advantage. With a great deal of figuring, quarter points can be established which will make the curve fit the track quite closely, but on long curves, where several courses are necessary, this takes an enormous amount of figuring and multiplies the chances of error. A good curve runner, using the trial curve method described, should establish and stake 3,000 ft. of curve a day. I have established and staked 5,000 ft. of curve in a day and had some little time to spare.

Bolt Locking.

BY W. H. ARKENBURGH.

The specifications for mechanical interlocking at present under consideration by the Railway Signal Association provide as follows:

"91. All facing point switches, derails, movable point frogs, on high-speed routes shall be bolt locked with signals governing such route."

"In all cases where switch and lock movements are used, bolt locks shall also be used."

"92. The switch bar on all bolt locks shall have an independent connection to switch point."

"93. The signal bar on bolt lock shall * * * be a part of the line and not lugged or looped in * * *."

A bolt lock is a device whereby a signal governing a route blocks and is locked by any or all switches in the route, that is, a proper position of the switch is made necessary before the signal can be cleared. Generally only facing point switches and high-speed signals are bolt locked.

The necessity for a bolt lock lies in the supposed unreliability of the facing point lock and the switch and lock movements. The former is usually some form of plunger actuated by a lever distinct from the switch lever, designed to pass through and hold in position a rod attached to the first or bridle rod of switch. It is obvious that should the connection between the plunger and the lever break, after the plunger had been withdrawn, the switch could not be locked. Also, with the present almost universal method of using but one plunger which will pass through either of two holes in the lock rod, according as the switch is normal or reversed, if the switch connections should fail, the plunger would relock the switch in the same position as before it was withdrawn. The switch and lock movement is a device for throwing and locking a switch with one lever and line of pipe. If any part of the connection should break the lever could be moved without any effect on the switch.

To provide safety even should any of the above events take place, bolt locking has been resorted to. In general practice a bolt lock consists of a notched bar extending from the bridle rod of the switch and intersecting at right angles a similar bar inserted as an integral part of the signal connections. The notches are so arranged that only when the signal is properly set can the signal bar pass over the switch bar.

There are many so-called bolt locks in use which consist of nothing more than a facing point plunger and casting, the plunger lugged to the pipe line and passing through an ordinary lock rod connected to the switch when the switch is properly set and the signal cleared. Only one hole is provided so that if the switch is not right the plunger cannot enter and consequently the signal cannot be cleared. This sort of construction is wrong in one very important particular. If any of the pins holding the plunger and its connections should fall out or be removed the apparatus is inoperative. In other words a failure of the apparatus produces a dangerous condition. This is what the specification aims to do away with. If two notched bars are used, and the signal bar is made a part of the line, any failure of this bar or its connections will prevent the signal from being cleared.

It has been customary in many cases where the interlocking station is located between a signal and a switch governed, to extend the signal pipe line both ways from the lead out through a double jaw in order to bolt lock the switch. Theoretically this is wrong, for should any part of the line between the lead out and the switch break down a false signal might be given. A strict interpretation of the specification forbids this being done, but careful consideration should be given to the conditions necessary to allow a false signal to be given. First, the switch connections must fail allowing the switch to be in a position not corresponding to that of the lever, or the facing point lock connections must fail, allowing the switch to stand partially open, provided it is sufficiently out of adjustment, with the facing point lock lever reversed. Second, the bolt lock connections between the leadout and the switch must fail. *Both* the first and second conditions must occur at the *same time*. The probability of this combination of circumstances occurring is extremely remote. Now there is no reason why the pipe line from leadout to bolt lock cannot be made absolutely continuous with tang end riveted and screwed connections throughout. The matter of adjustment can be taken care of by a turn buckle and there is no need to insert a compensator, for the expansion and contraction of 1-in. pipe amounts to only .008 in. per 100 in. per 1 deg. F., and this could be provided for in the length of the notch in the signal bar without danger of clearing the signal to such an extent that it would be accepted by an engineman. The only alternative solution of the problem is to run the signal pipe line first to the farthest switch governed, returning thence by means of cranks through bolt locks to the signal. In other words run the line all around the plant. It is perfectly evident that this method is out of the question owing to cost and general complications in plants of any size. It is possible, however, to meet the situation by electrical means. Before describing such it will be well to consider some weak points of present practice which are negatively allowed by the specifications, but are far more dangerous than some of those it condemns.

First, consider the switch bar of a bolt lock and its connections. Almost universally, this consists of a rod at one end of which is the notched bar and at the other a jaw. This rod is attached to the *lug* on the bridle rod or switch point by a *pin* through the jaw secured by a *cotter key*. Lugs are secured to switch point by bolts and nuts. Very often the notched bar is also secured to the rod by a jaw and pin. Suppose a pin falls out or the bolts break or are removed (both have occurred), of what use is the bolt lock? If the rod is fastened to a lug on the bridle rod, there are four more chances of failure; the switch point lug bolts and the two pins holding the bridle rod to the switch point lugs. Sometimes the bolt lock connection to a switch passes across several tracks, through transverse pipe carriers. The failure of one or more of these carriers might very well allow the rod to buckle and produce a dangerous condition. These transverse pipe carriers are not nearly so substantial as the regular pipe carriers.

The specifications require bolt locks only on high-speed signals. Theoretically and practically one signal is just as important as any other at an interlocking plant, and the failure of one end of a cross-over might very well cause a side or head-on collision, through clearing an unboltlocked dwarf signal.

It is a fact that some roads are experimenting with, and to a certain extent, have even adopted rigid switch and lock rod fittings. That is to say bridle and lock rod together with the switch point lug are made all in one piece, except that sometimes a turnbuckle is introduced for adjusting. The same is done with a throw or second rod. Here, of course, the cage must be retained. With this arrangement pins and cotters are done away with in one of the places where they are most dangerous. If this form of construction were carried one step further so as to include the switch connection to the bolt lock, making it a part of the bridle rod, most of the weak points of present bolt locking practice would be eliminated. It seems pertinent to remark in this connection that if the plunger of the facing point lock were attached to the line by means of a riveted tang end joint instead of by a jaw and pin, another source of danger would be removed.

Electrical bolt locking can be accomplished in a number of ways. Where power operated or semi-automatic signals are used, the control circuits for these can be broken through controllers on the various switches. A strict interpretation of the specifications would require a mechanical bolt lock even where a power operated signal is used. This would seem absurd on account of the expense of the pipe line and connections, especially if it would be necessary to run all around the plant. Moreover, any failure of the mechanical bolt lock would not prevent the signal from being cleared. It is really unnecessary, as breaking the control circuit is just as efficient a method. In any electrical scheme, however, the tendency is to locate the battery for all apparatus in the tower and to run, if conditions seem to require it, to one end of the plant and back again through the various instruments past the tower to the apparatus controlled. This is even worse than running both ways from the leadout to reach a bolt lock, unless the wire between the battery and the first instrument is kept absolutely insulated from the rest of the circuits. This is because a loop is established and any break-down of the insulation between the battery feed and another part of the same or another circuit will cut out all intermediate instruments. Every signalman has had experience with nails through trunking, dry and wet rot on the insulation, cracks in the insulation and numerous other phenomena of a similar nature. It is hardly possible that anyone will claim that as much dependence can be placed on the insulation of a wire as on a pipe line for the operation of signaling apparatus. Short circuits to the common return frequently lead to similar results. The safe method is to insulate the main positive and negative feeds from all other circuits either in separate trunking or on a pole line, or put a battery at each end of the plant.

A safer method of electrical control of power operated or semi-automatic signals is to make both the plunger of the facing point lock and the switch itself control the circuits. When this is done assurance is given not only that the switch is properly set but also that it is locked, before a signal can be cleared. This method can be applied also to electric selection of signals by the switch.

Electric locks, controlled by either method described, can be attached to the signal lever latch to lock it normal, unless the route is properly set. This is an efficient method, but is more expensive than breaking the control circuits. It is really the only electric bolt locking feature that can be applied to a purely mechanical plant. If route levers are used, as they sometimes are, especially where extensive approach and detector locking devices are employed, the lock can be applied to the route lever to lock its tappet reversed. Such a scheme would be far more liable to tie up a plant than the former, in case of failure, for the route would be locked as set up. It is, however, always possible to provide a release. The term tappet as here used is meant to include any device actuated by the movement of the lever latch.

Electric locks, however controlled, when used for bolt locking, should not be attached to a facing point lock lever only. For, should the connections between the lever and the lock break down no protection could be secured. As an additional safeguard, to lock the switch with the signal clear, locks on the tappet of the facing point lock lever, as above, might prove very efficient, but would seem unnecessary, especially where approach or route locking is employed. When so applied the circuit would be controlled through a normally closed circuit breaker on the home signal arm.

It would seem that in the present state of the art of signaling the whole subject of bolt locking has an exaggerated importance. There is certainly more room for improvement in facing point lock construction and switch fitting; and this might, in the end, render bolt locks unnecessary. The bolt lock is at best a cumbersome and expensive device. The only excuse for its existence is an attempt to overcome defects in other apparatus which might better be improved.

Locomotive After Derailment.

Hauling a Locomotive Up a Mountain Side.

On February 3, 1908, passenger train No. 604 on the Erie division of the Pennsylvania Railroad, hauled by engine 555, was derailed at the top of the mountain just before entering the village of Frackville. The train was running at 30 miles an hour when the engine suddenly left the track and plunged down the mountain side to a wagon road about 200 ft. below. The engineer was instantly killed; the fireman escaped without injury.

When the engine left the track, the coupling between the tender and the first car broke and the passenger coaches passed safely along the track and stopped a few hundred feet beyond the point of derailment. The tender turned a somersault over the engine and landed beyond it in the wagon road, completely blocking it. The engine stood on its wheels at an angle of 45 degrees with the horizontal, with the pilot buried in the ground.

Track (Upper Right Hand Corner), Engine at Foot of Slope, and Highway.

The mountain side was so steep and the engine so far away from the track that it was very difficult to get it back again. Several attempts to pull it directly back up the slope with two 50-ton steam derricks failed. It was finally decided to lay a track from the wrecked engine about 200 ft. along the public road to an old inclined plane which ran to the top of the slope.

About 80 years ago Stephen Girard built the Danville & Pottsville Railroad, which consisted of stretches of comparatively level track connected by inclined planes up which the cars were hauled by cables. The road was projected from Danville, on the northern branch of the Susquehanna river, to Pottsville, but was built only from Girardville to Pottsville, being used to develop the resources of the Girard estate. No. 5 of these planes is near the point of the Frackville derailment.

After the prostrate locomotive had been turned around by hydraulic jacks, so that it was parallel with the road, it was possible by using long cables attached to the derrick at the head of the plane, to pull it about 200 ft. along the wagon road on the temporary track to the foot of the plane. From this point the difficult and dangerous task of retracking the engine began. The plane was on an angle of about 45 degrees from the horizontal and about 350 ft long. The two steam wrecking derricks, of 50 tons capacity each, were placed at the head of the plane on the main track, each derrick having a line of steel cables strung from it to the locomotive so that each derrick worked independently of the other. This was done so that one derrick could hold the engine in case of accident to the other. On account of the long distance the engine had to be pulled up the plane, five cables, each 50 ft. long, joined together, were used on each derrick.

When everything was ready, the signal was given to each der-

Locomotive Being Turned Parallel with Highway.

Locomotive at Foot of Plane after Having Been Pulled Along Highway. Telegraph Pole Marked "X" Shows Where Derailment Occurred.

rick to pull and the heavy engine started to move slowly up the plane. After it had been pulled 50 ft. a stop had to be made. While one derrick held the engine, the other took out a section of its cable. The start up the plane was made at 10 a. m., Sunday, February 15, 1908, and at 12:45 p. m. the locomotive was safely alongside of the

Locomotive Being Pulled Up Inclined Plane.

main track at the top of the hill. The accompanying photographs show the locomotive at various stages of this work.

Notwithstanding its long fall the engine was not greatly damaged. The cab and small parts had been stripped from it, but the frame, boiler and wheels were intact, so that after it was retracked it was hauled to the shops on its own wheels, and was soon ready for service again.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XIII.

Charter Freight Rates and Attempts at Their Control.

The sea is free, and in a consideration of the principles controlling its freight rates the cast-off theories of land transportation are found to apply to its principal lines of trade. The most pronounced change in the theory of land transportation is the growing recognition of the fact that competition is not the controlling force that it was once supposed to be. Upon the ocean, on the other hand, the theory of free competition still finds application.

The reason for this difference between land and sea transportation will be most easily seen if one considers for a moment what constitutes the unit of transportation by land and by sea. Upon the ocean it is a single ship. Ports are open to all; the ocean is a free and toll-less highway upon which the ships of all nations may and do come and go at will. Upon land the railroad train renders the similar carrying service, but the carrying unit is the railroad itself complete from end to end. The equipment for carrying a ship's cargo 3,000 miles is not 10 per cent. more costly than that of carrying it across a narrow channel. The cost of equipment necessary for supporting a train may be roughly put at 50 to 100 per cent. of the value of the train for every mile it goes. Before a train can be run 3,000 miles there must have been years of labor for the building of 3,000 miles of railroad, requiring the investment of one to two hundred millions of dollars in roadway, terminals, branches, feeders, repair shops, etc. A new competitor for this same 3,000-mile service must expend another hundred or more millions prior to running the first train and, as population increases, the cost of railroad building increases because of higher land values. Equipment for sea carriage, on the contrary, becomes cheaper year by year through the process of invention. Ocean transportation investment requires the ownership of vehicles only—movable capital. Railroad transportation investment is chiefly in the form of fixed capital—roadway, structures and terminals. This heavy investment of fixed capital must earn dividends where it is placed or be an almost total loss. In contrast to this the steamship or sailing vessel capital is the most mobile in the world. The world ocean is open to it, and it can speed away to the shore of any and every maritime country upon the surface of this terrestrial globe.

A discussion of ocean freight rates must be introduced by a brief reference to the two distinct methods of operating ships and carrying on the transportation business: (1) Charter traffic, in which the unit of operation is a single vessel working independently; and (2) line traffic, in which many ships combine to render one service.

1. *Charter Traffic.*—The fact that the sea is an open highway enables any navigator to go where he will and engage singly in the carrying trade, if he wishes to do so. This absolute independence of the single ship has its economic advantages. No costs need be incurred except those necessary for the particular traffic in hand. If the shipper can deal in ship-load lots, he has no need of a liner. He hires a vessel of his own.

The primary object of tramp or charter traffic is cheapness with efficiency. The primary qualifications of line traffic are regularity and speed. These entail costs, and there must be higher freight rates to make line traffic profitable. There is room for both services. The exacting traffic in manufactures and passengers is increasing, and with it the demand for line traffic and corporate organization. Along with this is the growing traffic in cheap and bulky goods requiring the service of unorganized cheapness. The trade of the present comprises many million tons of cheap and bulky raw materials which must be transported in great quantities and at the lowest possible cost. These usually go in ship-load lots as charter traffic.

If steel rails, iron, locomotives or other heavy manufactures are moved in sufficient quantities, as is occasionally the case, they may become charter traffic, but the staple articles for this type of ocean work are grain, lumber, coal, ores, sugar, cotton, petroleum, nitrate of soda, jute, etc. This is absolutely a world trade. The chief market for wheat is Great Britain and the nearby parts of the continent, but this one commodity is shipped from the Atlantic ports of America from Galveston to Montreal, from San Francisco, Columbia river and Puget sound on the Pacific, from the Argentine Republic and India, from Russian ports on the Baltic and Black seas, from the Danube river and sometimes from Chile and Australia. Cryolite comes from Greenland; nitrate of soda from Chile; nickel ore from New Caledonia; iron ore from Arctic Norway, Sweden and tropic Cuba; jute from Calcutta; wool from New Zealand; sugar from Germany, Cuba, Java, Brazil and Peru. There is no ocean, no zone, no continent, no great island that does not contribute its threads to this world mesh of routes including hundreds of ports to and from which sail thousands of ships, each ship operated independently and usually as the result of a particular bargain between the shipper and the carrier. Here competition reigns.

A cargo is in the warehouse and a ship at the anchorage. what shall be the rate if the ship takes the cargo? Both parties are after profits. If there is a cheaper ship in sight, the shipper takes it. If there is a better cargo in sight, the ship takes it. If cargoes are plenty and ships are scarce, the rates will rise to the point where it is cheaper to let the goods lie rather than move them at the increased rate. A 300 per cent. rise in rates has occurred within a fortnight, although plenty of ships were lying idle in the next ocean; but they happened to be 50 days away and the goods had to go within a month. In this case, for that particular traffic the idle ships did not exist, although the next month they were on the spot and rates came down again to their former level. If ships are plentiful and cargo scarce, the ships bid for the cargo and rates go down and down. If profits cannot be made, the manager aims to cover expenses; if not whole expenses, then enough of the expenses to make a small loss rather than a great loss, and he ties his ship up only when his operating losses exceed the loss resulting from absolute idleness with its rapid depreciation and interest and other costs.

The charter rate is a marginal rate. If there are 10 ships and five cargoes, the cheapest ships get the cargo. If there are 10 cargoes and five ships, only the highest paying cargoes can be moved. Fluctuations are, therefore, sharp and there seems to be a present tendency for rate depressions to be prolonged. There are several reasons for this prolongation. One is the appeal that the shipping business makes to the gambling instinct. There are seasons of great profit; ships at times pay for themselves in a year. There are also years when there is only loss, because the great prizes have served as a magnet to draw too many people into the shipping business. Again, it requires no special knowledge. A person needs only some capital and the acquaintance of brokers who will buy him a ship and other brokers who will secure her cargo on commission. A novice with money could begin in an hour after he reached a long distance telephone anywhere in the United States or England.

It is customary in the business, especially in Great Britain, for an enterprising manager to form a stock company and build a few ships which the promoter manages on a salary or commission. The ship builder or the public will often loan money on these ships so that the company has a divided responsibility in stock and bonds much like an American railroad. The greater number of charter boats are apparently owned outright, but when depression strikes the business and there is any tendency toward maintenance of rates the manager of a mortgaged fleet is goaded to desperation by the knowledge that the holders of the bonds and probably of the stock also must have some satisfaction or his ships will be foreclosed and his company and his business wiped out. Thus the mortgaged ship is a rate depresser.

Another factor tending to prolong depression is the cheapness of new ship. When the demand for new ships falls off, the ship builders face the necessity of turning off their men. To prevent this they will build ships at a very low figure and keep their force together for better times. These changes in the price of ships and in the prosperity of the shipping business quickly respond to the state of the carrying trade. In the prosperous year, 1900, the chairman of a British shipbuilding company in addressing his stockholders said, "A ship which four years ago could be built for £70,000 to-day would cost £100,000." In August, 1900, a freight steamer 11 years old brought at auction £30,000. In November, 1901, after a break in rates, the same steamer sold for less than £18,000.*

During periods of cheap ship building the manager of chartered vessels sees a good opportunity to provide himself with some thoroughly modern ships at a low figure and be ready for the hoped-for advance when it comes. If it does not come immediately, his new vessels, possessing all the latest economies and low capital cost, can be operated more favorably than older, less efficient and more costly vessels. The result of this reasoning and of the action which grows out of it is that the amount of building does not readily respond to depressions in rates, and these depressions drag on to great length because ship building continues in spite of them. The low rates which resulted from a number of causes in the spring of 1901 can scarcely be said to have had any relief till the autumn of 1905. Any signs of higher rates brought out idle ships from their moorings, and these ships promptly put the rates down to the dead level.

Why do not the owners of vessels for hire agree upon rates and maintain them? This problem is akin to that of universal peace among nations and really does involve the harmony of many nationalities. Will the Greek, the Turk, the Chinaman and the Hindoo agree with the men of Liverpool and London, New York, Hamburg, Marseilles, Genoa and Christiania, and will they all adhere to the agreement if they make it? What if the agreement leaves a man's ship idle while the other 98 per cent. of the tonnage is busy with profitable voyages at the agreed rate? By the slightest shade of undercutting he can be deluged with cargoes. Will he abide by loss that others may profit? Even if the ship owners of the world should agree, and keep their agreement, there are a thousand other men now in their employ who know the business. Capital awaits investment. Ship builders will build ships for any responsible party in a few months. Ships are always being sold so that you and I may buy some to-day, place them in the hands of a broker or agent whose business it is to find cargoes and manage ships, and behold, there is competition again upon the sea. The biting and absolutely controlling force of this competition lies in this: If 98 per cent. of the shipping should be operated under a maintained rate agreement that gave good profits and there arose any dearth of cargo, the 2 per cent. of independent ships with a rate a shade below the agreement rate would be desperately busy and profitably employed. All the idleness would be with the agreeing ships, the new building would be with the outsiders, the increase of idleness would be with the agreeing ships until their union perforce broke down because of the large number of idle ships in the union and the prosperity outside of it.

The line separating profit and loss seems to set the limit to which charter rates can possibly be raised by agreements among carriers. Above that point there is no need of agreements, since, if cargo is more abundant than ships, rates are high from natural causes and, if there is an excess of tonnage, the rate cannot be upheld for the reasons previously stated. This statement is borne out by the history of attempts at rate control and by the united opinion of ship owners themselves.

The lack of successful rate control by the owners of charter vessels cannot be charged to lack of experience in co-operation. There is a large number of shipowners' associations in all large shipowning countries, and especially in England, where the bulk of this class of shipping is owned. In London alone there at least nine such organizations. These associations exist for nearly all the purposes that can be attained by co-operative action. The annual report of one of the Liverpool associations for 1905, for example, describes efforts to effect favorable legislation in London; to change local harbor regulations; to persuade the government to take action on the policy of various foreign governments toward British shipping; to change charter party forms (form of chartering agreement); to change coal trimming charges at Cardiff; to reduce Suez Canal tolls, etc. One strong and growing association exists only to fight organized labor, and many associations are concerned chiefly with the ever present insurance question. They are often perfectly willing to spend £5,000 sterling in combating a case involving £100 and a precedent. One of these bodies—the North of England Protecting and Indemnity Association—reported that on December 31, 1905, there were enrolled in the association 2,470 steamers with a tonnage equal to about half of the total under the British flag. For some purposes at least the ship owners know how to co-operate.

The recent prolonged depression in freight rates which began in the spring of 1901 produced two serious attempts at charter rate control of an international character, and their results help to show the limitations upon such efforts and their essential futility as producers of profitable rates. The condition of the shipping business in this period was such as to drive men into agreements, if any economic force could produce that result. The shipping journals were full of letters, articles and editorials proclaiming the unprofitable conditions of the trade. The president of the Clyde Steamship Owners' Association declared in his annual address, January 20, 1903, that it was hardly possible to sketch out a round voyage on which a freighter could pay expenses. A British shipowner of much experience stated in March, 1905, that "on the average, British sailing ships of over 3,000 tons (dead weight) have lost about £1,000 each per annum during the last three years and that smaller vessels have fared almost as badly." On December 29, 1904, *Fairplay* summarized the report of 49 tramp vessel owning companies for the year then ending. They had 393 vessels of 1,184,358 gross tons, capital £10,253,752, and debt £3,157,128. Assuming 5 per cent. interest on the indebtedness and the customary 5 per cent. for depreciation, they would have required £140,040 more than their total earnings to avoid a loss even if no allowance be made for income tax and management expenses. A month previous to the publication of the digest of these reports, the same journal had declared editorially that, "taken upon the whole, tramp tonnage is being run at a disastrous loss." At the end of 1903 a similar analysis of 36 companies showed results like those cited above, and six of the 36 had actual cash loss for the year on operating expenses, to say nothing of expenses of management, interest on bonds, depreciation or dividends.

In such times as these anything tending to improve the condition of rates was eagerly snapped at. The French bounty-fed sailing ships, receiving a government bounty that paid almost enough to run them, were in a position to make competition exceptionally ruinous for British and German ships of the same class. There was an international conference of these sailing vessel owners in Paris in December, 1903. It drew up a constitution for the "Sailing-ship Owners' International Union," which was to become operative when subscribed to by the owners of 75 per cent. of the shipping involved. The organization, with headquarters in London, was formally launched in June, 1904, when the first rate committee announced the schedule of minimum rates for the guidance of its membership. The circular sent to the members in June, 1905, states that

> The Sailing-ship Owners' International Union . . . has only to do with vessels of 1,000 tons net register and upwards, and the control of the union is in the hands of an international committee, the members of which are appointed annually by the various nationalities in agreed-on proportions.
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> Although it is obvious that much good work might be done in many directions by such an international association, the only object of the union for the present is the binding together of sailing-ship owners not to accept less than certain agreed-on rates for freight for the principal homeward voyages in which sailing-ships engage, and members of the union are bound under a penalty not to charter their vessels at a lower rate than the minimum prescribed by the committee of the union for any particular voyage.
>
> The intention of the union is not to push up freights to such an extent as to oppress shippers or check business, but to prevent the ruinous competition which has come into the business and reduced freights to such a point that they could not possibly pay expenses, and in many cases were leaving heavy losses to owners.
>
> The union was originally started on the basis of not less than 75 per cent. of the British, French and German tonnage interest being included, but for 1905 the percentage has arisen to 87 per cent.

By November, 1905, the seventh freight circular had been issued, but most of the rates had remained unchanged, except to permit a small reduction to cargoes of over 2,500 tons. In 1906 the organization was still in healthy existence. Its limitations become apparent when it is noted that it applies only to the longest voyages, namely, the Pacific coast of North and South America, Australia and New Caledonia to Europe, and that it covers only the return voyage, leaving absolute freedom for the outgoing voyage and for all other trades.

A shipowner who had been influential in promoting the union said of it in a letter in December, 1905:

> This Sailing-ship Union would never have come into existence if it had not been for the French sailing-ship bounties and the absurd manner in which these bounties are paid. If the French ships had been competing on level terms, there would have been no need of any union. So far as I know there has been no attempt on similar lines to control sailing vessel rates in the past, and I know of no combination among shipowners which has held together as this one has done. The minimum rates adopted are intended to prevent loss rather than make gain. In most cases they are lower than cost, taking into account the outward rates that have been ruling, and which, of course, come into the calculation for the round voyage. The idea of the union, however, has been, if possible, to steady the freights, interfering as little as possible with the ordinary course of business and the natural fluctuations of the market. At the present time, unfortunately, the only place from

*See *Lloyd's Weekly Gazette*, Oct. 5, 1905, p. 638, and *Fairplay*, Nov. 21, 1901.

which anything in excess of the minimum rate is obtainable is from Australia, the conditions of the markets on the Pacific coast both of North and South America being such that the minimum rate is barely obtainable. The minimum rate applies to vessels of 2,500 tons, and for every increase on this size a slight reduction is allowable, as it was found that the larger ships could not get employment as long as the smaller vessels were available on exactly the same terms.

As far as the members of the union are concerned, the minimum rates have been maintained wherever they have been fixed, say west coast North and South America and Australia. Unfortunately, owing to the want of cargo on the west coast of North America, and the accumulation of tonnage in South America, various union ships have been unable to get the minimum rate and have required to move in ballast to some other part of the world where prospects were better. The small percentage of ships still outside the union, moreover, has at various times caused trouble by cutting in just under the union rate. The prospects are, however, that for next year fewer ships will be outside the union.

An owner with a fleet of vessels in the union, states its advantages thus: "I think you might put it that they provide for a small loss rather than a great loss. This has undoubtedly been for the advantage of sailing-ship owners." The advantages of being among the few outside the union were shown by freight quotations at this time. The San Francisco *Chronicle*, January 28, 1906, stated that "apparently anything willing to take less than combination rates is promptly picked up." On February 18, the same journal stated: "Freight rates continue lifeless to the United Kingdom as well as from the north as from here. Charterers are not willing to pay combination rates, and it makes a deadlock for the present." That deadlock means ships lying idle in the harbor, eating up the owners' bank account. If that were being tried when a 2 per cent. cut on a *profitable* rate would give employment, it is not likely that the union would long survive.

The small scope and importance of this union as a force in the control of world rates appears from considering that it is limited (1) to minimum rates which are on a basis that affords no profit (e.g., wheat 22s. 6d. from San Francisco to Liverpool); (2) to certain long voyages; (3) to returning voyage only; (4) to vessels of certain size only; (5) to sailing vessels only, when sailing vessels all told are not now doing over 6 or 7 per cent. of the work of ocean transportation.

In January, 1907, this organization seemed to be on the verge of final dissolution. Strange to say, or rather, quite naturally, its embarrassment seems to have resulted from a burst of prosperity attendant upon the rebuilding of San Francisco after its destruction in April, 1906. There was a great demand for coal, cement and steel which doubled the out rate from Europe from 15 to 30 shillings per ton. Under the normal conditions of trade, the rate outward from Europe is a by-product rate, a ballast rate. The larger movement of freight is from the Pacific to the Atlantic, and the ships take back anything they can get at any rate they can get, or as alternatives take ballast. That is why sailing vessel-owners made no attempt to control the out rate.

The San Francisco disaster suddenly reversed things. So many ships went out with building material that there was a plethora of shipping seeking return cargo, and having had the unusual experience of making profit on the out freight, they were willing to take a by-product rate home again. This the Minimum Agreement prohibited. "This standard has been circumvented by vessels being fixed on a round freight from United Kingdom or continent or from New South Wales to west coast and home to United Kingdom or continent.*

One week after the above sentence was published in London, the Shipowners' Union sent out on January 11th a new rate circular to members saying that there would be no change in the minimums last announced except that the nitrate rate to the United Kingdom and continent would be suspended from January 14th. This was a very extensive exception, being quite half of all that the union stood for. Lloyd's Liverpool correspondent spoke of friction in the association, of its frequent meetings, of rumors of German withdrawal. "Indeed it is felt," he continues, "in some quarters that its breaking up is only a matter of a very short time. The abandonment of the nitrate rates was apparently the beginning of the end. This, however, proved to be a continuance of life rather than the death rattle, for the organization was still in a normal condition (minus nitrate rate) in February of 1908.

The same conditions of depression that drove the sailing vessel owners of Paris brought about a somewhat similar conference of steamship owners in Copenhagen in February, 1905. The success of the sailing vessel owners was one of the reasons that led to the assembling of those interested in the commerce of the Baltic and White seas. This narrow geographic unit has corresponding to it what might also be called a commodity unity also. The trade is predominantly in wood and lumber, with coal as return freight. The great world markets for oversea lumber are the United Kingdom, Germany, Holland, Belgium and France. This import trade amounts to more than 15,000,000 tons, and less than a fifth of it comes from across the Atlantic. The remainder, or more than 12,000,000 tons, is shipped from Norway, Sweden and Russia. This is one of the greatest items in the world's trade.*

This traffic, while international, is little greater in geographic extent than is the traffic of the American Great Lakes. Some of the leading shipowners, dissatisfied with unprofitable timber carrying, conferred for three days at Copenhagen in February, 1905, and fixed a minimum scale of rates for the various ports, and then went back to their various countries to work up support for the scheme so that it might be put in force at another conference in June. In this they were successful, but only as regards the outgoing rate on lumber. The total vessel tonnage affected by this agreement is only about 1,612,000 divided among 1,048 steamships. Although this Baltic and White Sea agreement is purely local in character it is the most comprehensive among charter steamship owners that has as yet been seriously considered. This organization has had no revolutionary earthquakes to upset its plans and is now entering upon its third year in better shape than the Sailing-vessel Owners' Union, which was its prototype. The Scandinavian winter makes the Baltic trade quite largely a summer season trade. In the season of 1906 the agreed-upon rates were maintained, and on April 12, 1907, there was another meeting at Copenhagen to arrange for the ensuing summer. Much exhortation was given the members to insure their doing nothing that would increase the difficulty of maintaining the rates.

This organization has busied itself much with work of the kind usually taken up by the various shipowners' associations of Great Britain, namely, the establishment of favorable and uniform charter parties. These blank forms or contracts are exceedingly important in such an organization, for by them it would be easy to name a uniform cash consideration and bring about practical discrimination by varying the clauses about measurement, loading, discharge, or insurance of cargo, etc.

These two rate agreements, the small and weakly newborn offsprings of the most profound shipping depression of modern times, seem but to emphasize the controlling force of free competition in deciding the charter rate, which is a world rate. If the agreeing Baltic carriers should push their rate much above the general level, they would probably be greatly embarrassed, and the timber shippers greatly pleased, by the appearance of ships sent in by the hungry and enterprising Greeks, Hindoos and other shipowners from the remotest ends of the earth.

(*To be continued*).

Lloyd's Gazette Weekly, 1907, p. 10 and p. 41.

*American wheat exports amount to from four to seven million tons per year, and sugar (about 2,000,000 tons) is our heaviest import.

Foreign Railroad Notes.

The French in their several colonies in West Africa in the five years since 1902 have built 554 miles of railroad, in addition to the 370 miles then open. Capital has been provided for building 466 miles more. The longest of these roads extends from the River Senegal at Kayes, the head of navigation, which is 320 miles from the mouth, southeastward 345 miles to a navigable part of the Niger at Koulikoro, 420 miles up stream from Timbuctoo, of which the poet says:

If I were a cassowary,
On the plains of Tim-buc-too
I would eat a missionary,
Skin and bones and hymn-book too.

The course of the Niger from Koulikoro to Timbuctoo is northeastward, thence southeast and south more than a thousand miles to the Gulf of Guinea.

The gentlemen who drive their cattle on the tracks in front of trains to recover damages must hide their diminished heads before a Belgian peasant. He had been slightly hurt by a railroad accident and had been paid $75 therefor. Delighted to find that his skin might be a source of income, he loosened a rail on the track about a quarter of a mile from a station, took the first train from that station, and succeeded in being hurt when the train ran off and killed the engineman, wounding five men seriously and others slightly. He insisted on going home, and for some reason was suspected. When a policeman came to search his house he took a gun, ran into the field and shot himself.

The Central Northern Railroad of Argentina was opened on the last day of 1907 from Jujuy northward 176 miles to the southern border of Bolivia at La Quiaca. The new road was built by L. Stremitz & Co. for $6,894,659 gold. Jujuy is 2,133 ft. above the sea; La Quiaca, 11,293 ft. The highest point on the line, however, is 62 miles further south at Tres Cruces, 12,100 ft. above the sea. On the southern 21 miles there are 125 bridges from 7 to 690 ft. long. For six miles Abt cog-wheel engines are used. A section of the line is liable to be covered by mud and rocks brought down by torrents from the mountains. La Quiaca is about 150 miles south of Potosi.

The Metal Tie.*

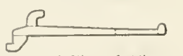
BY DR. ING. A. HAARMANN,
Geheimer Kommerzienrath

III.

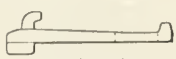
An efficient means of attaching the rail to the tie has always been of material importance in extending the use of metal superstructure. The main considerations in this connection are: Avoiding the bending of ties to secure inclination of rail; efficiently protecting the tie against wear, reducing the number of pieces needed for attaching the rail, increasing the ease of track-supervision, and providing for easy gage adjustments on curves. These considerations led to the introduction of my hook plate fastening on the Prussian State Railroads as early as 1882. The hook plate gives the rail its inclination and distributes the pressure on the tie. By entering into the tie, and by grasping the flange on the outside, it renders additional fastenings at this point unnecessary, and as a result of the uniform spacing of the holes in the ties it makes adjustment of the gage on curves a simple matter.

To be sure, the first hook plate was not perfect, especially was it too small (Fig. 34). But the tie of that date had defects also, prominent among which was too narrow an upper surface. Too much account was made of actual requirements, and too little of the much greater demands of the future that were but dimly appreciated. For the somewhat wider ties of sections 51 and 52 (Fig. 33, *Railroad Gazette*, March 27), the plates could be made longer, but even this size was not sufficient, as was evidenced by the wear of the ties and of the plates. By increasing the width of the plate, and in addition transferring the seat for the clip to the hook plate itself, the hook plate fastening was materially improved. The movements of the rail were, however, still communicated to the hook plate, so that the surface wear of the ties and fractures at the corners still continued. To remedy this, an inside stud was added, and this so-called "stud plate" was in addition provided with a rib having an inclined face for the clip to brace against, thus getting a firmer grasp on the rail. While this arrangement permitted the adjustment of the gage by the use of a single size of clip instead of the four sizes heretofore required, the added stud required that holes be made in the tie differently from the standard. Another arrangement, not open to this objection, was that in which there was only one stud, this being on the outer side of the stud plate, the stud filling the hole but not being provided with a hook. These stud plates represent the transition from the older hook plate to the newer hook stud plate, which, combining the advantages of both, neither requires a perforation of the tie different from the standard, nor lacks the increased safety furnished by the hook. It excels both in the increased surface of contact and in that it provides a cover for the hole receiving the stud, thereby insuring longer life to the tie.

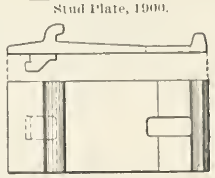
Hook Plate, 1881.



Hook Plate, 1882.



Stud Plate, 1900.



Hook Stud Plate, 1906

Fig. 34—Development of the Hook Plate.

Fig. 35 represents graphically the yearly increase in the number of hook plates. The lower line gives the quantities furnished yearly, the upper line the total number that have gone into service, amounting to 57,000,000, or enough to equip 12,400 miles of track. As regards the hook stud plates, after a preliminary trial in the spring of 1906 on the Württemberg State Railroad (Fig. 36), 25 miles of track have been equipped with them by the Oldenburg State Railroad (Fig. 37). In Württemberg and in Oldenburg the rib ties proposed by me have been adopted. They were first laid on the road between Georgsmarienhütte and Hasbergen; then, since 1900, on a section between Cologne and Hamburg, and, since 1904, on several sections of the Breslau and of the Elberfeld divisions of the Prussian State Railroads. The chief feature of the rib tie consists in two ribs along the upper edge that secure the bearing plates in their position. They have curved sides, a broad base and are easily tamped. The Württemberg specifications require a spacing of 28 in.; the Oldenburg, 28$\frac{1}{3}$ in. The bearing surface of the track is about the same in both cases and exceeds that of the American roads with their well-known close spacing of wooden ties. The Prussian State Railroads have decided to adopt the rib tie with hook plate fastening as a standard. The tie will be the same as before, with the addition of the ribs; the width is 9$\frac{1}{8}$ in., bearing surface 971 sq. in. and weight 137 lbs. (Fig. 38). At the joints the so-called broad-tie, form 66, is to be used. This tie, with two pairs of ribs, has a bearing surface of 2,016 sq. in., and weighs 282 lbs. The hook stud plates are adapted to a 3$\frac{3}{4}$ in. flange (Fig. 39). The illustration (Fig. 40) shows the track of the Georgsmarienhutte Railroad; 300 miles of road will be thus equipped by the State Railroad management. It is perhaps worthy of notice that malicious tampering with this style of track is much more difficult than is the case with one using wooden ties and spikes or chairs and wedges. Whoever has seen a rib tie crack in operation will never be satisfied with one with wooden cross ties.

*Address delivered at the meeting of the "Verein der deutschen Eisenhüttenleute," Dec. 8, 1907, at Düsseldorf. Reprinted from *Stahl und Eisen*, by permission.

In 1880 the late Privy Councillor Grüttefien read a paper at

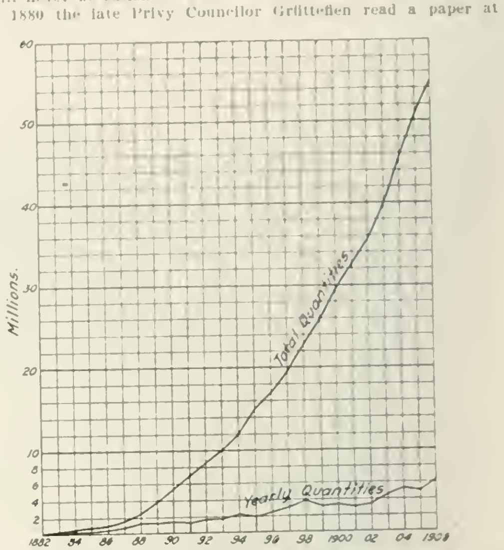


Fig. 35—Total and Yearly Quantities of Hook Plates Used for Permanent Way with Metal Ties.

the meeting of the Iron and Steel Institute at Düsseldorf "On the Results Obtained with Various Systems of Permanent Way in Prussia." At that time it was impossible to foretell that the metal cross tie would be the victor in the contest with the longitudinal tie. It therefore seems irrational to cite against the metal tie, as does the society for furthering the use of wooden ties, the deductions made by Grüttefien 27 years ago, when the development of the metal tie was only beginning. This authority pointed out that the Vautherin tie and the Hilf tie were too weak, too short and too light. But he also said, and this was based on the experience of the Prussian State Railroads with metal ties for only five years, that the eventual success was not doubtful. This opinion he based on the better lasting qualities of the metal ties, the more reliable methods of attaching the rails, the greater uniformity in spacing, the diminished tendency to creep and the quiet and elastic movement of the rolling stock. Citing England and the United States is not to the point, if for no other reason than because the conditions obtaining in those countries are quite different from ours. In England unusually large masses of metal mounted on broad wooden ties are used, and in the United States they are not

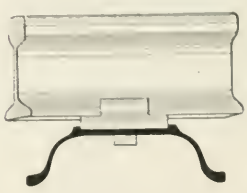


Fig. 36—Rib Tie, Form II; Württemberg State Railroads.

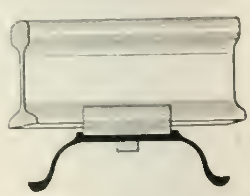


Fig. 37—Rib Tie, Form III; Oldenburg State Railroads.

niggardly in the matter of wooden supports. But that thereby the riding on English or American tracks is more satisfactory than on our own, I deny from personal experience. Even on the well cared for Midland Railway almost every joint is felt, and the jars and oscillations on the line from London to Liverpool, and on that from Liverpool to Manchester, in spite of the careful maintenance of track and the inspection of wedges morning and night, leave nothing to be desired on the score of distinctness. Rather might the riding over some of the American roads be considered superior.

But that is not entirely the result of the close spacing and of the heavier rails, for a material part is due to the many wheeled American trucks, which are excellently equipped with springs and which in combination with the long cars adapt themselves to the track with the utmost ease. On a previous occasion I have called attention to the importance of the truck and I can now only confirm the statement that in regard to it the American roads have the lead. This statement is not incompatible with a weakening of my former enthusiasm for the Pullman cars, that vary considerably in the quality of their accommodation. As to the tracks themselves? There are some main routes, for instance those of the Pennsylvania Railroad, that are treated like parade horses and are cared for and caparisoned accordingly. But there are also other less favored lines owned by the same company, e.g., Buffalo to Harrisburg, that are treated more like cart horses. Opinions concerning English and American railroads must be accepted with some caution. The layman is apt to mix cause and effect. In the United States the opinion is more exalted as having to do with a "great country." One of its railroad magnates, Mr. Gould, a few weeks ago expressed him-

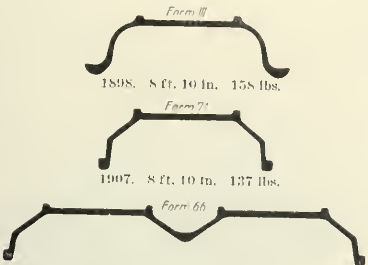


Fig. 38—Rib Tie Sections.

self to the effect that, "Between our railroads and those of Europe there is no comparison. Ours are the best in the world." He did concede that he had seen some pretty fair ones in Germany. In this qualified praise he was about right, for here just as yonder there is a difference between the permanent way and car equipment of main lines and those of branch lines. Perhaps there is another difference; possibly the citizen in Germany protests more loudly if he considers himself unduly neglected in governmental regulations than does the citizen on the other side of the pond. But in making his critical remarks, Mr. Gould should not have forgotten

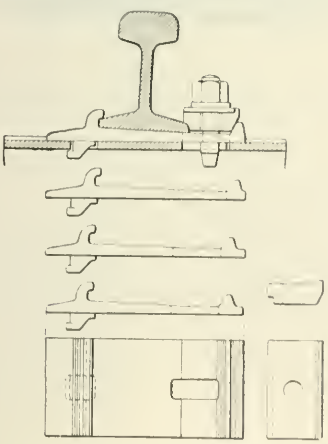


Fig. 39—Hook Stud Plate; Prussian State Railroads, 1907.

that while accidents cannot be avoided entirely, still those recorded in America go far beyond a reasonable average.

Those who defend the wooden tie from principle cannot be reproached with the fact that the perfecting of this tie has not kept pace with the development of the metal tie, because that was a matter beyond their control. Should it be necessary to give this member particular dimensions, a desirable shape or a definite weight, such requirements entail no problems with the metal tie. A case in point is the broad tie for joints, made to meet the requirements of the administration of the Prussian State Railroads. If the demand were made for ties of still greater weight, no rolling mill would declare it impossible. And if specifications called for a tie to have a life of 50 years or more for use on lines with heavy traffic, even this demand the iron and steel industry would meet, furnishing a product of great uniformity both as to shape and quality. In making these assertions I am exaggerating in no way. The old and light Cosyns ties, which, after having stood 40 years' service, can still be used, although laid on a roadbed that cannot be compared with that of the coal regions, have demonstrated the lasting qualities of the material even with unfavorable ballast, and that is the important thing. Surely it is reasonable to expect that a metal tie properly constructed, proportioned and equipped, turned out in accordance with our present experience, will have a still longer life. The comparative behavior, under similar conditions of heavy traffic, of impregnated wooden ties and of metal ties with and without ribs is well shown by samples in the Osnaburg Track Museum. In view of the superior qualities of the metal tie, we iron and steel men are amply justified in placing it prominently in the foreground.

There is no question that the wooden ties have done great service; to deny their importance would be foolish. But is not the producer of wooden ties entirely dependent on the growth of the tree? In regard to dimensions, cross-section and length, resistance and durability, the friends of the wooden tie must be satisfied with the qualities offered by nature in each individual case. As it is impossible to make all the ties of a large order from trees of the same character in respect to age, growth and freedom from knots, we cannot speak of the uniform durability of the wooden in the same sense that we speak of it in the metal tie. The time for the selection of woods is long past, and the best that can be done is to delay its rapid deterioration by impregnation, and so defend it against the attacks of its numerous enemies. If the wooden tie is to reach a higher value for use, the means must be borrowed from the iron and steel industry, and, by equipping it with heavy tie plates or massive chairs, lengthen its life and increase its ability to render service.

In the estimate made to establish the relative economic value

Fig. 40—Permanent Way with Rib Ties, Showing Joint Tie.

of the wooden tie and the metal tie, I have not taken into account as factors the undoubted increase in safety of operation, nor the favorable effect of properly constructed metal permanent way on rolling stock. Furthermore, I have left out of the reckoning the fact that the manufacture of metal ties means a considerable outlay in wages which would inure to the benefit of our country, and would amount to not less than $9.80 per ton.

The basis for the comparison are the specifications laid down by the Prussian State Railroads for the construction of permanent way for fast train service, i.e.:

1. A permanent way with 25 impregnated fir ties supporting a rail of 49 ft. 2½ in. long.

2. A permanent way with rib ties (forms 71 and 66, Fig. 38), 23 intermediate ties and one broad tie for the joint, this last counting for two single ties,* the length of rail being the same.

The cost of rails, splice bars, ballast and maintenance has been assumed to be the same for both systems, although we have sufficient evidence that metal ties, in the long run require less labor for maintenance than do wooden ties. All prices for metal are official. For old material, I assume a loss in weight of 20 per cent and a value of only $10.09 per ton. An estimate presented by me at a meeting of the "Verein für Eisenhüttenkunde," and which has not been controverted, sets forth that every ton of metal ready for use in permanent way represents an income from freight to the railroads transporting the finished or partly finished products, the scrap and the raw materials (coal, coke, pig iron, slag, etc.), amounting to $6.54 and, including the old material, to $7.20. This item cannot be disregarded even though the freight charges do not in every case inure entirely to the benefit of the road purchasing and using the ties. All that interests us is to obtain average values applicable to the large territory served by the Prussian State Railroads. The fact that other roads, on account of their geographi-

*Since this paper was read, new specifications for the standards of permanent way require 24 intermediate ties and one joint broad tie, i. e., one tie more than above.

or economic position, may have to use different values does not change the general accuracy of the proposition. As the wooden ties have also to be transported, I will deduct the freight on the finished metal ties and instead of \$6.51 or \$7.20, place the freight receipts at \$5.45 per ton, thus avoiding any charge of discrimination in favor of the metal tie.

The cost of the impregnated tie is not obtainable from official statistics, as these give only the average cost of the total of wooden ties, making no distinction as to their character, whether impregnated, fir, beech or oak. I shall have to rely, therefore, on my own general knowledge. It would certainly not be excessive if I assumed the cost of the ties ready for laying in the track (including cost of impregnation and planing, but excluding transportation from storage points to place of use) at \$1.20 each. Incidentally, oak ties on the same basis cost \$1.62 and beech ties \$1.80. But I will assume the purchase price of the impregnated fir tie at only \$1.02. It is assumed that the ties remain in use in main track up to the time of their removal, and the value of these old ties I will put at the rather high figure of 30 cents each. This is on the assumption that they will be fit to some extent for use on sidings, although many, probably the most, will be disposed of for fuel at much lower figures.

Next the question of their life. Experience has shown the average length of service for impregnated fir ties on main tracks under heavy traffic to be 10 to 12 years. I will assume 12 years. After what has preceded we might reasonably allow to the rib tie three times as long a life. I will not go so far, however, and will content myself with 20 years as the average length of service for metal rib ties.

In regard to the fastenings, it is known that their renewal generally coincides with the removal of the ties, excepting possibly in the case of the bolts, which often require earlier replacement. Eight years' experience with rib ties furnish the assurance that the carefully designed hook stud plates and the clips, with their large contact surface, will have a length of life equal to that of the tie. This result can be confidently expected, as the hook stud plates are now being worked out of the cold bar by especially designed machines. For the T-bolts I assume an average life of 12 years. As the hook plates of the wooden ties are of generous dimensions, I assume that they will last 18 years, while the small clips and the tie screws will be worn out in main track service in from 10 to 12 years, the same as the ties. Possibly this may be too optimistic for these last, as the repeated tightening and refastening occasion considerable wear. Finally, the cost of the labor of replacements, taking out old ties and putting in new ones, must not be neglected, and for this, whether the ties be of wood or of metal, I will allow 12 cents per tie.

Based on the above data, the following is the calculation in detail of the net cost per mile of the ties with their attachments required by the two systems, credits being allowed for the value of scrap and for the freight earnings accruing from the transportation of material as noted above.

1. *Fir Tie Permanent Way.*

25 ties supporting rails 49 ft. 2½ in. long.

No.				
2,685	Fir ties, each (\$1.02 − 0.30) at \$0.72		\$1,933	
	Labor replacing ties, 12 cents each		322	
				\$2,255
4,939	Hook plates,* 14.6 lbs. each =	36.055 tons		
430	Hook plates,† 14.9 lbs. each =	3.204 tons		
		39.259 tons at \$39.27 − 5.45 = \$33.82	\$1,326	
	Less scrap	31.407 " at 10.90	343	
				983
5,797	Clips, 1.28 lbs. ea.	3.710 tons at \$54.45 − 5.45 = \$49.09	\$183	
	Less scrap	2.968 " at 10.90	32	
				151
16,522	Tie screws, 1.03 ea	8.159 tons at \$56.72 − 5.45 = \$51.27	\$434	
	Less scrap	6.820 " at 10.90	74	
				360
				\$3,749

*For intermediate ties

†For joint ties.

2. *Rib Tie Permanent Way.*

23 intermediate and 1 joint broad tie (counting for 2 ties) supporting rails 49 ft. 2½ in. long.

No.				
2,467	Intermediate ties, 137.3 lbs. ea =	169.355 tons		
108	Joint broad tied, 277.0 lbs. ea =	14.958 tons		
		184.313 tons at \$24.43 − 5.45 = \$18.98	\$3,498	
	Labor replacing ties, 12 cents each		321	
			\$3,819	
	Less scrap	147.45 tons at \$10.90	1,607	
				\$2,212
5,369	Hook stud plates 6.9 lbs. each =	18.523 tons at \$54.54 − 5.45 = \$49.09	\$909	
	Less scrap	14.818 " at 10.90	162	
				747
5,369	Clips, 3 lbs. ea =	8.052 tons at \$42.54 − 5.45 = \$37.09	\$299	
	Less scrap	6.443 " at 10.90	70	
				229
5,369	T bolts, 1.5 lbs. each =	4.027 tons at \$63.27 − 5.45 = \$57.80	\$233	
	Less scrap	3.222 " at 10.90	35	
				198
				\$3,386

The annual amount required to be paid into a sinking fund to cover, by the time replacements are necessary, the above outlays at the rate of 4 per cent. compound interest, is.

1. *For Permanent Way with Wooden Ties*

Wooden ties, clips and screws for ties

$$\frac{(2{,}255 + 151 + 360)\ 0.04}{1.04^{12} - 1} = \$184.44$$

Hook plates for wooden ties

$$\frac{983 \times 0.04}{1.04^{18} - 1} = 38.54$$

\$222.98

2. *For Permanent Way with Rib Ties.*

Rib ties, hook stud plates and clips,

$$\frac{(2{,}212 + 747 + 229)\ 0.04}{1.04^{20} - 1} = \$107.07$$

$$\frac{198 \times 0.04}{1.04^{12} - 1} = 13.18$$

\$120.25

From the above it appears that in a country with an efficient iron and steel industry, wooden ties are at least 85 per cent. more costly than metal ties. If the difference of \$102.73 between the annual payments to the sinking fund is to disappear, wooden ties must become materially cheaper. But these figures do not tell the whole story of the economic superiority of the metal tie. In addition to a

Fig. 41—Permanent Way with Rib Ties.

greater safety in operating, and a saving in wages, there would accrue to the country at large the indirect benefits arising from the regular and steady work that would fall to the share of the metal industry.

I am confident that the time is approaching when, in view of the demonstrated longer life and greater reliability of permanent way with metal ties, even after a very material reduction from present prices, the wooden tie will be regarded as too expensive. We must accustom ourselves to the idea that, as in ship building, house building, bridge building and in other fields, so also in railroad building metal is crowding out wood. When half of the 70 million wooden ties at present lying on 33,000 miles of important lines of main track are replaced by metal ties (which in itself would mean lower costs of operation and of maintenance) the saving in the amount of the yearly contributions to the sinking fund would amount to nearly \$1,700,000, representing the interest on a capital of \$42,500,000, and we iron and steel men would be in position to pay for labor additional wages amounting to over \$26,000,000 yearly.

In this presentation and in the deductions made, I have only, as I believe, set forth clearly incontrovertible facts. If the German iron and steel makers share this belief, it will be their task to champion the metal tie energetically. The choice of the particular metal tie best adapted to given conditions will lie with the proper railroad authorities. I have the utmost confidence that these, both in the engineering department and in that of finance, will recognize the validity of my demonstration. Eventually, in our permanent way, the use of wooden ties will only be justified to the extent that in the interest of domestic forestry it may be tolerated on some branch roads. On the main lines they will have to be given up, and we can confidently hope that before long the entire structural part of the permanent way will be of steel and iron.

The distilleries of the upper Congo are protected against the pauper distilleries of Europe by a freight rate on spirits over the Congo Railroad at the rate of 70 cents per ton per mile, making \$175 per ton, or \$8.75 per 100 lbs., for the 250 miles.

GENERAL NEWS SECTION

NOTES.

The New York Assembly has passed a bill compelling railroads to issue half fare tickets to school children.

According to recent advices the outlook for a big wheat crop this year in the Kansas wheat belt is extremely good.

The Missouri Pacific has asked for a injunction forbidding the Nebraska Railroad Commission from attempting to regulate its traffic or rates.

It is understood that the Atchison, Topeka & Santa Fe has bought 1,200 acres of oil lands in the Midway field in California at a cost of about $2,000,000.

The Indiana Railroad Commission issued an order March 30 reducing express rates between 10 and 12 per cent. The Commission thinks the companies are earning too much.

At a conference between presidents of Missouri and Illinois roads and their general counsel, March 26, it was decided to test the constitutionality of the 2-cent passenger rate laws in those states.

On and after April 1 the Southern Railway will apply the 2½-cent passenger rate on all tickets sold in Tennessee. It will also give an open party rate of 2 cents for parties of 10 or more traveling on one ticket.

The Canadian Pacific has adopted a demerit system of discipline instead of the suspension system. Sixty demerits will be grounds for dismissal. For every year free from demerits, 20 demerits will be deducted.

On April 1, Attorney-General Bonaparte transmitted to United States attorneys information of 28 instances where the Federal Safety Appliance Law is alleged to have been violated. Of the total number, 13 occurred in California.

The Interstate Commerce Commission has reversed its own ruling and will allow transcontinental roads to grant rates to California for April 4 and 5, the occasion of manoeuvers by Admiral Evans' fleet, without insisting on the 30-day provision.

It is understood that the government will bring a test case as soon as possible after May 1 to try out the commodity clause of the Rate Law, and will thereafter not prosecute railroads for failure to comply with this clause, pending a decision of the Supreme Court.

The passenger department of the Southern Pacific announces that between March 1 and March 18 more than 7,000 people entered the state of California, most of the immigrants going to the northern part of the state. The company's tourist travel was 20 per cent. less this winter than a year ago.

The Oklahoma Corporation Commission on March 26 rescinded its former order ousting the Fort Smith & Western Railroad from the state on account of its refusal to do passenger business on a 2-cent basis. The Commission decided after a hearing that the road should be allowed to continue to do business on a 3-cent basis.

Chairman Knapp, of the Interstate Commerce Commission, wrote the Senate committee on interstate commerce March 30, to the effect that the Commission believed that a physical valuation of the railroads of the country could be completed in three years and that the total expense would perhaps be not less than $3,000,000.

Judge Pollock, in the United States Circuit Court at Topeka, Kan., on March 27, enjoined the State Board of Railroad Commissioners and the Attorney-General from putting into effect a new schedule of freight rates on April 1. The railroads alleged that the proposed schedule was confiscatory. The case will be argued on April 14.

Arrangements were made March 30 for the purchase by the city of Winnipeg, Man., of the entire holdings of the Winnipeg Electric Railway, which is a consolidation of the Winnipeg Electric Street Railway and the Winnipeg General Power Co., and operates the entire street railway, gas and electric business of Winnipeg and St. Boniface.

An appeal was made to the employees of the Chicago, Milwaukee & St. Paul last fall to economize in each detail of operating expense in order to avoid the necessity of reducing wages. According to recent advices, $160,000 was saved in January by careful work, about one-fourth of which is attributed to the saving in coal, due to careful locomotive firing.

For 589 railroad stations in the western New York car service district 65,569 cars were reported during February, as against 78,377 cars during the same month last year, a decrease of 29 per cent. The average detention was unchanged. For the eight months ended with February the Pacific northwest car service district reports 574,708 cars; a gain of 19 per cent. for the current commercial year.

A delegation of freight trainmen employed by the Philadelphia & Reading have asked the State Railroad Commission to obtain information for them about the working of the federal 16-hour law. They argue that the 16-hour limit often expires when they are only a few miles from a terminal point, and want to know whether it is their duty to stop work and tie up traffic under such circumstances, or to take the train to the end of the run.

Judge Thomas G. Jones, of the United States District Court, at Birmingham, Ala., made permanent on March 28 the preliminary injunction issued last August directed against certain acts in the Alabama railroad law which sought to prevent the railroads from going to the federal courts for relief. All rate acts are also suspended by the injunction until the justice of the rates can be determined. The opinion followed the general lines of that given by Justice Peckham in the Minnesota and North Carolina cases.

The United States Supreme Court has decided in favor of the company what is known as the Meat Rate case of the Interstate Commerce Commission v. the Chicago Great Western, involving the right of the company to reduce the rate on live stock products without making a similar reduction in the rate on live stock. The Commission found that the change of the rate on one article without a corresponding change on the other was unlawful, but the court reversed this decision.

Judge Calhoun of the United States District Court at Austin, Tex., on March 28 rendered a decision ousting the Western Union Telegraph Co. from Texas and assessing against it back franchise tax fees amounting to $100,000. The question at issue was whether the company had a right to transact a telegraph business between Texas points without first having obtained a domestic charter or a foreign permit to do business in the state. The company is now prohibited from doing any interstate business in Texas, except that for the federal government.

The Ohio Railroad Commission has added another rule governing the loading and unloading of cars and free time. It provides that when a consignee shall elect to work on a fixed standard of receipts his business shall be rated as to daily capacity and thereafter if the cars consigned to him exceed the rating, he shall be charged each day with 1½ times his rated daily capacity, 48 hours being allowed for unloading each day's placing, actual and constructive. The ratings shall be done by the railroad and the consignee shall have the right of appeal to the Commission. All ratings shall be filed with the Commission.

Assistant Postmaster-General McCleary has given his decisions on the questions of fining railroads for delays in handling the mails and of compensation for the so-called "half car line" mail routes, where a car is only needed one way, and the government has hitherto adopted the practice of paying only half the usual compensation for the round trip. Mr. McCleary has decided that the long roads of the West and South shall be divided into divisions of from 200 to 400 miles, and the penalties for failure to observe the schedule shall be exacted on these shorter hauls rather than on the long, continuous route. As regards the "half car lines," the railroads are to be paid for hauling mail cars both ways whether the cars are in actual use both ways or not.

The Eureka Tape Repairer.

A convenient steel tape repairer is being put out by the Chicago Steel Tape Co., 6233 Cottage Grove avenue, Chicago. It is made of thin sheet metal, folded in the shape of a sleeve and coated inside with a combination solder and flux. The heat of a match is enough for soldering the sleeve to the broken ends, making a strong joint. The sleeves are made to fit any width and weight of tape and are very light, a dozen of them weighing less than half an ounce.

Traffic Club of New York.

At a meeting of the Traffic Club of New York on March 31 an address was delivered by Capt. J. W. Miller, Vice-President and General Manager of the New England Navigation Co., who after recalling incidents of his earlier experiences in the Navy, read a paper covering the general subject of Water Transportation. Mr. Miller showed how in the last 30 years the opportunities of the West had turned away the American people from maritime enterprise and predicted that the time has now come when the trend would be the other way and the merchant marine of the United States would be built up. He showed how in the course of development of the West by railroads, rebates and other discriminations had arisen, and pointed out that a new era in transportation is just beginning, in which fair methods must be used and tariffs must be made more simple and understandable.

New England Navigation Company's New York Terminals.

The New York terminals of the New Haven Line and the Bridgeport Line were moved on April 1 to Pier 28, East River, near Catherine street. The steamers of these lines formerly used Piers 19 and 20, East river.

New York City Street Railway Conditions.

Mr. Ivins shows, taking his facts from the petitions of the receivers to the Federal courts and to the State Board of Tax Commissioners, that in 1894 the whole number of revenue passengers carried in Manhattan was 236,012,000, of which 5,306,000 were transfer passengers. In 1902 the total number of passengers had risen to 382,268,000, and the transfer passengers to 134,963,000. In that year gross receipts from operation were $19,739,000. Five years later, for the year ending June 30, 1907, the number of revenue passengers had fallen to 376,629,000, and the number of transfer passengers (transfers required by law) had risen to 194,765,000. The gross receipts at the end of this five-year period had decreased $377,737, and operating cost had risen $1,234,000.

Anybody can see that this is the road to ruin. Yet the responsible men of the Metropolitan system were led to believe, and the people were led to believe, that the universal transfer was a public benefit justifying consolidation of the lines and a liberal policy toward them. The result shows that a corporation can be asked to give too much.

The relation of the special franchise tax to the difficult, and, as it has seemed, insoluble problem of the street railway situation, is made no less clear by Mr. Ivins' calculation of the operating account of the system based upon the receivers' figures. From gross income from all sources of $21,919,692, there are to be deducted operating expenses of $13,172,571, leaving a surplus for maintenance, wage increase, renewal, depreciation, taxes, interest and dividends of $8,747,121. After the deductions for maintenance, depreciation, wage increase, and taxes, exclusive of a special franchise tax, are made, there remains available for interest and dividends the sum of $3,605,743. On the carefully estimated cost of reproducing the system, which Mr. Ivins puts at $106,500,000, this gives only 3.4 per cent. return. There could, of course, be no possibility of any dividends on stock, and the city would lose the $900,000 of special franchise taxes for which no provision could be made.

Mr. Ivins dryly remarks that in these figures "the invitation to private capital is not irresistible." A private corporation would not, the city should not, undertake to carry on a street railway business in New York under conditions and requirements that make this showing inevitable. The private corporation that has hitherto operated the lines has paid rentals and dividends only by starving the maintenance account until the roads are physically as well as financially bankrupt. The franchise tax they have not paid at all. The city has no right to undertake a losing business. The carrying of street railway passengers is not a philanthropy.

The teaching of Mr. Ivins' analysis is precisely the teaching of our present deadlock in subway construction. The lesson the people must learn, though they will be most unwilling to learn it, is the lesson that they and their lawmakers, in seeking to make better terms for the public, have made unbearable and bankrupting terms for the corporations. The stock watering and misdeeds of Metropolitan management are not involved in the problem. Mr. Ivins takes no account of the $240,000,000 of outstanding capital—his estimate is based on production cost. Against the abolition of the general transfer there would be a loud public protest. Against the repeal of the special franchise tax the voices of its original sponsors and of thousands of agitators who have since that time become vocal would be raised. But if transfers are to be given under present conditions, and if the other requirements of the law as it now stands are to be enforced, either surface railway passengers must be carried by the city on a charity basis or they will not be carried at all.

Mr. Ivins deserves the thanks of the community for the opportunity he has given it to look the facts in the face. We regard his utterance as deeply significant, a notable indication of the turning of the tide.—*New York Times.*

Some New Scherzer Bridges.

The New York, New Haven & Hartford, on which several Scherzer rolling lift bridges are in service, is building a number of additional bridges of this type. These include a double-track bridge across the Seekonk river at Providence, R. I., and six-track bridges across the Bronx and Eastchester bay on the Harlem river branch of the New York division. The New York Central is building a double-track Scherzer bridge across Wappinger creek on the Eastern division, which will be ready for service in the near future. Double-track Scherzer bridges for the Lake Shore & Michigan Southern and Chicago, Lake Shore & Eastern railroads across East Chicago canal at Indiana Harbor, Ind., are building, and will be ready for service when the canal is opened. The Norfolk & Western has two double-track Scherzer bridges building across the Southern and Eastern branches of the Elizabeth river near Norfolk, Va., and a single-track bridge is being built for the Seaboard Air Line across Hillsboro bay, Tampa, Fla., as a part of the terminal improvements being made by the Seaboard at that point. Two single-track bridges of the Scherzer type are being built for the Norfolk & Southern across Albemarle sound as the movable spans in a long trestle being built to replace the present ferry service between Edonton and Mackay's Ferry. The double-track Scherzer bridge crossing Coney Island creek for the Brooklyn Rapid Transit system has been in service for several months, carrying the heavy traffic on that line. The single-track Scherzer bridge crossing Rainy river for the Duluth, Rainy Lake & Winnipeg and Canadian Northern railroads is expected to be ready within 30 days. Work is also being pushed on the long span double-track bridge for the San Pedro, Los Angeles & Salt Lake across the San Gabriel river at Long Beach, Cal.

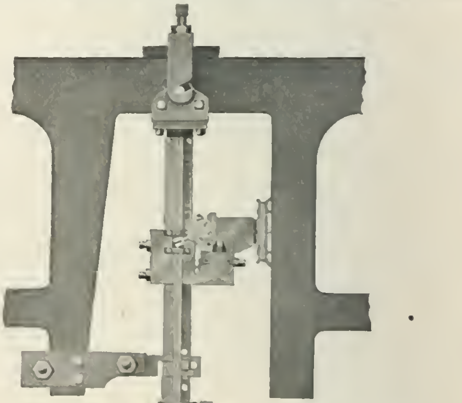
A number of Scherzer rolling lift bridges are being built for both British and Colonial railroad service. It is expected that the combination single-track railroad and highway bridge at Barrow-in-Furness, England, and the two double-track bridges for the Buenos Ayres Great Southern Railway at Buenos Ayres, Argentina, will soon be placed in service, and work is now being pushed on the long span bridge for the Burma Railways near Rangoon, India. Several bridges of the Scherzer type are in operation or under construction in Egypt, and the two railroad and highway bridges for the Tehuantepec Railway Company at Salina Cruz, Mexico, will be completed in the near future.

About fifty Scherzer bridges have been built for electric street railway and interurban service, nearly all being double or multiple track structures.

Facing Pedestal Legs of Locomotive Frames.

The illustration shows a machine for facing pedestal legs of locomotive frames. It is made by H. B. Underwood & Co., Philadelphia, Pa.

At the top of the squared bar is a steel swivel, so that the cutting tools can be placed to work on either leg. There is also a swivel to allow work to be done on the angular side of the shoe. The top of the swivel is a large surface which clamps firmly to the frame and is easily changed, so that the work can be done in narrow spaces. In one side of the squared vertical bar, or slide, for the milling head is a steel square thread feed screw. The milling head has a bronze



Machine for Facing Pedestal Legs of Locomotive Frames.

half nut, engaging the feed screw by a ratchet and pawl for change of feed. The feed is operated by an eccentric on the milling head, driving the vertical shaft. The milling head has two adjustments, to and from the leg and across the face, giving fine and quick adjustments without knocking or loosening any part. At the lower end, universal adjustable clamps hold the device rigidly to the frame.

Power is applied to gears turning the milling spindle. This is threaded to receive the milling cutters, which are made of squared high-speed steel and are removable for grinding and adjusting. Power reaches the gears through a telescopic shaft, having universal tumbling joints at each end. By using this flexible shafting the source of power may be placed in a convenient and out-of-the-way place, and belts are eliminated.

The machine removes a large quantity of metal quickly, making light cuts, but taking only a little time for each cut. The Underwood two-cylinder air or steam motor is recommended for driving this and other portable tools.

Heating and Ventilating the Storage Battery Stations on the New York Central & Hudson River.

In the electrification of the New York Central terminal at New York, an interesting problem was the heating and ventilation of the storage battery stations at Lexington avenue, Yonkers, King's Bridge and Bronx Park. The company installing the storage batteries was willing to guarantee them for 10 years, provided the temperature was maintained at 70 deg. F. This necessitated a heating plant for cold weather and a means of cooling in warm weather, as well as proper ventilation at all times.

Fig. 1—Battery Floor; Kings Bridge Sub-Station.

In charging the batteries, destructive acid fumes are thrown off, which precluded the possibility of heating by direct radiation, as the fumes would attack and destroy the radiators and pipe lines. The blower system was therefore adopted. The heating plant could thus be placed in a detached building, and the air ducts to the battery building are protected against the corrosive action of the acid fumes.

So far five stations have been equipped. The battery room, busbar chambers, corridors, stair halls, controller chambers, etc., are the portions heated and ventilated. The method used for heating and ventilating the King's Bridge sub-station is typical of all stations. The air is circulated through a sectional pipe heater by a steel plate fan driven by a belted motor. Steam is supplied by a small low-pressure boiler, located in an adjacent room. The hot air is distributed by suitable ducts to various points.


Fig. 2—Battery Floor, Looking East; Yonkers Power House.

Two methods of distribution are used. These are shown in the accompanying photographs. One is by carefully protected galvanized iron ducts, as shown in Figs. 1 and 2, this being used only at Yonkers. At the others there is no piping, the air being admitted at one end of the room through tile conduits terminating at registers made of 95 per cent. lead and 5 per cent. antimony. The results have been fully as satisfactory by this method as by distributing air by ducts with branches at frequent intervals. The advantage, so far as appearance is concerned, may be seen in Fig. 3. Furthermore, the ducts are costly to install and require frequent attention to keep them in condition to resist the acid fumes.

The heating system is compact, easily accessible and under control at all times. It is claimed to be moderate in cost, easily installed and economical both in operation and maintenance. It is also very flexible, it being possible to deliver the air at any temperature without diminishing the volume. Thorough ventilation for the battery rooms is therefore assured while the batteries are being charged.

The American Blower Co., Detroit, Mich., designed the systems and furnished the apparatus, which was installed by John Hankin & Brother, heating contractors, New York.


Fig. 3—Battery Floor, Looking West; Yonkers Power House.

American Iron & Steel Institute.

The American Iron & Steel Institute, formed mainly by United States Steel Corporation interests to afford a means of communication between members of the iron and steel trades, has been incorporated in New York. The Directors are: Elbert H. Gary, William E. Corey, Charles M. Schwab, E. O. S. Clarke, W. J. Filbert and John A. Topping, of New York; Howell Stackhouse and F. C. Felton, of Philadelphia, Pa.; Willis L. King, of Pittsburgh, Pa.; Edward Bailey, of Harrisburg, Pa.; J. C. Maben, of Birmingham, Ala.; W. O. Rogers, of Buffalo, N. Y.; J. F. Welborn, of Denver, Colo.; T. J. Drummond, of Montreal, Que., and Samuel Mather, of Cleveland, Ohio. The principal office is to be in New York.

A Newspaper Story.

At Homestead, Pa., Sunday afternoon the locomotive of a fast train tossed John Hastings over the roof of a (one-story) house and into the window of a shoe shop 40 ft. away. "He hadn't a broken bone, a bruise or a scratch," says the reporter. "He was conscious. Two bundles of laundry which he carried, one under each arm, were intact. He said he wanted to go home, and the doctor said he had no objection."

INTERSTATE COMMERCE COMMISSION RULINGS.

Rate on Cameras Upheld; on Motorcycles Reduced.

The Commission, opinion by Commissioner Prouty, has decided the case of Merchants Traffic Assoc. v. Atchison, Topeka & Santa Fe et al. The complaint was that the rates on cameras and camera stands from St. Louis, Mo., to Denver, Colo., and on bicycles and motorcycles are excessive. The Commission decided that while the rate on cameras and camera stands is high, it is not so excessive as to warrant interference; this branch of the complainant's case was not sustained. The rate applied on motorcycles from St. Louis to Denver was held to be excessive, and ordered to be reduced so as not to exceed the rate on bicycles between said points.

TRADE CATALOGUES.

Steam Shovel News.—The current number is a special spring number. The leading article is on "Testing High Explosives," by Waldon Fawcett. The tests referred to are those now being made by Dr. Charles E. Munroe for the United States Government. Other interesting articles are: "Transporting a Steam Shovel," describing the moving of a traction steam shovel through some heavily timbered and swamp country in Minnesota; "Steel Sheet Piling for Cofferdam Construction"; "Steam Shovel Work in the Klondike", "A Scow for Trench Shovel", "Stripping Ore Mines," and "Quarry Economy." There are also descriptions of some new boom and swing engines for heavy-duty shovels, and an electric shovel.

Waterproofing.—The Standard Asphalt & Rubber Co., Chicago, has prepared a pamphlet regarding its waterproofing for foundations and track elevation and other structures. The physical properties and the general method of application are first described, and this is followed by illustrated descriptions of a number of pieces of work done for railroads, large buildings, reservoirs, etc. There is also a list of similar work which has been done or is under way. Another pamphlet is a catalogue and price list of coatings and dips. An effort has been made in this to give a concise and true description of the materials and the work to which they are adapted. The book is 3⅝ in. by 6 in. and has 28 pages.

Signal Construction Materials and Lightning Arresters.—The signal department of The Railroad Supply Co., Chicago, has issued Sections 3 and 4 of Catalogue No. 7. Part 3 shows signal construction and maintenance materials, including battery chutes and receptacles, batteries and battery supplies, channel pins and bond wires, insulated joints and track insulations, insulated and line wires, and miscellaneous construction and maintenance materials. Part 4 shows various styles of lightning arresters, designed for both direct and alternating current. Various lightning arrester applications, ground plates, ground rods and water and fireproof boxes for arresters are included.

J. G. White & Co. have issued an exceedingly interesting pamphlet of 82 pages showing illustrations and brief comment upon their engineering work in every quarter of the world. The pamphlet includes a map on which 115 J. G. White contracts all over the globe are indicated by red dots. It is entitled "At Work Around the World."

London & North Western.—This company has issued a revised list of its picture post cards. There are now 55 sets of these cards, selling at 2d. per packet. Eight million cards have been sold.

Mine Equipment.—A circular issued by The Jeffrey Manufacturing Co., Columbus, Ohio, illustrates 14 of the Jeffrey specialties in mine equipment.

MANUFACTURING AND BUSINESS.

The offices and plant of the Gordon Battery Co. have been moved to Aldene-Roselle, N. J.

The offices of the General Contracting & Engineering Co., 15 Whitehall street, New York, will be moved on or about May 1 to the Hudson Terminal building, 50 Church street.

The receivership of the Westinghouse Machine Co., Pittsburgh, Pa., was vacated on March 31. The company now has no floating debt; it has a large number of orders and about $1,000,000 cash on hand.

Fred K. Potter, for many years connected with the Capell Fan Engineering Co., has been appointed Manager in the Pittsburgh district for the Sirocco Engineering Co., New York. Mr. Potter's office will be in the Keenan building, Pittsburgh, Pa.

The Railroad & Car Material Co., Bessemer building, Pittsburgh, Pa., was recently incorporated to deal in wholesale lumber, railroad equipment and supplies, including castings and forgings. The officers are: President, J. W. Scull, formerly Purchasing Agent of the Pressed Steel Car Co., Pittsburgh, Pa.; Vice-President, C. W. Cantrell, formerly Eastern Manager of the Herman H. Hettler Lumber Co., Chicago; and Secretary, W. H. Coyle.

The net profits of the Canadian Westinghouse Co., Ltd., Hamilton, Ont., for the year ended December 31, 1907, were $427,053, an increase of 23 per cent. Dividends of $215,221 were paid, $200,000 was reserved for depreciation, and $20,000 for inventory. The profit and loss balance carried forward was $391,284. At the end of the year the unfilled orders amounted to $1,136,000. The output of the air-brake department increased 35 per cent.

John C. Sesser, Engineer of Maintenance of Way of the Chicago, Burlington & Quincy at St. Louis, Mo., has resigned to go to the W. K. Kenly Co., Chicago, as Vice-President in charge of the railroad department. Mr. Sesser is a graduate of Lehigh University, having completed the engineering course in 1896. From that year until 1902 he was a construction engineer on the Chicago & North-Western, the Union Pacific and the Chicago, Milwaukee & St. Paul. From 1902 to 1903, he was Chief Engineer of the Au Sable & Northwestern, leaving that road to become Superintendent of Construction of the Burlington. In 1907 he was appointed to the office he now leaves. Mr. Sesser is a member of the Maintenance of Way Association and an associate member of the American Society of Civil Engineers. His new headquarters will be in the First National Bank building, Chicago.

The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., has an order from the Dominion Iron & Steel Company, Halifax, N. S. for a 500-h.p. electric generator, which will be used in the operation of one of the company's iron mines on Belle Island, Newfoundland. It is interesting to note that in one of the mining camps at Guanajuata, Mex., the Pinginco mines, 250 Westinghouse motors, ranging in capacity from 5 to 200 h.p., are being operated.

A new company is being formed to take over and continue the publication of Moody's Manual, heretofore published by The Moody Corporation, New York. The manual for 1908 is now ready for the press. Arrangements are being made to supplement the book with a monthly service, thus keeping the manual up-to-date throughout the year. The price of the manual, including this monthly service, will be $10, which has heretofore been the price of the book alone.

The joint convention of the American Supply & Machinery Manufacturers' Association, the National Supply & Machinery Dealers' Association and the Southern Supply & Machinery Dealers' Association will be held at Richmond, Va., May 13-15, 1908. William H. Taft, Secretary of War, is to address the three associations on Wednesday afternoon, May 13. F. D. Mitchell, 309 Broadway, New York, is Secretary-Treasurer of the first named association.

The Quincy, Manchester, Sargent Co., New York, recently closed a competition in which prizes were offered to men in charge of track work for the best answers to certain inquiries regarding the use of, and suggestions for, anti-rail creepers. The judges of awards were as follows: W. M. Mitchell, Manager and Chief Engineer, Kentucky & Indiana Bridge & Railroad, representing the railroads; O. Metcalf, Jr., American Railway Device Co., representing the selling interests of anti-rail creepers, and W. C. McMahon, President of the Belle City Malleable Iron Co., representing the manufacturers. There were 85 competitors, and prizes were given as follows: First prize, W. H. Kofmehl, Roadmaster, Chicago, Milwaukee & St. Paul, Elgin, Ill.; second prize, W. H. Hoyt, Assistant Chief Engineer, Duluth, Missabe & Northern, Duluth, Minn.; third prize, E. J. Boland, Roadmaster, Union Pacific, Cheyenne, Wyo.

John Albert Brill, Vice-President, Director, and one of the founders of the J. G. Brill Company, Philadelphia, Pa., died on March 25, after four years' sickness. The following sketch of his life has been prepared by James Rawle, his life-long friend and President of the Brill company:

Mr. Brill was born in Philadelphia on December 15, 1852, whither his parents had moved from Cassel, Germany, a few years before. Always studious as a lad he received a sound education. At the early age of seventeen his instinct of industry led him into the works upon which he has since stamped his strong individuality and to whose building up he gave the absolute love and devotion of his life. Endowed with great ability, in which keen insight was united with infinite perseverance, he brought to the work of his life the qualities of an inventor of the most valuable improvements in transportation facilities. These embraced nearly every feature of cars and trucks which go to make up the modern electric car. At the outset of his career he did with his whole soul the things which a boy could do—drove the engine, kept the accounts. Gradually he was advanced by the firm to more responsible positions and was soon placed in charge of the department of sales. In this his great abilities found their appropriate sphere. When, in 1887, electric propulsion developed, his genius developed with it, and the present types of electric trucks in universal use are practically those which he invented. He was in every sense of the word a pioneer. He led; others followed. He foresaw by instinct, and usually years in advance, the direction in which electric street railway practice must necessarily develop, and he devoted himself to the task of teaching the railway companies These high in their management

John A. Brill.

recognized his wisdom and sound judgment and constantly sought his advice—sooner or later they always followed it. In 1904 the Franklin Institute awarded him the John Scott legacy premium and medal for meritorious inventions in cars. He had a strong sense of justice, but resented bitterly any treatment which he considered unfair. It is sad to see a man so strong, so worthy and so useful, stricken down by the lingering pain of disease.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 26.)

The Traveling Engineers' Association.

At the next regular meeting of this association there will be a paper for discussion on the "Use of Steam Heat on Passenger Trains," and at the next annual meeting a paper on "How can Road Foreman of Engines interest Engineers and Firemen in keeping posted on progress in locomotive development including valve gears and steam distribution?"

American Society of Mechanical Engineers.

The semi-annual meeting of this society is to be held in Detroit, Mich., June 23-26. The papers to be presented at this meeting are as follows: Method of Cleaning Gas Conduits, by W. D. Mount; Method of Checking Conical Pistons for Stress, by Prof. George H. Shepard; Clutches, with special reference to automobile clutches, by H. Souther; Gas Power, by Prof. L. S. Marks; Journal Friction Measuring Machine, by Henry Hess, and A By-Product Coke Oven, by W. H. Blauvelt. There will also be a symposium upon machinery for conveying materials, with papers by several authorities. The Society for the promotion of Engineering Education will also hold its annual meeting in Detroit at this time, which will enable members of each society to participate in the sessions of the other.

Iron and Steel.

The Interborough Rapid Transit is in the market for about 1,000 tons of rails of standard section.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Railway Commission of Canada.—Judge J. P. Mabee, of the High Court of Justice of Ontario, has been appointed Chief Commissioner of the Canadian Railway Commission, succeeding A. C. Killam, deceased. Mr. Mabee in 1905 was Chairman of the International Waterways Commission. His appointment to the Railway Commission is for 10 years.

Operating Officers.

Canadian Northern.—A. E. Warren has been appointed Superintendent of the Second division, with headquarters at Winnipeg, having authority over all branch lines out of that city.

Chicago, Rock Island & Pacific.—J. C. Nolan, who resigned as Superintendent of the Louisiana division in October, has been elected President, with office at Ruston, La., of the Ruston, Natchitoches & Northeastern, projected from Ruston, La., north to Farmerville, 25 miles.

Gulf, Colorado & Santa Fe.—The jurisdiction of Oliver Snyder, Superintendent of the Galveston division, has been extended to include the Southern division. The two have been consolidated and are now operated as a single division. His headquarters will be transferred from Galveston, Tex., to Temple. K. S. Hull, Superintendent at Temple, is now Superintendent of the Texas & Gulf, with office at Longview, Tex., succeeding M T Pratt, who returns to the engineering department of the Atchison, Topeka & Santa Fe.

International & Great Northern.—H. W. Clarke, Second Vice-President and General Manager, has been appointed General Superintendent, with office at Palestine, Tex., in charge of the whole road, reporting to the Receiver. J. C. Dailey, General Superintendent, has been appointed Superintendent, with office at Palestine, Tex., reporting to the General Superintendent. The Division Superintendents, Superintendents of Machinery, Chief Engineer, Car Accountant and General Claim Agent will report to the Superintendent.

Louisville, Henderson & St. Louis.—Lucien J. Irwin, General Freight and Passenger Agent at Louisville, Ky., has been appointed General Superintendent, succeeding A. M. McCracken, retired.

New York, Chicago & St. Louis.—G. C. Todd, Trainmaster of the Buffalo division, has been appointed Joint Superintendent of Telegraph of the New York, Chicago & St. Louis and the Western Union Telegraph Company, with headquarters at Cleveland, Ohio, succeeding R. W. Mitchener. J. W. Cantlin has been appointed Trainmaster, with headquarters at Conneaut, Ohio, succeeding Mr. Todd.

Texas & Gulf.—See Gulf, Colorado & Santa Fe.

Traffic Officers.

Cleveland, Cincinnati, Chicago & St. Louis.—Charles Krotzenberger, General Agent of the passenger department at Cincinnati, has been appointed Assistant General Passenger Agent at St. Louis, Mo., succeeding C. L. Hilleary, now General Passenger Agent of the Lake Erie & Western. W. G. Knittle, General Agent of the passenger department at Toledo, Ohio, succeeds Mr. Krotzenberger, with headquarters at Cincinnati. W. F. Carter, Traveling Passenger Agent, with headquarters at Toledo, succeeds Mr. Knittle at Toledo.

Delaware, Lackawanna & Western.—F. P. Fox, Industrial and Advertising Agent, is to resign shortly to go into other business.

Kalamazoo, Lake Shore & Chicago.—W. H. Cochrane has been appointed General Traffic Manager, with headquarters at Chicago, Ill.

Lake Erie & Western.—C. L. Hilleary, Assistant General Passenger Agent at St. Louis of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed General Passenger Agent of the Lake Erie & Western, succeeding S. D. McLeish.

New York, New Haven & Hartford.—George L. Connor, Passenger Traffic Manager, and Artemus C. Kendall, General Passenger Agent, have both at their own request retired, the former after 40 years and the latter after 41 years of service. Mr Connor entered transportation service in August, 1868, as a clerk in the Treasurer's office of the Narragansett Steamship Co. (Bristol Line), between New York and Boston. In 1873 he was appointed Auditor of Passenger and Freight Receipts of that company, and in 1874 General Passenger Agent. After three months' service as General Passenger Agent he was appointed General Passenger Agent of the Old Colony Steamboat Co. (Fall River Line), a position which he held for 20 years. For six years of this time, beginning in 1887, he was also General Passenger and Ticket Agent of the Old Colony Railroad, until in 1893 it was absorbed by the New York, New Haven & Hartford. In 1893 he was also appointed Passenger Traffic Manager of the New York, New Haven & Hartford and shortly afterward of the Providence & Stonington Steamship Co., controlling the Sound lines to those ports. In June, 1894, his title was changed to Passenger Traffic Manager of the Old Colony Steamboat Co. On July 1, 1898, he was appointed Passenger Traffic Manager of the rail and Sound lines of the New York, New Haven & Hartford, including the New England Navigation Company, a position which he held until April 1, when he was placed on the retired list.

Mr. Kendall entered railroad service in 1861 on the Boston & Worcester, now part of the Boston & Albany, as ticket clerk at Brookline, Mass. In 1863 he was ticket clerk at Boston. In 1867 he went to the Boston, Hartford & Erie, now part of the New York, New Haven & Hartford. For three years he was Ticket Agent of this road at Boston, and for six years General Ticket Agent. In 1876 he became General Passenger and Ticket Agent of the New York & New England, now also part of the New York, New Haven & Hartford. In 1893 Mr Kendall became General Passenger Agent of the Eastern district of the New York, New Haven & Hartford, and on July 1 1905, General Passenger Agent of the entire road.

The office of Passenger Traffic Manager of both the New York, New Haven & Hartford and the New England Navigation Co. has been abolished. Mr. Kendall's successor as General Passenger Agent is A. B. Smith, with headquarters at Boston, Mass. Mr. Smith was born in Boston and entered railroad service in 1880 in the engineering department of the Burlington & Missouri River Railroad in Nebraska, now the western lines of the Chicago, Burlington & Quincy. After working in the engineering and operating departments he was appointed Assistant General Passenger Agent. In 1904 he went to the Northern Pacific as Assistant General Passenger Agent, and in 1907 came to the New Haven as General Traffic Manager of the Connecticut Company, which operates the extensive electric system in Connecticut of the New Haven. He has been promoted from this position to be General Passenger Agent of the New York, New Haven & Hartford and of the New England Navigation Co., in which latter position he succeeds F. C. Coley, who, besides being Assistant General Passenger Agent of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., becomes Assistant General Passenger Agent of the New England Navigation Co., with headquarters at New York

The authority of R. T. Haskins, Freight Traffic Manager of the New England Navigation Co., has been extended to represent the freight traffic interests of the N. Y., N. H. & H., at New York, including such special duties as may be assigned to him. Mr. Haskins will report to B. Campbell, Vice-President.

Pennsylvania Lines West.—M. S. Connelly, General Western and Division Agent, at Chicago, Ill., has been appointed General Freight Agent, with office at Pittsburgh, Pa., succeeding James B. Hill, deceased.

Southern Pacific.—John H. Glynn has been appointed New England Agent in charge of the passenger and freight departments, with headquarters at Boston, Mass., succeeding E. E. Currier, deceased.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—John C. Sesser, Engineer of Maintenance of Way at St. Louis, Mo., has resigned to become Vice-President of the W. K. Kenly Co., Chicago. See Manufacturing and Business.

Kansas City Southern.—F. R. Cooper has been appointed Superintendent of Machinery, with headquarters at Pittsburgh, Kan., succeeding R. M. Galbraith, resigned.

Purchasing Agents.

New York, New Haven & Hartford.—J. H. Sanford, Assistant Purchasing Agent, has been appointed Manager of Purchases and Supplies, with office at New Haven, Conn., succeeding A. E. Mitchell, resigned.

LOCOMOTIVE BUILDING.

The Lehigh & New England is said to be in the market for three locomotives. This item is not yet confirmed.

CAR BUILDING.

The Wisconsin & Northern is in the market for three passenger cars.

The Pittsburgh, Shawmut & Northern is asking bids on 1,000 coal cars.

The International Railway, Buffalo, N. Y., is said to be in the market for electric cars. This item is not yet confirmed.

The Third Avenue Railroad, New York, is said to be in the market for electric cars. This item is not yet confirmed.

The New York City Railway is said to be in the market for 150 pay-as-you-enter cars and 100 standard cars. This item is not yet confirmed.

The Oklahoma Railway Co., Oklahoma City, Okla., is said to be in the market for three interurban cars. This item is not yet confirmed.

The Lehigh & New England has ordered 250 forty-ton, all-steel gondola cars from the Cambria Steel Co., and 250 thirty-ton steel underframe box cars from the American Car & Foundry Co.

RAILROAD STRUCTURES.

Acapulco, Guerrero, Mex.—The Mexican government, it is said, has plans under way for harbor improvements here to cost several million dollars. The preliminary work includes a new wharf, for which contract has been let.

Brandon, Man.—Plans, it is said, are being made by the Canadian Northern to put up a new passenger station here.

Empalme, Sonora, Mex.—Work is now under way putting up reinforced concrete shops for the use of the Cananea, Yaqui River & Pacific and the Sonora division of the Southern Pacific here. It is said that over $1,000,000 gold is to be spent for general improvements. Plans call for the erection of 15 buildings, including a tie treating plant to have a capacity of 4,500 ties a day.

Mobridge, S. Dak.—The new steel bridge of the Chicago, Milwaukee & St. Paul, at this place, has been opened for traffic. It is said that the company will put up a new steel bridge at Chamberlain this year.

Port Bolivar.—The Santa Fe, it is said, has spent about $100,000 on improvements here, including a pier, and will spend about $100,000 more to finish the work. Port Bolivar, which is the deep water terminal of the Gulf & Interstate division of the Santa Fe, is five miles east of Galveston on the main land, is being developed into an important port by the Santa Fe. The Gulf & Interstate, which runs from Port Bolivar east to Beaumont, is also to be rehabilitated.

Pottsville, Pa.—The Pottsville Union Traction Co., it is said, will build a bridge at Mauch Chunk street.

St. Johns, N. B.—Bids, it is said, are wanted by William Downie, General Superintendent of the Atlantic division, Canadian Pacific, for the construction of concrete piers and arches for bridges at various points on the road.

Saskatoon, Sask.—The Grand Trunk Pacific and the Canadian Northern, it is said, will jointly put up a passenger station here.

Winnipeg, Man.—Bids are wanted April 15 by M. H. MacLeod, General Manager, Canadian Northern, Winnipeg, Man., for putting up a union passenger station, hotel and terminal shops, here, for the joint use of the Canadian Northern and the Grand Trunk Pacific. The estimated cost of the improvements is $3,250,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—Excavation work has been finished on the new double-track tunnel through Raton Mountain, near Raton, N. Mex., to be 5,000 ft. long through solid rock, and 144 ft. below the existing tunnel, and the bore is being cemented. It is expected to have the tunnel in service in July. The Lantry Construction Co., of Kansas City, Mo., contractors. (March 13, p. 389.)

Birmingham & Gulf Railway & Navigation Co.—Incorporated last year in Alabama with $10,000,000 capital, to build an electric line from Tuscaloosa, Ala., northeast via Birmingham to Gadsden, about 120 miles; also to operate a line of steamers and coal barges between Tuscaloosa, Mobile and Gulf points, and Montgomery and Mobile. The company has bought the Tuscaloosa Belt Railway, a 12 mile belt line at Tuscaloosa, which is being electrified. Work is now under way on the 120 miles between Tuscaloosa & Gadsden. Henry S. Thompson, President, New York; J. A. Vandergrift, General Manager, Tuscaloosa.

Canadian Northern.—The city authorities at Winnipeg, Man., it is said, will compel this company to construct a concrete subway under Water street.

Canadian Pacific.—This company, it is said, has given a contract to Janse & MacDonald, of Maple Creek, Sask., to build a new line on the north side of the river from Lethbridge, Alb., west to McCloud, about 36 miles. The old line south of the river which has steep grades, it is said, is to be abandoned. Work is now under way on a large bridge over the Lethbridge river for the new line.

Canadian River Railroad.—See Santa Fe, Liberal & Englewood.

Chicago, Milwaukee & St. Paul.—This company is reported to be ballasting and relaying its extension from Mitchell, S. Dak., to Rapid City, the track from the Missouri west, having been originally laid on a gumbo roadbed, making it almost impossible to operate in wet weather.

Durango & Sombrerete.—Surveys are reported made by this company for a proposed line, from Durango, Durango, Mex., southeast to Sombrerete, Zacatecas, about 100 miles. It is said contracts for building the line will shortly be let. Mining interests of Sombrerete are promoting the line to provide an outlet for the ores from that section.

Grand Trunk Pacific.—Contracts for building 365 miles additional in New Brunswick, Quebec and Ontario, was recently let by the National Transcontinental Railway Commission as follows:

(1) District A. New Brunswick, from a point 58 miles west of Moncton to the crossing of the Intercolonial Railway, 39.7 miles. Grand Trunk Pacific Construction Co.

(2) From last named point to the Tobique river, N. B., 67 miles. Grand Trunk Pacific.

(3) From the last named point to $2\frac{1}{2}$ miles west of Grand Falls, N. B., 31.5 miles. Willard Kitchen Co., Ltd., Fredericton, N. B.

(4) From boundary line between Quebec and New Brunswick west, 52.9 miles. M. P. & J. T. Davis.

(5) From west of Abitibi river crossing, Ontario, west 100 miles. E. F. & G. E. Farquler, Ottawa.

(6) From about $19\frac{1}{2}$ miles west of the crossing of Mud river, near Lake Nepigon, east, 75 miles. E. F. & G. E. Farquler, Ottawa. (Mar. 20, p. 429.)

Foley, Welch & Stewart, who have the contract for building 126 miles from a point six miles east of Edmonton, Alb., west, have sublet some of the work as follows: Chas. Lawrence, six miles; D. Fitzgerald, 12 miles; John Timothy, eight miles, James O'Connor, 11 miles; Fitzgerald & Tompkins, five miles; F. Mann, three miles, and MacDonald & McAllister, 10 miles. Additional sub-contracts will shortly be let by H. J. Fetter, of Edmonton, Alb.

Great American.—Incorporated in South Dakota, with a capital of $15,000,000, by Wisconsin capitalists and nominal headquarters at Pierre, and office at Chicago, and at Lancaster, Wis. The proposed route is from Chicago, Ill., northwest to Winnipeg, thence west to

Medicine Hat, Alberta. The incorporators include A. J. Hyde, Thomas T. Orton, J. C. Brockert, H. L. Moses, Lancaster, Wis., and I. W. Goodner, Pierre, S. Dak.

Illinois Central.—It is announced that regular through freight traffic over the Birmingham extension will be begun on April 19.

Interlake Railroad.—Incorporated in Illinois to build a line from a point on Lake Michigan, in Cook county, Ill., northwest to Fox Lake, in Lake county, about 30 miles. The incorporators include Otto Heper, M. F. Smith, G. S. Melcher, G. H. Coney and F. A. Stuckman.

Lake Shore & Michigan Southern.—On the extension of the Pittsburgh & Lake Erie, from Youngstown, Ohio, to Lake Erie, contract was let last year by the Lake Erie & Pittsburgh to the Carter Construction Co., to build from Mill Creek Junction, near Cleveland, southeast to Kent, 26 miles. Grading and bridge construction will soon be finished. Track laying is to be started early in May and the line from Mill Creek Junction to Kent will probably be ready for operation this fall.

Manistee & North-Eastern.—Surveys are being made by this company for an extension of its eastern branch from Wexford, Mich., northeast toward Alpena.

Mexican International.—Contract is reported let to B. Corrigan, of Monterey, Mex., for building a branch coal line through the Cloete coal fields in the state of Coahuila, connecting with the main line at Sabinas. The contract also calls for building a large bridge over the Santiago Papasquiero river, on the Tepehuanes division.

Mexican Roads.—A system of railroads about 200 miles long, it is said will be built in the state of Zacatecas, Mexico, to connect the various mining districts. The state government has granted a subsidy of $2,000 per kilometer and the right of way across the public lands has also been donated. American Smelting interests headed by R. S. Towne, are reported back of the project.

New York Subways.—The New York Public Service Commission, First district, will begin advertising for bids for building the Fourth avenue subway in Brooklyn April 6. Construction of this subway was approved by the Board of Estimate on March 27. It is to run from the Brooklyn end of the Manhattan bridge under the Flatbush avenue extension to Fulton street, thence to Ashland place, thence to Fourth avenue and under Fourth avenue as far as Forty third street, Brooklyn. The work is divided into six sections and separate contracts will be let for each section. Nothing will prevent one contractor from bidding on all six sections. The estimated cost for the six sections is about $15,000,000. Comptroller Metz opposed the resolution on the ground that the city's finances were not in condition to build the entire subway at the present time, and announces that he will refuse certification of contractors' checks accompanying bids so as to bring the matter into the courts. (March 13, p. 393.)

Northern Dakota.—An officer writes that bids are wanted April 15 for building this proposed line from Edinburg, N. Dak., on the Great Northern, north to a point near Hallson in Pembina county, thence northwest to a terminal not yet named on the Canadian boundary, in Cavalier county, about 21 miles. The work includes a 300-ft. pile trestle. Thos. D. Campbell, President and General Manager; C. H. McFarlane, Chief Engineer, Grand Forks, N. Dak. (March 13, p. 393.)

Rome & Osceola.—This company is to be incorporated to build from Rome, Oneida county, N. Y., north to Osceola, Lewis county, 25 miles. The names of the incorporators are not given.

San Diego & Arizona.—This company, which has some surveys made for its proposed line from San Diego, Cal., east to Yuma, Ariz., 200 miles, and a small amount of grading finished near San Diego, is being promoted by John D. Spreckles, of San Francisco. A concession, it is said, has been asked for by the same interests from the Mexican government to build south on the peninsula of Lower California to Magdalena bay, thence across the peninsula to the port of La Paz. It is proposed to build a line about 700 miles long.

San Juan, Taviche & Oaxaca.—This company is now owned by the Consolidated Metals Co., with headquarters at Oaxaca. It is said that the new owners have given contracts for an extension to the Taviche mining camp, in the state of Oaxaca.

Santa Fe, Liberal & Englewood.—An officer writes that work is under way at various points building this line from Des Moines, N. Mex., east via Hooker to Woodward, Okla., with a branch from Gate, Okla., northeast to Englewood, Kan., a total of 321 miles. The Canadian River Railroad, building from the proposed terminus at Woodward, southeast to Watonga, from which place there are to be two branches, one east to Guthrie and the other southeast to Oklahoma City, is to form part of this line. Very little construction work has been finished on this line.

York (Pennsylvania) Railway (Electric).—This company recently opened for traffic its new line from York Pa. southwest to Hanover, 18½ miles. Plans are reported underway for an extension from York to Harrisburg.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—A semi-annual dividend of 2½ per cent. was on April 1 declared on the common stock. This is at the annual rate of 5 per cent., which is a reduction from the 6 per cent. rate, which has been paid for one year. Before April, 1907, the rate was 5 per cent., and from 1902 to 1905, 4 per cent. The first payment on the common stock was made in 1901, when a dividend of 3½ per cent. was paid.

Gross earnings for February decreased 9 per cent. as compared with February, 1907. Net earnings decreased 5½ per cent. There were 166 more miles operated in 1908 than in the previous year.

Birmingham & Gulf Railway & Navigation Co.—This company has bought the 12 miles of belt railroad, formerly owned by the Tuscaloosa Belt Railway, at Tuscaloosa, Ala. This is now being electrified and contracts have been let for a 120-mile extension to Gadsden. George D. Rogers, 12 Broadway, New York, is Secretary and Treasury. (See Railroad Construction column.)

Chicago, Cincinnati & Louisville.—The receiver has applied to the United States Court for permission to issue $1,500,000 receivers' certificates. He says that the road has never been fully completed or equipped. It needs to be reballasted, side tracks must be put in at Cincinnati and other points, the freight-house at Cincinnati must be enlarged, an overhead crossing must be built at the Big Four tracks to avoid threatened suit, an additional telegraph wire from Cincinnati to Chicago must be strung, a roundhouse and other improvements must be made at the Peru shops, a station must be built at Hammond, a station should be built at Converse, coaling stations should be put in at Richmond and at Brighton and other improvements must be made. About $500,000 to $600,000 would cover the foregoing. Furthermore, though a good passenger business is done at night between Cincinnati and Chicago in Pullman cars, the day business is bad because of the poor day coaches; $100,000 should be spent for parlor cars, café cars and day coaches. Not less than $300,000 to $400,000 worth of freight cars are also needed. There are charges against the road by other roads for handling C., C. & L. cars, which, if not paid, will result in the company's being shut off from communication with other roads. There are claims for labor, material and supplies. The receiver thinks that by using $1,500,000 it will be possible to earn not only operating expenses, but enough to meet all fixed charges and so increase the value of the property that when finally sold a price more than $1,500,000 greater than could now be obtained will be received.

Chicago Great Western.—Gross earnings for the six months ended December 31, 1907, decreased 9 per cent., as compared with 1906. Net earnings were $817,000, against $1,500,000 in 1906, a decrease of 45 per cent. There was a deficit of $360,000 after paying interest on the debenture stock and all prior charges, as against a surplus of $520,000 in 1906. Cash on deposit on December 31, 1907, amounted to $2,256, while the company's bank account had been overdrawn $109,715.

Chicago Junction Railway.—See Indiana Harbor Belt.

Chicago Union Traction.—The preferred stock has been assessed $3⅓ a share and the common stock $1 a share, payable on or before May 1, 1908. The present plan of reorganization involves cutting down the $12,000,000 preferred stock to $6,000,000 and the $20,000,000 common stock to $5,000,000.

Colorado & Southern.—Gross earnings for February were $1,083,000, against $1,027,000 in February, 1907. Net earnings were $330,000, against $314,000 in 1907. Owing to an increase of $16,700 in the interest charges, there was a decrease of $1,366 in surplus after charges.

Delaware & Hudson.—This company owns all but one share of the $1,000,000 common stock of the New York & Canada Railroad. This one share has recently been bought by Vice-President W. H. Williams for a price said to be $1,500. The Delaware & Hudson is now asking from the Public Service Commission, Second District, authority to acquire this remaining one share and to absorb the New York & Canada. The New York & Canada runs along the west side of Lake Champlain from Whitehall, N. Y., to Rouses Point, and forms a part of the Delaware & Hudson's through line to the Adirondack mountains and Montreal.

Denver & Rio Grande.—Gross earnings for February were $1,2[illegible], against $1,500,000 in 1907. Net earnings after taxes were $377,000, against $417,000 in 1907. For the eight months ended February 29 net earnings after taxes were $4,69[illegible] in 1908, against $4,636,000 in 1907.

Erie.—This company has been authorized by the Public Service Commission, Second District, to issue $15,000,000 notes dated April 1, 1908, and payable on or before July 1, 1913, secured by general lien 4 per cent. bonds to the amount of $9,157,000 and Pennsylvania collateral 4 per cent. bonds not exceeding $750,000, as collateral. These notes have not, so far as is known, been sold, although the Erie has $5,500,000 discount notes maturing on April 8, besides other pressing obligations.

Grand Trunk Pacific.—The Transcontinental Railway Commission is to buy the Temiscouta Railway for use as part of the line from Moncton, N. B., via Quebec, to Winnipeg, Man., 1,800 miles. The Temiscouta Railway runs from Riviere du Loup via Edmundston Junction to Connors, 113 miles. Only the line from Riviere du Loup to Edmundston Junction, 81 miles, will probably be used as part of the through line.

Great Northern.—The following controlled companies are now owned directly by the Great Northern:

St. Paul, Minneapolis & Manitoba	Montana & Great Northern
Eastern Railway of Minnesota	Billings & Northern
Willmar & Sioux Falls	Spokane Falls & Northern
Park Rapids & Leech Lake	Columbia & Red Mountain
Minnesota & Great Northern	Washington & Great Northern
Duluth, Watertown & Pacific	Seattle & Montana
Dakota & Great Northern	Minneapolis Union
Montana Central	

Gulf & Ship Island.—Net earnings for February were $16,000, against $65,000 in 1907, a decrease of 75 per cent.

Indiana Harbor Belt.—The report of the Chicago Junction Railway for the year ended December 31, 1907, has the following statement in regard to the sale of the outer belt line of the Chicago Junction to the Indiana Harbor Belt:

> That part of the railroad of the Chicago Junction Railway known as the "outer belt," which is the railroad originally belonging to the old Chicago, Hammond & Western, has been sold under the terms of contract dated June 29, 1907, between the Chicago Junction Railway and the Indiana Harbor Belt Railroad, the Lake Shore & Michigan Southern and the Michigan Central. The consideration received consisted of $2,500,000 bonds issued by the Indiana Harbor Belt Railroad. These bonds bear interest at the rate of 2 per cent. per annum for the first five years, 3 per cent. per annum for the second five years, and 4 per cent. per annum thereafter, and the principal is payable July 1, 1957. The bonds are guaranteed as to principal and interest by the Lake Shore & Michigan Southern and the Michigan Central. The so-called "outer belt" was subject to a mortgage executed by the old Chicago, Hammond & Western, to secure an outstanding issue of $2,500,000 6 per cent. bonds, and connected with it were contracts with other railroads which involved constant expenditures for increased trackage and facilities. This mortgage and indebtedness and the performance of these contracts were assumed by the purchasers. As the property would require the immediate expenditure of large sums for necessary betterments and improvements, and increased facilities, the sale upon the terms stated was considered highly advantageous to the Chicago Junction Railway. The result has been to relieve it from liability for the payment of the $2,500,000 of existing bonds and the fixed charge of $150,000 per annum, as well as from the necessity of providing large sums for improvements and for additional trackage under existing contracts.—(Nov. 15, 1907, p. 666.)

Leavenworth, Kansas & Western.—See Union Pacific.

Lehigh Valley.—Gross earnings for February were 10 per cent. less than in February, 1907, and net earnings 50 per cent. less. This is the worst showing which the road has made in any month of the present depression.

Louisiana & Arkansas.—Net earnings for February were 50 per cent. less than in 1907.

Metropolitan Street Railway.—See New York City Railway.

National Railways of Mexico.—On March 28 the public deed of incorporation of the new company, in which are to be merged the Mexican Central, the National of Mexico and other railroads controlled by the Mexican government, was signed by 23 incorporators, headed by Minister of Finance Limantour. (March 6, 1908, p. 330.)

New York City Railway.—Messrs. Joline & Robinson, as receivers of the Metropolitan Street Railway, has been authorized by the United States Circuit Court to issue $3,500,000 one-year 6 per cent. receivers' certificates, no part of whose proceeds may be used except in the improvement, acquisition and maintenance of the property. (March 20, 1908, p. 430.)

Kuhn, Loeb & Co. offer to pay the semi-annual interest coupon, due April 1, 1908, on those of the 4 per cent. refunding 100-year mortgage bonds of the Metropolitan Street Railway, which have been deposited subject to the bondholders' agreement, prior to May 15, 1908. This same firm took similar action in regard to the coupons defaulted January 1 on the 4 per cent. bonds of the Third Avenue Railroad.

Pacific Coast Company.—A quarterly dividend of $1\frac{1}{4}$ per cent. has been declared each on the second preferred and the common stock, making an annual rate on each of 5 per cent., instead of 6 per cent. annually, which has been paid since 1905 on each of these classes of stock. The Pacific Coast Company operates five steamship lines along the Pacific coast from Nome, Alaska, to Mexico, and also owns the Columbia & Puget Sound Railroad, about 50 miles, and the Pacific Coast Railway, with 80 miles of narrow gage line.

Pennsylvania.—Gross earnings of the Lines East, directly operated, decreased 14 per cent. in February, 1908, as compared with February, 1907. Net earnings decreased 17 per cent. For the two months ended February 29 gross decreased 15 per cent. and net 20 per cent.

Shipments of bituminous coal originating on the Pennsylvania Railroad Company's Lines East of Pittsburgh and Erie for the three months from Dec. 31, 1907, to March 28, 1908, were 8,093,033 tons, against 9,196,623 tons in 1907, a decrease of 12 per cent. The coke shipments were 1,718,252 tons, against 3,433,088 tons in 1907, a decrease of 50 per cent.

Philippine Railway.—This company controls the projected railroads on the Philippine Islands other than Luzon, the lines on that island being controlled by the Manila Railway. The Philippine Railway has 10 miles in operation on the island of Cebu and 20 miles more on that island under construction. On the island of Panay, 40 miles are under construction. Its contract with the Philippine government calls for the construction of a total of 95 miles on Cebu, 100 miles on Panay and 100 miles on Negros. The New York Stock Exchange has recently listed $1,500,000 first mortgage 4 per cent. 30-year bonds of 1937, guaranteed by the Philippine government, and has authorized the listing prior to July 1, 1908, of $1,000,000 additional of these bonds.

Reading Company.—Gross earnings of the Philadelphia & Reading in February were $2,600,000, against $3,100,000 in 1907. Net earnings were $770,000, against $889,000 in 1907.

Rock Island Company.—It is reported that plans are under way for the separation of the Chicago, Rock Island & Pacific, the Choctaw, Oklahoma & Gulf, which is the Choctaw division of the Chicago, Rock Island & Pacific, and the St. Louis & San Francisco. Strong protest against the present close combination between these roads has been made by the state authorities of Oklahoma.

Southern.—Gross earnings for February were 16 per cent. less than in 1907. Net earnings decreased 9 per cent. Taxes increased 18 per cent. and net earnings after taxes decreased 15 per cent.

Temiscouta Railway.—See Grand Trunk Pacific.

Texas Southern.—The foreclosure sale of this road, often advertised and postponed, is now set for May 5; the upset price, $375,000. The road, which runs from Winnsboro to Marshall, 74 miles, with four short branches, making a total operated mileage of 109 miles, is said to be in a chaotic state.

Third Avenue Railroad.—Frederick W. Whitridge, Receiver of the Third Avenue Railroad, and of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway, has been appointed by Judge Lacombe, of the United States Circuit Court, Receiver of the Union Railway, one of the subsidiaries of the Third Avenue Railroad. The Union Railway operates street railways in the borough of the Bronx, New York City.

Tuscaloosa Belt.—See Birmingham & Gulf Railway & Navigation Co.

Union Pacific.—A special meeting of the stockholders will be held on May 5 to ratify the taking over of the physical properties of the Leavenworth, Kansas & Western, which runs from Leavenworth, Kan., to Miltonvale, 166 miles, and has been operated separately, although all of its stock is owned by the Union Pacific; and of the Topeka & Northwestern, which is a cut-off from Menoken, Kan., to Onaga, with an extension under construction to Marysville, in all 69 miles. This cut-off is to connect Kansas City with the main line in Nebraska. The stockholders are also to authorize an issue of bonds on the (about) 1,650 miles of line of the Union Pacific now mortgaged, including the two railroads already named. This bond issue will probably be about $50,000,000, secured by a first mortgage on these lines.

The directors of the Union Pacific have denied the request of certain stockholders that they should sue E. H. Harriman, H. H. Rogers and James Stillman, directors, for personal profits alleged to have been made by them in the sale of stocks held by them to the Union Pacific, and have made the statement that the ownership of the three directors named in certain of the stocks bought during the latter half of 1906 was known to the Board, and that these directors were excused from voting on the matter of purchase, furthermore, that so far as is known by the Board, and it is so informed by Kuhn, Loeb & Co., none of these directors had any ownership in the 105,000 shares of the Illinois Central stock purchased by the Union Pacific from that firm.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

OFFICERS:

W. H. BOARDMAN, *Prest. and Editor*
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RAY MORRIS, *Secretary*
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CHARLES H. FRY
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BRADFORD BOARDMAN

CONTENTS

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We print in another column a full abstract of the address recently delivered by Arthur Hale to a committee of the Massachusetts legislature opposing a reciprocal demurrage bill. Mr. Hale is always worth listening to, and when he talks about car service he has a way of expressing rather more clearly than anybody else a lot of principles that the average operating man understands but has never really thought out or formulated in his own mind, and that the average state legislator does not understand at all. What Mr. Hale had to say, reduced to its shortest and most impolite terms, was that reciprocal demurrage is not reciprocal, that it is an unfair and unwise principle and that New England has too many detention privileges already; but he put these plain truths in so amiable and convincing a fashion that it must have dispelled any illusions that existed in the minds of his hearers about this rather illusive subject. We are printing a good deal of Mr. Hale's address because we want it to be read in states that need it even more than Massachusetts does.

Although the electric motor is the ideal means for moving draw spans which must be turned by power, an examination of existing practice indicates that its adaptation to the work has not been well understood in the past. For example, a 250-ft. double track swing span weighing 600 tons is equipped with two 50-h.p. railway type motors. The maximum effort required of these motors, according to the ammeter readings, is about 45 h.p. In another case a 350-ft. double track swing span having twice the weight of the first, or 1,200 tons, is to be equipped with two 25-h.p. motors. A third case, a proposed 480-ft. double track span of 1,800 tons, is to have two 40-h.p. motors—three times the weight with four-fifths the power of the first. In the first instance the power provided obviously is excessive. What of the other two, which agree pretty closely? The greatest resistance to overcome in such service is the inertia of the span. Some recent experiments have shown that when the average angular velocity is approximately 1 deg. per second, about 80 per cent. of the effort of the motor is used in accelerating the motion of the span. This requires a large torque at starting and a uniform accelerating effort, conditions that are best met by the characteristics of the direct current series motor. In determining the design and capacity of the motor both the character of service and the maximum requirements are governing conditions, and it is here that advantage may be taken of a peculiar quality in electric motors to secure the most economical installation possible. An electric motor properly designed is capable of sustaining a considerable overload for a short period of time without injurious heating. Therefore where a motor is loaded intermittently and for short periods, with intervals of rest between, it can be made to do work considerably in excess of its normal rated capacity. Furthermore, it may be specially designed for this intermittent loading and therefore be even better adapted to the work than a motor designed for continuous duty. The duty of a drawbridge motor is unique in that the working period covers only a few seconds of time and the cycles of operations may be separated by long periods of rest. For illustration, take the 250-ft., 600-ton span mentioned above. Assume it must be turned 90 deg. in 60 seconds. The demand on the motor is for 45 h.p., increasing from zero to a maximum at the end of 40 sec., say. Assume a rest period of 15 min. At 500 volts the maximum current used is 67 amperes. It can be shown that the equivalent heating effect of this current applied for 40 sec., followed by a period of rest of 900 sec., would be produced by a current of 14 amps., or about 10 h.p. at 500 volts, if continuously applied. Obviously, therefore, even one motor having a continuous capacity of 45 h.p. is too large for the service. What is required is a motor rated on its intermittent capacity of the full horse-power at full voltage for such a length of time as will produce the requisite temperature rise in service.

The "Bureau for the Safe Transportation of Explosives and Other Dangerous Articles" has been in operation since June 10, 1907. The report of Major B. W. Dunn of the United States Army who is Chief Inspector, covering the work of the Bureau up to February 1, 1908, is summarized in another column. This association is a splendid example of the way in which necessary and important results, which it has been proved by bitter experience it would be impossible to get by individual initiative, can be successfully brought about by intelligent co-operation. After the disastrous wreck in 1905 on the Pennsylvania Railroad near Harrisburg, Pa. caused by the explosion of a freight car loaded with high explosives, the Pennsylvania tried for two years through its own special inspectors to secure conformity to the revised rules of the American Railway Association for the transportation of explosives which had been amended as a result of this disaster. This company was successful in carrying out these regulations on its own lines; nevertheless only a small proportion of the dangers from explosives were guarded against, because this one railroad company was powerless to enforce these regulations on connecting lines from which dangerous cars were constantly being received. President McCrea, of the Pennsylvania, was the leading spirit in the formation of the Bureau of Explosives, being chairman of the committee which drew up its constitution and by-laws. The bureau includes such members of the American Railway Association as choose to become members. Expenses are proportioned according to: (a) mileage; (b) gross earnings; (c) number of factories on each line where explosives are made. Its regulations for transportation of explosives were published in the *Railroad Gazette* of November 8, 1907. There are at present 91 railroad companies operating 149,669 miles of railroad which are members. The Baltimore & Ohio, the Chicago, Milwaukee & St. Paul, the Great Northern and the Northern Pacific are large roads which have not yet joined the Bureau. This mileage of nearly 150,000 miles is distributed among 17 local inspectors whose mileage runs from the 4,000 miles in the Indianapolis district to the 23,000 miles in the Kansas City district. The most striking results of the inspections can be summed up in three items from the summary: During the less than eight months covered by the report, the inspectors found 119 magazines with dirty floors stained with nitro-glycerine and 59 magazines with high explosives stored in them in a leaking and dangerous condition. Out of 178 cars inspected in transit or at terminals, the lading in 99 had moved because of improper loading or staying or other conditions such as would easily bring about a dangerous accident. One of these cars, which had cracks in the roof, sides and ends, contained over two tons of dynamite. Light material had been used to brace these packages and the bracing had given way, allowing the packages to slide about the car. As if this were not enough, loose iron pipe and a roll of wire cable in an upright position were loaded in the same car. The car was placarded for explosives on one side only. Here were conditions ripe for a terrible and costly accident. Based on experiences such as these, the fact that in spite of all that has been accomplished only 41 of the 94 railroads which are members of the Bureau had on February 1, received either a "first general inspection" or a "partial inspection," and the further fact that the Bureau is about to issue regulations for transportation of inflammables whose traffic volume is many times that of explosives, Major Dunn makes a strong plea for more inspectors. In his words, "the Bureau has undertaken a work of unsuspected magnitude." Great good has already been accomplished, actually and potentially. The Bureau must either go forward or backward; at the present stage of its development it cannot stand still. More funds are necessary if it is to do its now evident duty. The present is, of course, a difficult time to secure larger appropriations from railroads, but Major Dunn points out that the total of the known losses from the six major accidents from explosives and one large fire from a shipment of inflammable liquid, shown in the records of the Bureau for 1907, was over $500,000 and even this does not represent by any means the total loss. If such losses are to be prevented in future the Bureau must be upheld in its work.

THE REASON FOR THE STEEL WHEEL.

It is a peculiarity of American railroad rolling stock that there is a roughness of finish and a crudeness of connection, not only between stationary parts, but also between parts that have some motion, the one over the other, that is not to be found in cars built in other countries. The reason for this is not hard to find. America was a great, undeveloped, sparsely settled country and the railroad, as a rapid means of intercommunication, was an absolute necessity for the upbuilding of the nation. In order to meet this demand, construction was carried on with great rapidity and pushed through territory where the immediate traffic in sight was very meagre. Consequently the first cost of roadbed and equipment was cut down to the lowest notch that made operation a possibility and so cast iron was substituted for forgings and rough metal for finished parts. Therefore, while the foreign car builder turned to wrought iron for the centers and early tires of his wheels, the American, being in possession of a very superior grade of cast iron that was not only exceedingly strong, but capable of being chilled to great hardness in the mould, used that metal for his wheels with great success under both passenger and freight cars.

Throughout all the middle years of the nineteenth century, cast iron was the only metal used for car wheels in the United States, and during the whole of this period makers were constantly experimenting with mixtures of metals and forms of patterns in order to produce a wheel that would possess some quality that would make it superior to its rivals. The records of the patent office are replete with the work of the designers in this direction. The result of this concentration of energy was the production of a wheel that took a high rank in the records of the time for durability and safety and was known as the charcoal iron wheel. Such a wheel was usually formed of about 85 per cent. of charcoal iron pig and 15 per cent of the scrap iron resulting from this mixture, melted with the old companies' Lehigh coal, and was possessed of a chilled tread of great hardness and durability.

Meanwhile there had been no uniformity of practice in the form of the tread and flange, and other parts of the wheel. Each maker or purchaser had been a law unto himself, with the result that great variations of practice existed in different sections of the country and upon different roads in all of the details of wheel construction. Under the conditions existing at the time, this was a matter of comparatively small importance. The individual railroads were almost isolated, there was a diversity of gages, and interchange of traffic was so small that it was not until after the organization of the Master Car Builders' Association that any systematic effort was made to introduce a uniformity of practice into car wheel construction.

That association originated in a meeting of master car builders brought together to consider the conditions set up by the running of line cars over their respective roads and the rules under which such an interchange of traffic should be carried on. It was quite natural then that the wheel should be among those details that should receive early attention. It was necessary that it should run over tracks that differed slightly in gage; that were laid with rails of widely different pattern, with still wider variation in the methods of track laying and permanent way construction. It was necessary that the tread and flange of the wheel should be so proportioned that it could run over these different conditions of track with ease and safety, and further that the wheel should be of such diameter that the height of the cars and their couplers might be brought approximately to a uniform distance above the rail, a condition that was not realized, however, until many years afterwards.

At the meeting of 1868 an agreement was reached, regarding the width of the compromise tread, and thereafter there was considerable private discussion as to the desirability of a standard tread and flange, but it was not until 1882 that the subject was really brought before the association for action. At that time an agreement was reached regarding the width over all, as well as the diameter and the machinery was set to work to secure a standard form. The next year forms for tread and flange were proposed and these were almost identical with those that were afterwards adopted. In 1884 M. N. Forney read an elaborate paper on the relation of the wheel to the rail, and at the next convention in 1885, a contour was submitted for adoption as a standard, but was rejected as that of 1883 had been. In 1886 another form was submitted in which the tread was made slightly conical instead of cylindrical as in the case of the one presented in 1885, and this was adopted as a standard and has remained such until the present time.

In 1906, it was modified and the modification adopted as recommended practice by the addition of ¼ in. to the thickness of the flange and the changing the taper of the tread from one in twenty-five to one in twenty. It is not probable that any further changes will be made for many years to come other than the abandonment of the old standard and the adoption of the recommended practice of 1906 in its stead.

Turning now to the character of wheels used during these early years we find that, as soon as the weights of passenger cars were increased above those obtaining in the late sixties and early seventies, due to the introduction of sleeping and parlor cars, managers felt a doubt as to the safety of the cast iron wheel for passenger service and the steel-tired wheel was introduced; slowly at first, but later it came into universal use except on a few roads with facilities for making their own wheels, so that they were put in a position of absolute control over methods and materials used.

At first the construction of the steel-tired wheel was somewhat complicated and involved the use of a large number of pieces. This was afterwards simplified to a great extent, and the parts made less. Meanwhile, when the first steel-tired wheels were placed in passenger service the standard capacity of the freight car of the country was 20,000 lbs. with the empty car weighing about as much more. In the later seventies there was a movement to increase the carrying capacity of these cars and in the succeeding fifteen years it rose to 60,000 lbs. Up to this time there had been no trouble with the cast iron wheel and no change had been made other than to increase the thickness of metal in the plates and hub to meet the requirements set up by the heavier load that was to be carried and the larger axle that was to be used. This heavier wheel apparently fully satisfied the requirements of the 60,000 lbs. capacity car, though there were some complaints of the inferiority of the later day wheel as compared with those of twenty-five years before. Whether the wheel was actually inferior or was as good and simply failed oftener because it did not have the same margin of strength as the older wheel is an open question.

Later when car capacities were raised to 80,000 lbs. there was no appreciable shortening of the average car wheel life as compared with those under cars 60,000 lbs. capacity. But when in the late nineties the cars of 100,000 lbs. capacity were introduced a new element was brought into play. Roads equipped with such cars began to have a great deal of trouble with broken flanges.

On level roads the wheels are apparently able to give better service, but on mountain lines where there are long continued applications of the brakes, overheating, checking and subsequent breakage are of common occurrence while the average life of wheels under these high capacity cars is approximately one-half that under cars of 60,000 lbs. capacity. Frequently the heating of the wheel by the brakeshoe sets up such internal strains that a crack will start in the body of the metal where no possible inspection could detect it and then it works outward until, when it reaches the surface, it has developed to such dimensions that the flange breaks without warning with results that are more or less disastrous.

Facing this condition, with doubts, on one hand, about the entire reliability of the cast iron wheel, and with the excessive cost of the built-up steel-tired wheel, on the other hand, rendering these wheels out of the question for freight work, a market has been opened for a cheaper steel wheel than any that has been upon the market.

But the service that has been required and rendered by the steel-tired wheel in passenger car and locomotive work has established a high standard of efficiency, and it is essential that any innovation in the methods of steel car wheel construction and design shall produce a wheel that, so far as the physical properties of the metal composing it are concerned, shall be fully up to the standards already set by the steel-tired wheel. Its chemical composition must be such that its hardness, ultimate strength, elasticity, and wearing qualities should stand in favorable comparison with the best, and this must be done at a price that will make it possible to use such a wheel in freight service at a cost not to exceed the cast iron wheel. This does not mean that the first cost is to be the same, but that, when the renewals are taken into consideration, the ultimate cost of wheels for a series of years shall be no greater with the steel than with the cast iron wheel.

THE PASSENGER AS A REFORM AGENT.

In a city not hundreds of miles from New York situated on a great railroad system there lived a "club man" who on his journeys to and from the metropolis often indulged in the luxury of a parlor or sleeping car. One day not long ago when starting on a long trip and seeking sleeping car accommodation he was, as he asserted, "held up" by the conductor of the car to the amount of $1 as a bit of personal "graft," in addition to the regular charge for the berth. On his return the passenger entered no formal complaint but made club land resound with his wrong. He had been robbed by a highwayman in the railroad company's uniform. The railroad company was not much better when it winked at such graft—and so forth and so on in the familiar terms of epithet of the angered and aggrieved passenger. The complainant, in one of his bursts of eloquence against the railroad, chanced to be overheard by one of the company's officers. The officer quietly started a careful investigation which in effect confirmed the dollar story and then called on the complainant to stand to his guns in a formal statement as basis for discipline of the offending conductor. Then the passenger backed water. He was one of the familiar type of men who are louder in talk than agile in action and who shirk even small responsibility. He refused to make formal complaint and declared that the dollar was but a gratuity pure and simple. And so the inquiry of the company with the improvement of the service as its aim came to naught.

A few weeks ago on one of the branch lines of the same railroad system another passenger was riding in the smoker on a special excursion ticket good on its face for that particular train. In insolent terms he was ordered back by the regular train conductor to three extra rear cars put on for excursionists. The passenger refused to go, showed the face of his ticket and stood successfully on his rights. Fifteen minutes later on asking an apology from the conductor he was refused. A week or two after, the same passenger, who was a lover of fishing, after a day's sport, cumbered with much angling *impedimenta*, reached a flag station of the same company after a toilsome pull at the oars and a hard trudge by highway. The train schedule called for a stop at the station and, by custom for years in the absence of the regular "drop" the stop signal was the waiting passenger on the platform, visible from far down the line. Here the waiting angler stood with two fish baskets, three bait pails and the same number of fishing rods like an animated semaphore. The engineer, afterwards alleging that he "didn't see," ignored the passenger and ran the train by and on. The train happened to be fifteen minutes late.

The outcome in these two cases was far different from the first. The aggrieved passenger followed up instantly each offense with a formal statement to the division superintendent. There was some delay—partly accidental—and cutting of red tape. But, in the end, after a fair investigation the conductor was summoned before the powers, found guilty, warned to exercise better courtesy and judgment and ordered to make apology to the passenger; and, in the case of the engineer, the result was substantially the same. A fair inference based on the rule of human motive and conduct justifies the conclusion that the conductor will hereafter be more heedful of duty and, what is of more importance, will spread his disciplinary experience among his mates to their own and the company's profit; that the engineer will not again run a belated train past a flag station in violation of the schedule; and that, in the earlier instance, the sleeping car conductor will be encouraged to continue his "graft." Incidentally it may be stated that the passenger who complained received official thanks.

These three cases are not fiction or parable. They are actual and recent instances which illustrate an evil and its remedy. Every railroad corporation, if wise, wants good service. It realizes or should realize that its chief point of contact with the public is in that service. It wants to subdue petty graft, to supply good cars, accurate train service, tactful and judicious conductors and faithful engineers and trainmen. Elements such as these are a part, and a large part, of the company's assets that connote public good will and reach up even to legislation. But a railroad corporation is not an Argus. It owns no accurate personal equation of its thousands of officials; and, in the detection of grievance, it must rely on the passenger's moral sense and individual backbone, its own responsibility ending when it offers the mechanism of prompt inquiry and correction. But it is against just such a condition that the average passenger fails to make good. He voices his wrong, real or imaginary, in private outcry, in an anonymous screed to a local newspaper or in "setting up" a sensational reporter with his tale. In not a few cases he swallows the offense in silence and says and does nothing. In his relation to the railroad company he belongs to that large group of citizens who in civic life are neglectful of duties and who would rather have things pleasant than have them right. When the railroad passenger reverses that too common viewpoint, drives his complaint home, reserves his outcry for the time when actual grievance is officially unredressed and recognizes his own *quasi* partnership with the railroad in improved service, then will the evil be minimized and the passenger himself become the advance agent of its reform.

NEW PUBLICATIONS.

Intercorporate Relationships of Railways in the United States, as of June 30, 1906. Prepared by the Division of Statistics and Accounts, Interstate Commerce Commission, Washington, D. C.

The Interstate Commerce Commission has issued its first special report under the amended Interstate Commerce Act. The report covers investigations intended to show the manner in which the railroad corporations have been welded into highly centralized systems, and to present a statement of net railroad capital outstanding in the hands of the public, eliminating all holdings of railroad securities by other railroad corporations. The statistical portion of the report is now in press; the portion at hand is the text only, but it shows, according to the Commission's calculations, that the net railroad securities of the country are on a basis of $58,050 per mile of line. This figure, which is of considerable statistical interest, is the only useful result which appears to have been accomplished by the very great amount of work which must have been spent upon the study. The report is illustrated with a number of diagrams showing the way the more complicated railroad systems have been formed together through the medium of holding companies. Although these diagrams are interesting, it is scarcely clear why the Interstate Commerce Commission should have spent time on them; as the subject matter is all of public record and easily obtained by those who are interested. The principal impression which the reader gains from the advance copy is a feeling of sympathy for the railroads, which had to answer the exceedingly complicated questions addressed to them by the Commission in a series of circulars in order to enable the Commission to bring out a number of well-known facts from original sources.

CONTRIBUTIONS

The Inland Waterways Commission and Transportation.

New York, March 23, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

For years the inhabitants of the Mississippi Valley have asked for such improvements of that stream and its affluents as would abridge either or both, the cost in time and money necessary for assembling and distributing commodities produced, consumed or transported for further increase of value in and about that basin. They labored under the impression that their efforts were impeded or nullified by the able chairman of the House River and Harbor Committee, and that the principle of proclaiming an unincreasable minimum and thus pitting locality against locality, popularly called log rolling, was being used with ability to continue the poverty of localities deficiently supplied with transportation facilities. This feeling led to action which is shown in the commencing sentence of our President's letter of March 14, 1907: "Numerous commercial organizations of the Mississippi valley have presented petitions asking that I appoint a commission to prepare and report a comprehensive plan for the improvement and control of the river systems of the United States. I have decided to comply with these requests by appointing an Inland Waterways Commission."

There follows this the names of his appointees, nine gentlemen, of whom Congressman Burton, chairman of the River and Harbor Committee of the House of Representatives, was at the President's suggestion made chairman of the committee, and by election of the committee Senator Newlands, of Nevada, is vice-chairman, and Dr. McGee, of the Bureau of Soils, is secretary. President Roosevelt seems to have handed those petitioners of the Mississippi valley, who desired cheaper transportation, a lemon. This vulgar and upstart word is used advisably. The classic "Dead Sea apple" has by reputation an inviting exterior. The report contemplates only inaction and delay. The committee contains no expert on transportation. Only one, General Mackenzie, apparently at all connected with transportation, and he, as chief of the United States Engineer Corps, dissents from his colleagues in three out of six items of a "Supplementary Report."

The chairman of the Commission has been highly and continuously praised for his services to the country in connection with River and Harbor bills by all "accelerators of public opinion" owned or employed by our railroad bankers. These services have been generally obstructive. The probable value of contributions to the science of transportation by the Secretary of the Commission may be judged by an extract from his speech at the "Atlantic Deeper Waterways Conference," Philadelphia, November 18-20, 1907. In this, after referring to the pre-revolutionary tax on tea (which Lord Acton said broke up the British Empire) he continued: "We are paying to our tyrant transportation a tax of 30 to 50 per cent. on all that we eat, wear or use in our every day lives. Our forefathers rebelled—why shouldn't we?" All this of the lowest freight rates in the world; substantially one-half those of Holland and Belgium, one-third those of Great Britain.

Vice-Chairman Newlands, at the same conference, referred to "men in our great financial centers who have been accustomed to gather together these fragmented railroads, form them into great combinations, and then force upon the country exaggerated volumes of bonds, preferred stock and common stock that bewilder the imagination." Those who traveled between Buffalo and New York, with four changes of trains to Albany and then ferried at that city, before Corning gathered together the fragmental railroads which he combined into the New York Central, will not particularly regret the combination. Nor will there be regret at the marked decrease in freight rates shortly following the consolidation. The Senator's idea of bonds, preferred stock and common stock being forced upon the country will perhaps not be concurred in by those who have worked early and late to obtain an infinitesimal percentage of the Senator's exaggerated volume. No recommendations of any potentiality in reducing the cost of transportation seem possible from a committee so officered.

President Roosevelt, however, basing his efforts on "the general and admitted inability of the railroads to handle promptly the traffic of the country," rather than on the economic value of capacious channels of exchange, the use of which cannot, without legislative action, be impeded by or to any one, endorses his appointees and their report in a message of transmission, Senate Doc. 325, as follows.

"This report is well worth your attention. It is thorough, conservative, sane and just. It represents the mature judgment of a body of men exceptionally qualified, by personal experience and knowledge of conditions throughout the United States, to understand and discuss the great problem of how best to use our waterways in the interest of all the people. If the report errs at all it is by over-conservatism."

Everyone has read, "that it was unregulated railroad competition which prevented or destroyed the development of commerce on our inland waterways." And there are traces on the public mind of a latent regret that the railroads could not have been so regulated as to make their freight rates as high as in Germany and so conserve the navigation of inadequate waterways. In the report prominence is given to Representative Burton's patent, which is "heartily" endorsed in the message, for impeding internal improvements by demanding an "equitable distribution" of their costs to the communities, etc., "beneficially affected." That is to say, e.g., we should have postponed building the Union Pacific Railroad until the Mormons (who, by the way, would have been starving before three years without it) could have contributed equitably to its cost. There may be some more ingenious way of continuing the poverty of localities whose principal products cannot bear the costs of production and transportation to market.

Through the report and not absent from the message, is evident a desire to build up another department of persons drawing pay from the public purse and dependent on executive favor. The asked for regulating power of this department might, in impure hands, become particularly valuable before elections. Closely connected with the above mentioned object seems to be a desire to build up a combination or trust between railroads and water carriers, as evidenced by such phrases as: "With a view to equitable cooperation between waterway and railroad facilities for the promotion of commerce and the benefit of the people," "devising means of rendering the two systems complimentary and harmonious and making such fair division of traffic that rates and management may be co-ordinated economically and with benefit to this country." It is to be hoped that neither an additional "administrative agency with large powers," nor a control of rail and water transportation which might render a farmer taking a sack of corn into his dugout for transportation, liable to fine by some future Table Mountain will commend itself to the country.

Noticeably the report is without consideration of the effect of depth on the cost of transportation by water. "Co-ordination" with the railroads seems hardly second to the desire for large powers for the agency. To be sure, the President speaks enthusiastically for deep channels. But those who remember his decision in favor of a barge canal to handle the traffic of the Lakes will doubt the adequacy of his conception of depth. Under that decision, by the then Governor of this state, we are in the course of expending $101,000,000 on a canal so shallow and inadequate that on its completion it will probably not bring to the city of New York 5 per cent. of the 70,000,000 tons of freight now passing Detroit; two-thirds of which is said to be on its way to an increase of value by manufacture. Its only value will lie in its ability to keep lake vessels from competing for freight with the vessels already on the Atlantic, and the people at the head of Lake Michigan who think they are going to get their vessels out by way of the Mississippi must be resigned to waiting.

Notice also seems desirable of the fact that both the message and the report are surcharged with references to monopoly which seem intended to develop a spirit of national antagonism rather than of mutual helpfulness and to decrease commercial confidence in the future. Some 16 years ago the country was filled with the cries of calamity howlers, whose terminology was mostly drawn from tons of literature sent west from this city. This literature was on like lines of passification and progress as those inculcated in the document under consideration. The howlers, it will be remembered, got their calamity.

The influences on the prosperity of the country which would follow ignoring depth and capacity in improving waterways, and adopting the above mentioned plans of control and trust development are liable to be very serious. Senator Newlands' "co-ordinated" trusts will most surely result in lower prices for farm products and raw materials at points of production, and higher costs at points of consumption. No politically appointed commission can be expected to manage transportation as economically as those educated to the business and whose future is dependent on success. And as those who direct clamor against "monopoly" are, in fact, still more insistent against "ruinous competition," we may expect under their administration an orthodox and uniform system of railroading that will kill initiative and invention; which will imperatively demand higher rates, which higher rates will not bring increased profits to transporters.

Heretofore, with the highest wages paid in the world and with money and materials generally dearer than elsewhere, our railroads free to charge what the traffic would bear, to build into others' territory and to wage ruinous rate wars, have steadily reduced the cost of freightage until they have presented the people of this country with an unprecedented and unascertainable beneficence; unascertainable because with the high freight rates of Europe much of our merchandise could not have stood the cost of production and transportation. The wealth accompanying its production and the decreased cost to consumers from its abundance would have been lost to the country by European freight rates. Our phenomenally low freight rates on the lakes and the influence they have on production is admitted by all. There is a lack of reliable statistics as to our coastwise commerce, but experts assert that no other country has as cheap coastwise carriage as this. All these great traffics until lately have been free of control. Since our state and national governments have assumed and extended their control railroad freights have risen notably. Lake and coastwise freights, less controlled, have not.

One of our great sources of prosperity, if not the greatest, since about 1870, when our average freight rates were reduced below those of England, has been the advantage we have had over competing countries in the cost of assembling the raw materials for manufacture and distributing the finished product. Senate Doc. 325 seems to promise no further reduction in the cost of such service. All who wish the continued advance of this country and understand the function of transportation should examine the document with care. EDWARD P. NORTH, C.E.

Automatic Inspection of Car Wheels in Service.

Sacramento, Cal., March 16, 1908.

To the Editor of the Railroad Gazette:

The inspection of car wheels in service for defects that may lead to failure is an interesting and exceedingly important part of railroad work. On the thoroughness with which the inspection is made depends in considerable part the measure of safety guaranteed every train on leaving an inspection point, and many readers of the *Railroad Gazette* may take at least a passing interest in anything proposed as an improvement in this field.

As every railroad man knows, there are car repairers and inspectors stationed at terminals and also usually at two or three other points on a division, and one of the duties of these men is to allow no pair of wheels to pass that is defective. They are expected to examine every wheel carefully all the way around—plates, flange and tread, and on every flange that appears to the eye at any point to be worn nearly to the limit of vertical wear or thickness they are to try their gage to ascertain if it should be allowed to pass; on flat spots, shelled-out spots and chipped rim, the gage should be tried to see if these defects exceed in extent the limit allowed. Any wheel that has been pressed too loosely on the axle and has shifted place under pressure brought to bear in passing curves and frogs, should be discovered in the inspection as the defect is most dangerous. The difficulties of such a thorough inspection are obvious. The time allowed is often short; inspections must sometimes be made at night and in storms; the wheels are under the cars, partially hidden by brakes, boxes, frames and bolsters, and thorough inspection is at best difficult and often impossible, making the temptation great for an inspector to chance that all is right on a wheel, a truck, a car or even an entire train.

The application of gages for the defects described takes time, and the particular part of a wheel on which it is desired to try a gage may be hard to get at. For example, suppose there was in a freight train of say 40 cars, one pair of wheels that were out of gage, due to a wheel slipping on the axle or other cause. To locate this pair might require the gaging of most of the pairs of wheels in the train—a good sized task. If it was not known that the defective pair was in the train, the chances are great that with the ordinary methods of inspection it would not be discovered; yet to leave it undiscovered courts disaster.

It has occurred to me that it is possible to place in the track at terminals or inspection points, on the incoming track or on a siding in connection with it, an automatic means of applying the gages to the wheels as they pass, and to register the condition of the wheels in such a manner that it may be seen at a glance if flanges are missing or worn to the limit of wear; whether all wheels are correct in gage, and even whether or not flat spots or shelled-out spots or chipped rims exceed in extent the limit allowed. In short, I want to apply the M. C. B. gage by mechanism instead of by hand, for detection and location of all the defects that require the application of the gage.

It may be objected that such a device would make car inspectors careless. It should not; they should be held responsible more than ever for cracked plates and other defects of wheels and running gear that do not require the application of a gage to determine their extent.

Under ordinary inspection, the rejection of a wheel for flange worn to the limit of thickness or vertical wear by use of the hand gage is to a considerable extent a matter of the inspector's judgment. Flanges are seldom worn so that the gages apply either for thickness or vertical wear just as they are shown to do in the M. C. B. rules. A flange is worn thin, but the gage does not go down on the tread so as to exclude daylight under it at the center, as it is shown to do in the M. C. B. rules; a flange is worn vertically until considerably beyond the limit of safety, yet this wear is seldom absolutely vertical, and a question is raised in the inspector's mind whether or not the wheel should be condemned. An automatic machine for applying the gage would have a "personal" equation of its own, but one that should be more constant than that depending on the various judgments of several inspectors. Such a machine would require expert attention, but it would require many men to attain the efficiency of one machine in inspection for the defects referred to.

Freight cars, a large percentage of which are loaded at way stations, may for months at a time pass inspection points only in through trains; they are liable to pass these points in storms and at night, and even at best, with many trains of many cars each and the limited time available, thorough inspection is impossible. Repairers and inspectors are often called upon to repair some damage to some car in transit, and that, too, takes up the time that should be available for inspection.

Railroad authorities state that from 60 to 90 per cent. of all wheels removed are removed for worn flanges. Inspection would show that many of these are worn much beyond the limit, proving that many of them must pass inspectors time and again before they are discovered and removed. On every wheel removed, no doubt an inspector has tried his gage, perhaps a number of times. If this could be done automatically by machinery, in the aggregate it should represent a considerable saving of time, taking into account the fact that one thorough inspection by some device that would register several points of every wheel in the train without fail should be worth a dozen superficial inspections.

The idea is new and untried, and to develop an efficient machine for the purpose would require much experimenting, but with ultimate success it should result in saving to railroad companies the time required for thorough inspection for the defects referred to, and in saving to public and railroad alike some of the life and property now lost in wrecks. CHAS. BROWNING, JR.,

Office of Laboratory Foreman, Southern Pacific Co.

(Mr. Browning modestly omits to mention that he has himself taken out patents for such a device. We understand that no machine has been built, however.—Editor).

Locomotive Types and Weights.

Boston, Mass., March 30, 1908.

To the Editor of the Railroad Gazette:

The first of the following tables is a compilation from the reports of the Interstate Commerce Commission from 1902 to 1906, both inclusive. It serves to show the tendencies of modern practice as to the use of locomotives of several of the most important classes. It is evident that the four-wheel switching engines are giving way to the six-wheel engines, which clearly constitute the accepted class. While a number of eight-wheel and ten-wheel switchers are used, the number is not large, nor the increase significant.

The most striking feature of the table is the increase in numbers in the Consolidation type, nearly double in four years. This appears clearly to be the accepted type for a large part of the freight service. The next most important feature is the steady falling off, since 1903, in the American type. This type is evidently yielding on one side to its modification, the Atlantic, for light, fast service, and on the other to the 10-wheel or the Pacific where heavier service is demanded. The Mogul and its modification, the Prairie, seem not to gain much in favor. The ten-wheel and the Pacific (its modified type) show a very material gain. The ten-wheel appears to be used both as a passenger type and as a freight type.

There has probably been a more or less complex change going on. In replacing an American, when worn out, the tendency for light fast service is towards the Atlantic, but in many cases a heavier engine takes its place, a ten-wheel or a Pacific. In the meantime a ten-wheel freight engine, when worn out, is probably replaced, in many cases, by a heavier Consolidation. So that while the American type is decreasing and the Consolidation is increasing, the six-driver types are both increasing and decreasing in numbers, but show a substantial net increase. The six-driver types, the ten-wheel, the Mogul, the Pacific and the Prairie, still outnumber the eight-driver types, the Consolidation, the Mastodon and the Mikado. It is no doubt the fact that the four-driver types still lead for passenger traffic, but it is losing ground steadily; for freight service the eight-driver types are far in the lead and are gaining rapidly; the six-driver types, divided between freight and passenger service are still gaining substantially. The use of the trailing truck in the Atlantic, Columbia, Pacific, Prairie, Mikado and Santa Fé seems to meet with considerable favor.

The tractive force (depending on the loads on driving wheels) is still increasing notably; the average tractive force has increased as shown in Table II.

Table I.—*Number of Engines, and Increase in Number.*

Classes.	Arrangement.	1906.	1905.	1904.	1903.	1902.
Switching.*	OO	970	1,118	1.172	1,212	1,106
		— 148	— 54	— 40	+ 106	
	OOO	5,858	5,165	4,796	4,222	3,683
		+ 693	+ 369	+ 574	+ 539	
	OOOO	171	149	168	166	115
		+ 22	— 19	+ 2	+ 51	
	OOOOO	19	14	10	9	7
		+ 5	+ 4	+ 1	+ 2	
	OOOOOO	1	1	0	0	0
		0	+ 1	0	0	
American	oo OO	10,348	10,753	11,323	11,652	11,280
		— 405	— 570	— 329	+ 372	
Atlantic	oo OO o	1,359	1,119	852	674	367
		+ 240	+ 267	+ 178	+ 307	
Columbia	o OO o	98	57	121	36	17
		+ 41	— 64	+ 85	+ 19	
Ten-wheel	oo OOO	9,855	9,396	9,232	8,702	7,605
		+ 459	+ 164	+ 530	+1,097	
Pacific	oo OOO o	521	323	186	38	3
		+ 198	+ 137	+ 148	+ 35	
Mogul	o OOO	5,539	5,182	5,465	5,247	4,871
		+ 57	+ 17	+ 218	+ 376	
Prairie	o OOO o	698	520	456	418	197
		+ 178	+ 64	+ 38	+ 221	
Consolidation	o OOOO	14,320	12,591	11,399	9,008	7,494
		+1,729	+1,192	+2,391	+1,514	
Mikado	o OOOO o	178	122	34	34	2
		+ 56	+ 88	0	+ 32	
Mastodon	oo OOOO	581	546	557	577	484
		+ 35	— 11	— 20	+ 93	
Decapod	o OOOOO	15	15	10	13	12
		0	+ 5	— 3	+ 1	
Santa Fe	o OOOOO o	140	86	85	0	0
		+ 54	+ 1	+ 85	..	
Total (all classes)		50,954	47,696	46,743	43,871	41,225
		+3,258	+ 953	+2,872	+2,646	

*Mainly.

Table II.—*Average Tractive Force.*

Class.	Tractive force 1902.	1906.	Per whl, 1906.
Six-wheel Switcher	20,300	23,400	3,900
American	13,900	14,700	3,700
Atlantic	21,800	23,400	5,800
Ten wheel	21,400	22,800	3,800
Pacific	28,300	30,200	5,000
Mogul	21,200	22,600	4,300
Prairie	25,300	29,500	4,900
Consolidation	29,400	34,200	4,300
Mikado	21,500	43,900	5,500
Mastodon	33,500	33,400	4,200
Santa Fe	......	62,800	6,300

The figures seem to indicate that many old (and light) American, ten-wheel and Mogul engines are still kept in service. The newer types appear to be of more powerful build, as shown by the greater tractive force.

C. FRANK ALLEN.

Committee Work of the Maintenance of Way Association.

The Board of Directors of the American Railway Engineering and Maintenance of Way Association has issued instructions to the various committees concerning their work for the coming year, an outline of which is given below. The committees have been rearranged and are thought to be unusually strong and efficient. The Board has established November 30 as the limiting date for receipt of committee reports by the secretary. Reports received after that date will not be presented for final action at the following annual convention.

I—ROADWAY.

(1) Continue the consideration of track elevation and depression inside of cities, and grade and curve improvement work outside of cities, and submit recommendations covering more particularly questions of detail relative to the handling of the work.

(2) Report on the best method for determining the size of waterways.

(3) Report on the protection of the roadbed in embankment and excavation from the action of water, more particularly with reference to protection from washouts or overflows and from slides, whether caused by surface or underground water.

(4) Report on the surface and sub-surface drainage of embankments and excavations.

(5) Report on the tiling of wet cuts and the curing of slides.

II—BALLASTING.

(1) Review the customary recommended practice for preparation and delivery of various classes of ballast, with cost of handling same, if practicable.

(2) Review the advantages and disadvantages of the various types of ballast, including stone of different kinds, slag and gravel, and the different qualities of gravel with reference to the amount of sand or clay contained.

(3) Report on the best method to be used in determining the wearing quality of crushed stone.

(4) Review the customary practice and practicability of treating rock ballast which has become foul under the ties.

(5) Prepare recommended principles of practice for slag ballast, chats ballast, cementing gravel ballast and chert ballast.

(6) Report on the necessity for and best material for subballast.

(7) Review of special literature on the subject of ballasting.

III—TIES.

(1) Continue the compilation of statistics upon the life of ties, both treated and untreated, and the causes of failure. Present summary compilation of reports received and draw such conclusions therefrom as the statistics warrant at the present time.

(2) Prepare critical review of the general question of the present and future status of the tie supply, the various methods heretofore adopted for reducing the yearly demands on the timber supply, and what general lines of investigation and change in existing methods may seem most desirable to be followed so as to secure the best results in the future.

(3) Collect statistics on the extent of the use and the life of metal or composite ties up to the present time, with illustrations and descriptions of the most successful designs, and draw such conclusions as the conditions may warrant.

IV—RAIL.

(1) Continue the investigation of the breakage and failure of rails and present summary of conclusions drawn from reports received.

(2) Report on the results obtained from the use of open hearth steel rails and the chemical composition of such rails.

(3) Report on any recommended changes in specifications for Bessemer steel rails as heretofore adopted by this association.

(4) Present recommendation as to standard rail sections.

(5) Present report showing diagrams or photographs of typical characteristic rail failures corresponding to the classification as given in form M. W. 1,200, Report of Rail Failures in Main Tracks.

V—TRACK.

(1) Review and revise the committee's report presented at the ninth annual convention, covering the following subjects:

(a) Report on the subject of turnouts and turnout material, including the best types of switchstands, switchpoints, frogs, guard rails and throat clearance, bearing in mind the possibility of an increase of the thickness of wheel flanges and the effect of worn ties and wheels upon the various parts of turnouts, frogs and crossings.

(b) Report on facing point switches for high speeds with a continuous main line rail.

(c) Confer with committee on signaling relative to switchstands.

(2) Continue investigations in connection with a sub-committee of the American Railway Master Mechanics' Association upon the subject of widening gage on curves and spacing of guard rails, as affected by the different lengths of engine wheel base, arrangement of flanged wheels and wheel wear.

(3) Report on whether wide gage which is due to worn rail should be corrected by closing in or replacing the rail.

(4) Report on the extent rail should be worn before it becomes unsafe.

(5) Consider revision of paragraph (3), under "Proper Method of Spiking," page 64, Manual of Recommended Practice, and report recommendation as to extent gage on curves should be worn open before closing in is necessary.

(6) Reconsider and report any recommended change in "Standard Drilling for Rails," as heretofore adopted by this association (Manual, 1907, p. 65).

VI—BUILDINGS.

(1) Reconsider amended conclusion No. 5, relative to locomotive coaling stations (Bulletin 95, pp. 69-70).

(2) Report on the use of reinforced concrete for coaling stations and storage bins.

(3) Collect data as to the actual use of reinforced concrete roofs for roundhouses, where located, life to date, results so far obtained, and critical analysis of advantages or possible defects; also diagrams of typical designs.

(4) Report on the best method for smoke removal, ventilation and heating of roundhouses.

(5) Report on the design and detail arrangement of oil houses at terminals.

VII—WOODEN BRIDGES AND TRESTLES.

(1) Continue the revision of the specifications for structural timbers, co-operating with Committee Q of the American Society for Testing Materials and other committees on the subject, with a view, if possible, of preparing a uniform standard specification.

(2) Prepare a list of recommended safe unit stresses for structural timbers.

(3) Revise the report on standard names for structural timbers.

(4) Study the principles and methods of pile-driving, and collect data relating to the current practice.

(5) Report on best method for classification of pine timber for structural purposes in place of classification by botanical names.

VIII—MASONRY.

(1) Reappoint a sub-committee to co-operate with the "joint committee" on Concrete and Reinforced Concrete.

(2) Collect data on the reported failures of concrete structures and the probable cause of same.

(3) Investigate and report upon the waterproofing of masonry, covering methods, results, cost and recommended practice.

(4) Report on the use of reinforced concrete trestles, typical designs, cost and recommended practice.

(5) Present typical plans of retaining walls and abutments, plain and reinforced, with comparison and recommended practice.

(6) Report on the desirability of all monolithic construction in arches or large abutments with wing walls.

(7) Submit specifications for reinforced concrete.

IX—SIGNS, FENCES, CROSSINGS AND CATTLE-GUARDS.

(1) Present such additional recommendations and conclusions covering the various subjects reported on in the previous reports of the committee as may be considered desirable.

(2) Report on snow fences, snow sheds and other means to prevent snow accumulating and best methods of clearing tracks and snow removal.

(3) Report on the use of concrete fenceposts, results obtained so far in actual service, designs and cost.

X—SIGNALING AND INTERLOCKING.

(1) Mechanical interlocking specifications.

(2) Electric interlocking specifications.

(3) Rubber-covered wire specifications.

(4) Prepare standard contract for signaling work.

(5) Prepare outline and description of a comprehensive system for universal signaling, suitable for general adoption.

(6) Confer with committee on Track relative to switchstands.

XI—RECORDS, REPORTS AND ACCOUNTS.

(1) Revise "Track Chart," form M. W. 1,016, so that the chart will show the conventional signs as adopted by the association.

(2) Recommend any desirable changes in conventional signs as heretofore adopted.

(3) Review the subject of "Time Book" and recommendations as to revising form M. W. 1,008, with a view to preparing a form that may be uniformly used for all maintenance of way departments, and offering a check against irregular practices and allowing the use of a daily time report.

(4) Recommend forms for use of maintenance of way departments for preparing preliminary detailed estimates of contemplated construction work, this form to be used preliminary to and form the basis for the summary estimate data embodied on form M. W. 1,017.

(5) Prepare forms for collecting and analyzing rail statistics.

XII—UNIFORM RULES, ORGANIZATION, TITLES, CODE, ETC.

(1) Supplement "General Rules for Government of Employees of Maintenance of Way Department."

(2) Prepare special rules for foremen and other employees, properly grouped and classified in accordance with and supplementary to the general rules heretofore adopted.

XIII—WATER SERVICE.

(1) Report on the use of coal and gasolene or other fuels as motive power for pumping plants, with relative economy and desirability of each system under different conditions.

(2) Report on the general principles of the water supply service, independent of the question of water treatment, and on typical installations for various characteristic conditions.

(3) Report on various types of track tanks, with designs of typical installations, and critical review.

XIV—YARDS AND TERMINALS.

(1) Report on the average and maximum classifying capacity of hump yards with one or two scales on the hump and the number of yard engines required under varying conditions.

(2) Report on terminal freight houses at large terminals and transfer points, more particularly with reference to general arrangement of buildings and platforms and the track layout.

(3) Development of mechanical handling as a means of promoting rapidity and economy in the handling of freight.

(4) The relation of the percentage or proportion of cars to be weighed to the location of scales on the hump or elsewhere, and if not placed on the hump, where should scales be placed, and the reasons therefor; also how weighing is done where cuts of cars are switched.

(5) Report on the feasibility of transferring freight by means of movable freight platforms, and outline of methods.

XV—IRON AND STEEL STRUCTURES.

(1) Continue investigations as to impact tests.

(2) Continue investigations in regard to injury to bridges and railroad structures caused by flat spots on wheels, conferring with committees of other associations.

(3) Report on the care of existing bridges, inspection, methods of field work and records of inspection.

(4) Report on the maintenance of bridges, including protection of steel structures from corrosion.

(5) Specifications for bridge erection.

(6) Report to what extent steel bridge construction for the main girders of bridges carrying heavy loads under high speeds is preferable to reinforced concrete construction.

XVI—ECONOMICS OF RAILROAD LOCATION.

(1) Continue the consideration of all questions connected with railroad location, grades, lines and improvement of grades and lines affecting the economic operation with relation to traffic, tonnage ratings, speed, density of traffic and financial considerations, with the special aim in view of establishing uniform methods and unit values for investigating and analyzing the relative changes and costs of comparative routes or proposed grade reductions and line corrections.

XVII—WOOD PRESERVATION.

The committee work is to cover in general the investigating and reporting on the preservation of wood used for ties and for railroad structures and buildings, confining the work of the committee more particularly to processes, methods and results obtained.

Present recommendation as to outline of work for the committee, with suggestion for classification to be followed.

Continue the work done heretofore by the committee on Ties and on Wooden Bridges and Trestles, relating to the special subjects of processes and methods of wood preservation.

UNIFORM GENERAL CONTRACT FORM.

Prepare uniform general contract forms and present recommendations on the subject.

Reciprocal Demurrage and Car Supply.*

BY ARTHUR HALE.

This is the first winter that I can remember—and my recollection goes back at least twenty-five years in transportation matters—that there has not been a car shortage.

A car shortage is a usual, I might almost say a healthy, symptom in the winter, but this winter of 1907-8 is the first winter that we know of when there has been a car surplus. The situation of the country and of the railroads is pretty well described in a recent Bulletin of the Department of Commerce and Labor, indicating a falling off in many of the leading trades in percentages from 10 and 15, up to 50 per cent. in the iron trade. That falling off in business is reflected in the business of the railroads. The reports of the roads for December are all in, and of some of the roads for January, and almost without exception those reports are showing fearful losses in gross earnings, losses which vary all the way up to 50 per cent. Some of the Pittsburgh roads are only earning 50 per cent. of what they earned last year.

The situation, so far as it regards cars, is indicated in the bulletins of our committee, showing surplus cars in this country on February 19 amounting to 320,000. That is a slight improvement, I am glad to say, over February 5, when the surplus cars reached their high water mark, 343,000. And I am glad to say that the next bulletin, which covers the situation on March 4, shows another slight decrease, although the totals will be over 300,000.

I am sorry to say that the decrease in surplus is largely caused by an event which I consider calamitous—the probable shutting down of the coal mines in the Middle West. The railroads in and about Chicago have a very strong feeling that the coal industry will suspend on April 1, and for that reason they are loading up all of the coal cars they can get, and there is on some of the railroads, for the first time in several months, a shortage of coal cars shown. But the reason of that is that they have loaded up all the coal cars they could get, either with their own coal or with somebody else's coal, in anticipation of this stoppage of labor on April 1. I do not think it will be called a strike. I hope it will not extend to the East, but everyone in Chicago who is familiar with the coal trade seems quite sure that on April 1 the mines in Indiana and Illinois will shut down, and they are taking precautions.

These figures, which have recently (and very much to my surprise), attained public interest, are figures which our committee has been collecting for about a year. We were appointed about a year ago to look into this car shortage question, for nobody knew what the car shortage was for the whole country. Every railroad knew what its own car shortage was, but there was no central body which knew what the car shortage of the whole country was. Our first

*Argument before the Railroad Committee of the Massachusetts State Legislature, March 11, 1908.

duty, therefore, was to find out what the car shortage was and where the car shortage was.

We, therefore, sent out circulars, but, in the first place, only to the larger railroads. We asked for their shortage, and we also asked for their surplus, although the request for the surplus was received with some derision by some of our friends. They said, "What are you asking for surpluses for? There aren't any surpluses and there never will be any surpluses." We got answers from about 61 of the leading railroads in January and in February, and in February on those railroads the shortage was over 100,000 cars. That was a shortage for one day. What the shortage would have been the next day, if that shortage had been filled, I don't quite know, but at any rate a shortage of 100,000 cars for one day was a serious thing—a serious thing in showing that there was more business than the railroads could handle.

I won't go into the question now as to whether that was a car shortage or an engine shortage, or a shortage of men or a shortage of brains. Men were very hard to get a year ago. It has been hinted by a great many people that it was a shortage of brains, and that the railroads ought to have done better than they did. Of course, that is something that railroad men cannot deny. But, unfortunately, there are only so many of us. We are running the railroads now, and while undoubtedly we can't run them as well as the theorists, yet we are trying to run them as well as we can, and we are about the only people you have got to run the railroads now —the only people who are willing to try to do it. So I will leave that part out, and I will call it a car shortage. Really, a transportation shortage would be a better term for it, because while cars were scarce in one place they were congested in another.

These reports were made to an office we have in Chicago. We gradually increased the number of roads reporting and now have about 160 reporting to us regularly, covering practically all the larger railroads. We had no idea that these reports would be of any interest to the public, and we did not publish them. When the spring came surpluses began, and we were able from our office in Chicago to indicate to the railroads which had a shortage that there were surpluses of cars on other railroads, and we did a good deal of shifting around and a great deal of good in that way.

When the summer came there were surpluses everywhere, and we could not do any work in that direction. In the meanwhile the American Railway Association had a meeting and had approved these plans of ours and had ordered us to publish, monthly or oftener, the results that we got from our reports. As the summer passed the supply became uneven again; there were surpluses on some roads and shortages on others, and again our bureau was somewhat efficient in indicating to railroads where cars could be sent to get the full use of them. When we came to October the shortage had increased so, that we were nearly in the same shape that we were in February, that is, there was a shortage of ninety thousand cars in the whole country. That was on October 30.

It was not until the middle of November that we began to feel the result of the panic, when the shortages dropped to 47,000. By the end of November the shortage had dropped to 17,000 and the surpluses jumped up to 40,000. Since that time, up to February 5, the surpluses steadily increased, and now they are about stationary, with the small diminutions I have spoken of.

I simply say this to show its bearing on the situation of the roads in general. A surplus of 300,000 cars means that 300,000 cars are not earning money. During times when cars were short, the cars of American railroads were earning nearly $2.50 a day gross; in some months it was less, but in September it was $2.50 exactly, as it happens, for all the cars. The railroads now have on their hands 300,000 cars which are not earning them anything a day. Those 300,000 cars were bought, practically all of them, in the last 12 months. Over 300,000 cars were bought in the year 1907, and they cost $300,000,000.

I hope this isn't to last very long. I hope the railroads are not going to lose that money; I hope that next fall there will be a revival; I hope this spring there will be a revival of business, but if there is, it will not use up the cars, because we always have a surplus in the summer. I hope, however, that next fall there will be such a revival of business that all these cars will be used; but meanwhile the railroads are already staggering under their loads, and I do not believe that you gentlemen will help to put another burden on them.

As regards the burdens which the passage of this bill will put upon the railroads, the proposers of bills like this uniformly say that the bills are for the good of the railroad, that they are reciprocal, that they are fair. Gentlemen, they are not for the good of the railroads, they are not reciprocal, they are not fair. This bill will give the railroads of Massachusetts nothing, no right which they do not now possess. And, furthermore, it crystallizes into a statute law a custom which all the rest of the country had hoped New England would voluntarily give up, and that this is the custom of giving the merchants of New England twice as long to unload their cars as it gives the merchants in all the rest of the United States.

The gentleman who has proposed this bill said truly that it was modeled on the laws of a number of other states, states I may say, in the South, in the Southwest and the extreme West. I think Vermont is the only one of the New England states that has a law of this character. But with the exception of Vermont—and the Vermont Act is a very recent one—everyone of these acts, and everyone of the rules framed by state commissions, gives a basic free time of 48 hours for the loading or unloading of freight cars. That is usual in the country.

The law of the state of Connecticut, which, by the way, is not a so-called reciprocal law, but simply a demurrage law—gives 96 hours. That, I am told by the lawyers, is only valid on intrastate traffic. But the railroads of Connecticut, not desiring to make a distinction, have always given freely, 96 hours to all traffic, interstate as well as intrastate, and the other railroads in New England have followed those of Connecticut. So that New England is peculiar in that it does not allow the railroads—well, I should not say that—in that two of its states do not allow the railroads to force an unloading in 48 hours, but give everyone 96 hours, and the other states of New England have followed them, so as to make no discrimination between the citizens of Massachusetts, for instance, and of Connecticut.

Based on that 48 hours, there are, to be sure, exceptions in a number of states, by which certain trades and certain kinds of goods, are allowed more time. For instance, in the South, people living so many miles from the station have an extra day. In certain states there is more time for certain commodities; for instance, in Chicago there is extra time for sampling grain, and so on. There is extra time for reconsigning coal and things of that kind which I dare say you undoubtedly have to have here, and do have here. Although this bill does not give the shipper the right to it, trade demands various exceptions of that kind. But the base of the whole thing is 48 hours throughout the United States, except in New England, where the basis is 96 hours free time.

I am sorry to say that extra privilege is reflected in your railroad performance. If you look at these figures in our reports, the reports of the Committee on Car Efficiency, you will see that freight cars in New England do not travel as fast as they do in the rest of the country. The average miles per car per day which the railroad men of New England are able to get out of their cars is not much more than 18 miles; and, taking the whole United States, you will find that there are some months where it runs up to 25 and 26 miles. You will find some railroads where it runs up to over 30. New England railroad men tell me, and I believe them, that one reason why freight cars in New England are less efficient, if you measure them by the miles per car per day, is because they are up against this four days for unloading and four days for loading. You can easily see how this is so. The average freight run, for instance, on the New Haven road, as I understand it, is 90 miles from point of shipment to point of destination. Now suppose the shipper takes four days in which to load a car, and the consignee takes four days in which to unload it, and the New Haven takes one day in which to run it 90 miles, you have 90 miles in nine days, and that is 10 miles a day. Now, I submit that that is unreasonable; I don't believe your merchants need it. I do not believe your merchants take it, all of them, but some of them do, undoubtedly, or else there would not be the large amounts for car service which are being collected. And that means, gentlemen, that there are some people in New England who are using cars for storehouses, and who did use cars for storehouses all through last winter when the country in general was crying for the use of cars.

I simply say that to explain my extreme surprise, when I happened in town a couple of weeks ago and found that one of these bills was up here. Why New Englanders, with their extra two days, could want a bill of this kind was more than I could possibly see. But I don't want to go into the reasons why this bill may have been brought in. I want to treat it on the broadest possible grounds, and I submit that this question of preference, of extra privilege that the Massachusetts and the New England merchant has over the merchants of all the rest of the country, is a very important thing, and one that should be considered very thoroughly. I hope if this matter ever does come to be a matter of legislative action or of commission action, that you gentlemen will say that 48 hours is a reasonable time in which to unload freight cars, and I hope that New England will voluntarily give up this privilege, which has caused the rest of the country so much car shortage. I would like to see Massachusetts and New England lead the way in this matter of demurrage by giving up a concession which they have had for many years, but which they at last realize is an unjust concession. I believe that the people of Massachusetts, if they only understood the case, would say to the railroads: "We don't want any special privileges. If the other merchants in the rest of the country can unload in 48 hours, we can; we don't want two extra days; we want to stand on the same basis as the people of the rest of the country."

Now, gentlemen, coming back to the hardship that a bill of this kind would put on the railroads, in the first place it demands that whenever a man orders a car, or cars, without limit—that is to say, whenever a man orders 100 cars or 1,000 cars, or 10,000 cars—of course, that seems absurd, but the bill allows it; when a man orders a car and he does not receive it in four days, that man gets a dollar; the next day he gets another dollar. He can name the points. He can take a siding, where you can only place five cars, and he can order ten cars there, and if they don't come he can collect his dollar. That is a hardship—I have called it that, but it really is an impossibility. But, leaving out the absurd side of the case, the railroads want to fill all orders; the railroads do fill all orders whenever they can, and when cars are scarce the railroads do their best to avoid discrimination in the filling of such orders as they can fill. The railroads want to fill orders for cars because they want to collect the freight money. Whenever a railroad cannot fill an order for a car it loses that freight money. There is one fine. Are you going to put another fine on of a dollar a day a car in addition to the losing of the freight money?

The question of car supply is not a simple one, it is a very complicated one. It is simple enough at a point where the same number of cars come in loaded and go out loaded. It is simple enough at the factory, which gets in so many cars loaded with one kind of material, manufactures the material and ships its goods out at about the same rate every day. It is simple enough when the trade is regular. But, in general, trade is not regular; trade is irregular. And that is the bottom of the difficulty with the question of freight car supply.

The regular trades, the factories where the receipts and shipments are practically regular, the great cities that consume about the same amount and ship out about the same amount, are pretty well taken care of in this country. The trades which pay a good rate of freight are pretty well taken care of in this country. The high class and the perishable freight is well looked after, but when you come to freight that moves irregularly, when you come to freight shipped, for which there is no storage, and which also moves irregularly, then there are difficulties with car supply, and there are difficulties which can only be gotten over by the expenditure of tremendous amounts of money, which would result in the providing of means for transportation that would only be used for a few weeks in the year.

In order to be entirely impersonal, I will speak of the coal trade first, because I think no coal man appeared for this bill; and, secondly, because being on the Baltimore & Ohio, I am familiar with the coal trade. There are no points of storage for bituminous coal at the mines; there is practically no storage for bituminous coal anywhere else except at certain docks on the Atlantic and the Great Lakes. There is a supply of coal in the mines all ready for shipment, three or four times the possible facilities for shipment. I am quite safe in saying that. There is coal in West Virginia on the Baltimore & Ohio, coal opened up, coal all ready to dig out of the mines and put in cars, in that one region, which would exhaust all the transportation facilities of the Baltimore & Ohio, and would leave us mines in Ohio, Pennsylvania and Maryland without a coal car.

The coal trade is all right in the summer, the regular coal trade goes along, everybody has all the cars they want and a lot of mines are shut down and a lot of mines are working half time. But when you come to the winter the price of coal goes up and every mine in the United States wants to ship coal. There is the coal; they take your inspector down and show him the coal, and they say: "There is the coal; give us cars. Here are contracts; we can sell this coal; give us the cars." It is a perfectly safe bluff for them to say that they can load the coal and sell the coal. They know perfectly well that there are not coal miners enough in the country to load all the cars; but we cannot prove that to them, because we have not got the transportation facilities, and it would be extremely stupid for the coal roads of the country to go ahead and provide transportation facilities to take care of the first winter rush, because after the first week's shipments there would be so much coal on the market that they could not ship any more for two weeks.

The coal trade is possibly an extreme case, but I have heard of cases where the live stock men in a region in Texas all wanted to ship the same week; they all had notes coming due about the same time, and they did overcrowd some of the roads out there in such a way that it was just as impossible for them to supply transportation for live stock in the time selected as it is for the Baltimore & Ohio to supply the cars for coal in the first cold snap of the winter. But the same thing is true of every one of the great staples which moves irregularly where the prices fluctuate, and where people want to ship when prices are high and do not want to ship when prices are low. A provision of this kind, fining the railroads so much a day for not supplying cars at any time, would be a tremendous burden on any railroad which originates traffic, at the time when prices happen to be high on the particular commodity which makes the bulk of the railroad's business. That is a perfectly genuine burden, and a burden which would infallibly fall on the railroads of this country. It would be a fine in addition to their losing the freight money, which is, I submit, a sufficient fine.

But if a real shortage occurs through different coal men wanting to get their coal in first in a time of high prices, you can easily see how several coal men could combine to put in orders that it would be absolutely impracticable for a railroad to fill. Suppose several men in one line of trade were to combine to put in orders at a certain point that could not possibly be filled by the railroad, the railroad goes ahead and pays its dollar a day, pays its fine and enlarges the facilities at that point. It would be perfectly easy for those men, when the facilities were put in, if the dollar a day felt warm in their pockets, to change their orders over to a siding ten miles away and insist on having the cars there. This is not an extreme case. When one of these bills was near passing in one of the western states, a representative of a large traffic industry came to a friend of mine and said: "Now, when this bill gets through we can readily shade that rate we were talking about by your simply failing to deliver our cars at such and such a place." Now, that is pretty bad, gentlemen, after we have sweat blood, after we have undergone all these losses in the hope that we are going to get rid of rebates, in the hope that we are going to be sustained by the government in treating everybody exactly alike, to have it proposed that something of this kind be introduced into the law which will open another door like that to rebates!

So much on the question of car supply. The other feature of this bill is the 50 miles a day. Well, that seems reasonable; we do move our freight 50 miles a day, and more; we average more per loaded car—a good deal more. But that is the average, and there is lots of high-class freight that we move a good deal quicker than that, and there is a lot of low-class freight that, while we may move it at that average, we do not move every car as fast as that, and we cannot move every car as fast as that without its costing us a great deal of money. The demand for this regular movement comes from men engaged in handling these staples to which I have alluded—coal, grain, hay—staples which are moved at very low rates of freight. And they pay us very little for moving these staples, and they do not get the best service. I suppose that on every railroad grain and coal are the cars that are moved last. Whenever a train pulls out of a yard they move everything else out and leave the grain and the coal, simply and solely because those pay us least. If you want the grain and the coal moved regularly they have got to be paid for.

I had this matter up in Washington with an official a little time ago. We were talking about grain. We were putting a reconsigning charge on grain of $2 a car, I think, and there had been a protest from Philadelphia people, and this gentleman said to me: "Now, Mr. Hale, these people say that if their freight was moved regularly they wouldn't have to consign it to intermediate points and reconsign it. If it moved regularly they could ship it straight through to destination, but they start a car of grain from Chicago or Kansas City and they don't know when it is going to get in." And he said: "Mr. Hale, we don't want to prescribe a rate, so many miles a day, but why don't you prescribe it on your tariffs? Put it as low as you like; but why don't you put on your tariffs a proposition that for this rate freight will be moved a minimum of so many miles a day!" I said: "That seems right, but I cannot consent to guarantee any time on freight which pays us less than three mills a ton mile." "What," he said, "does grain move for that?" "Yes," I said, "it does on the Baltimore & Ohio Railroad; it moves for less than three mills per ton mile." And he said: "I cannot believe it." So I sent him the figures the next day for the preceding month, and for other months.

New England coal pays us about the same rate. I don't know what hay pays, but I imagine that the hay from Michigan, which was alluded to here a couple of weeks ago, must pay a very low rate indeed. However, the hay question is another question which I will come to later.

I was comparing notes with one of your iron men here, when I was here a couple of weeks ago, and I found that our average rate on grain from Chicago was about the same as he was paying on iron from Pittsburgh. Now, I am not a rate man, I am not a traffic man, I am just a car man, but I have to get into rates occasionally, and I think if you look into the matter you will find that this grain, which is making all the trouble, can't be paying more than three mills per ton mile. And, honestly, I believe it costs the road that much to haul it. That rate, of course, is made in competition with the Gulf. Grain can go down the Mississippi very cheaply—I mean on the railroads paralleling the Mississippi river—for they have no hills and they can take long trains, and naturally they can do the work very cheaply, and so they cut under our lines and we have to bring the rate down.

I submit to you that for freight moving at rates of that kind it is impossible to guarantee time. And I want to tell you just what guaranteeing time means. Freight of high class is moved on schedule trains and is moved with approximate regularity. Whenever there is one of these special cases for which we get blackguarded occasionally, where a car of high class freight is moved very badly, it means either that the car has broken down, and broken down at a point where it cannot be repaired promptly, or that it gets into some kind of a congestion, and in order to keep the road open, the yard and trainmasters feel obliged to move other cars first and let this car stay, it being in an inconvenient point in the yard. Those are the only two occasions when freight of high class is moved slowly, and I think our claim departments always recognize that as to freight of high class; and if there is any real damage accruing, I think they are doing the right thing in the payment of claims.

But, when you come to freight of low class, it is moved in slow trains, it is moved in full trains, and if you are going to make us move that at any definite rate, say 50 miles a day, it means that in order to avoid our fines we will have to clear up every yard every day. That seems easy, it seems a simple thing to say that we must have enough power to move everything out of the yard by midnight. To clean it up and move everything out that has come in there during the day. It seems simple, but, gentlemen, it means a pretty expensive thing. It means a light train, a train not loaded to its full capacity, from, well, more than half the yards every day; and it means an expense which I have never felt justified in recommending to my management, even at times when we were making the most money, even at times when we needed cars most. To contemplate a law that will practically compel every railroad in this country to clear up every yard of all the slow freight every night, is something appalling to me. One could make figures on that, one could assume what it cost to move a train, and the amount that is lost in not moving a full train, and how many yards there are in the country. That would show as appalling figures as I have shown the railroads are loading. But that would be very largely speculative. The only point I want to make clear to you, gentlemen, is that this 50 miles a day, reasonable as it seems as an average, is very unreasonable as a minimum, when coupled with the extremely low rates of freight that the railroads are getting on the staple articles. And I submit to you that in the present situation of the railroads of the country, they are in no shape to bear burdens of that kind.

The real difficulty of which these gentlemen are complaining, if there is any, is one of discrimination. If any shipper is faring better than another shipper in the same line in his car supply, that is discrimination, and there is plenty of law to punish that. I do not believe that there is any conscious discrimination by the railroads of this country now. If any, there is at least so little that it does not show. I know that in order to avoid discrimination the railroads of the country are making the most strenuous efforts, and I know that in all its searching the Interstate Commerce Commission seems only to have caught a couple of cases. If they are real cases, I am very glad they are caught, and I think every railroad man in this country is glad that discrimination and rebates have ceased, as I believe they have. We do not want them. They were at one time considered a necessity, just as they are considered a necessity in almost every other line of trade. But it is very much more convenient for the railroad men to make a set of cast-iron rules and live up to them.

The Hepburn Act has helped us more in avoiding discrimination than anything else has. Prior to the passage of the Hepburn Act there were many shippers who would not pay demurrage, absolutely would not pay it at all—would hold our cars indefinitely and would not pay us demurrage, whereas other people were paying it. And the law was not clear that that was a discrimination. The Hepburn Act put demurrage on a plane with transportation, and to give a man a preference in demurrage is just the same as giving him a rebate. Since that time, we have had very little difficulty with the collection of demurrage as compared with what we had before.

I gather that the interest most concerned in this bill is the hay interest. Hay is an article which, when there are no demurrage rules, is usually handled on commission, and in the old days, when I was in Philadelphia and in Baltimore, before we were able to collect demurrage fully, the hay trade escaped demurrage very largely, because we had such frequent blockades of hay. Hay was at that time handled very largely on commission, which, of course, means that the commission merchant solicits shipments of hay, and that shipments are made at the owner's risk, practically, and often without notice to the merchant. The consequence used to be that whenever the price of hay went up, all the farmers who raised hay would send it in from all parts of the country, and before we knew anything about it, we would have more hay than we could deliver, and the hay would be backed off on sidings. I have known hay for Baltimore embargoed by all the railroads for three months, simply because the price happened to go up for a little while, and all the farmers in creation sent their hay to Baltimore in hopes of selling it on commission. That was, of course, a bad thing for the farmer, because the minute there was a glut of hay the price went down. I suppose the commission man finally got his commission out of it. I hope he did, but nobody else got much of anything out of it, and the railroads were very seriously embarrassed.

The difficulty with the demurrage was this: the hay men would not pay demurrage until the car was placed, until they could unload it, and so many cars of hay came in that it was absolutely impossible to place all the cars so they could be unloaded without filling up all the tracks which we needed for other freight, and there were always a lot of cars held in the outer yards, where the hay men could not get at them, and they would not pay demurrage on those cars which were held back. I notice someone has kindly put a provision in this bill, which will save the hay men paying demurrage on cars held back. The railroads are kindly allowed to collect demurrage on cars not unloaded within 96 hours, computing from 7 a.m. of the day after notice that the cars have been placed at a point accessible for unloading has been given. Now, if you pass this bill, it is a grave question whether the hay men cannot get an absolutely unlimited amount of hay into Boston, and by simply unloading the cars that are placed where they can get at them, compel the railroads to keep a supply back on which no demurrage is collected. After our difficulties in Baltimore and Philadelphia, we built hay warehouses to help out with the storage, and then we had it understood, and it is understood everywhere in the country for all classes of freight now, that if a man has a certain number of cars to unload, and if more cars come in so that they cannot be placed, demurrage accrues on those cars back in the outer yard just as much as it does on the cars which are placed. That is the principle of constructive placement, as we call it. We notify the man who has these cars standing that the cars are ready for him, and that constitutes a constructive placement. We give him two days (it would be four days here) from the time the car arrives in the outer yard, and then demurrage begins as long as he has cars which he can unload but which he does not unload. This bill takes away that power if it can be taken away, that is a question for the lawyers, of course. I hope it cannot be taken away. It would seem unreasonable to make a railroad hold cars out indefinitely when overshipments have been made.

The result of this action of ours in charging demurrage on those cars held in the outer yard, when there were cars which the shipper could unload, was to change the method of doing business very largely, and stop the handling of hay on commission, so that now hay coming to Philadelphia and to Baltimore, and I think to almost all other cities—I understand that it is increasing here now—is bought at the point of shipment, and does not come into the large terminal unless it is needed. Then it is not delayed. Of course when a merchant gets held up on a thing of this kind, when he is forced to pay demurrage, after he has for a long time been using cars for storage, he does not like it, and it is very natural for him to try to get back at the railroad. If he has to pay a dollar a day demurrage, it is very natural for him to say: "Can't I get the railroad to pay this dollar to me in some other way?" And I think the word "reciprocal" as applied to demurrage simply means an attempt to get back. It is not reciprocal in the way of giving something, but it is an attempt to be reciprocal in the way of getting something back, generally.

If the railroads do not charge demurrage on their cars, then there grows up a set of merchants who do business in their hats and use cars for free storage. That you all understand. I do not think I need dwell on that, but I would like to say a word about what the railroads are doing in this matter, and what they have done.

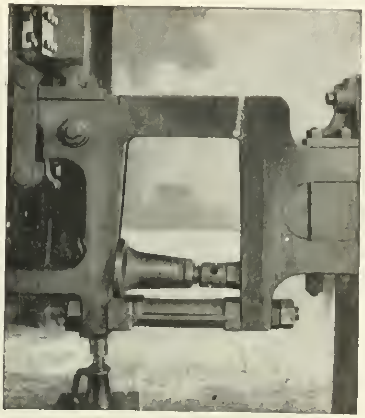
In the old days the car shortages were influenced and increased by the custom between railroads of charging each other for the use of cars by the mile. That put a premium on slow movement, and the movements of foreign cars in the country were then about what they were in New England; so the roads got together and decided to pay each other by the day. That was done about six years ago. They have increased the rate. During the extreme car shortage they got the rate up to 50 cents a day, and during that time they paid very considerable sums of money for our bureau in Chicago, which kept a very elaborate record to show where the cars were. The railroads have spent a great deal of money and taken a great deal of time to try to handle this matter properly. They are still at it. They have recently reduced the rate to 25 cents, because cars are not so scarce. They have appointed a commission of prominent railroad men to consider the subject and report, and I assure you that the railroads of this country have the question largely at heart. It is evoking more interest now than it ever has before.

The railroads understand now how important this thing is, and they are progressing toward a better method of car distribution much faster, I submit, than they will if one state attempts to tie them up in one way, and another state in another way.

A track watchman near Cologne, Hungary, for the substantial reward which the railroad usually pays to men who prevent accidents, unscrewed the nuts and removed the fish-plates at a rail joint, waited till an express train came in sight, and then laid torpedoes on the rails and brought the train up standing. The engineman, however, thought that the watchman had had plenty of time to fasten the joint after he saw him, and whispered his suspicions to a policeman. The next evening a tramp visited the watchman and said: "I saw your little game with the rail-joint. Bully for you! Of course I won't give you away; but when you get your hundred marks reward you'll let me have thirty, and then I'll be sure to remember." The watchman agreed, gave him a mark to bind the bargain, and agreed to meet him again the next day. The tramp was promptly on hand; but then he had his police uniform on. The watchman was tried and confessed. The State's Attorney said: "Judge, this is a serious matter. I ask for eight months in prison." The Judge said: "It is a serious matter indeed. Twelve months in prison and forever disqualified for any place in the railroad service."

Thermit Welding Instruction Book.

The Goldschmidt Thermit Co., New York, recently issued a book of instruction for the use of thermit in repair work, devoting particular attention to locomotive frame work. All through the book the writers urge the necessity of paying especial attention to the pre-heating of the parts before pouring the metal, and insist that the neglect of this precaution is apt to produce bad results.



Fracture on Locomotive Frame, Opened up by Drilling and Held in Place by Jacks in Preparation for Thermit Welding.

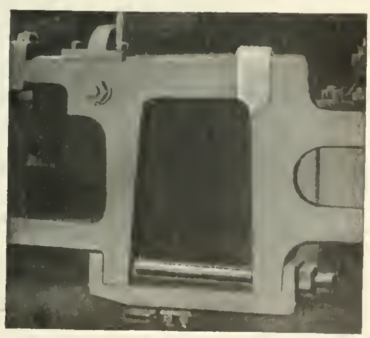
As the process has now become so extensively used for this class of repairs, the detailed instructions of the company cannot fail to be of interest to all who are called on to weld frames in division shops or roundhouses, where it is either impossible or undesirable to disconnect the frames from the cylinders and boiler. The instructions are as follows:

After having removed such parts of the engine as to make the fracture accessible and allow room for a mold box about 1 ft. wide, a series of holes should be drilled along the line of the break.

If the frame is a small one, ¾-in. holes should be drilled; if a large one, 1-in. holes.

Next clean the frame thoroughly at the fracture, as it is important that the thermit steel should come in contact with clean surfaces only.

The frame should now be placed in perfect alinement, and punch marks made on each side of the fracture within convenient reach of trammel points, yet far enough apart to be outside of the mold box, so that there may be no difficulty in regaining true alinement at the end of the welding operation.



Finished Thermit Weld on Locomotive Frame, with Reinforcing Collar Surrounding Fracture.

Jack the frame open about ⅛ in., to allow for contraction when the metal cast around the frame cools. The amount of this opening, however, must often be left to the judgment of the operator, as it depends on the width of the thermit steel collar.

Where the fracture occurs in a vertical member, or "leg" of the frame, it is necessary to construct a sand mold of such design as to cause the thermit steel to run through a gate to the lowest point of the mold and rise through and around the parts to be welded and into a large riser. The gate should not allow the thermit steel to impinge directly upon the metal of the frame, and the mold must allow for a band, or collar, of thermit steel to be cast around the defective parts or the ends of the pieces to be welded. The thermit steel flowing through this space in the mold will dissolve the metal with which it comes in contact and amalgamate with it, forming a reinforcement, which adds to the strength of the original piece, and must not be machined off entirely, although in case of necessity it may be removed from one or two sides.

The shape of this band, or collar, must resemble, in cross section, approximately the segment of a circle, the thickest part being directly over the fracture and sloping off gradually toward the edges. It should overlap the edges of the fracture at least 1 in.

The thicker the metal to be repaired the thicker must be the band of thermit steel, and the dimensions in general must make allowance for the nature of the repair.

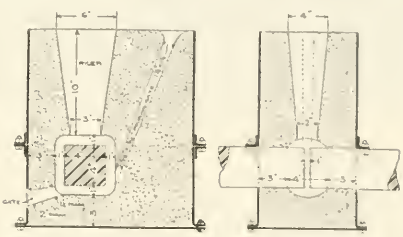
The matrix or pattern of the part to be repaired with the reinforcing band around it is first made, and from this a mold is constructed.

The best material for making molds is one part of fire sand, one part good fire clay and one part fire brick, thoroughly mixed in the dry state and moistened just enough to pack well.

As practically no two repairs are alike, the time and cost of making wooden patterns is considerable. A convenient way to make the molds for this class of work, therefore, is to use yellow wax as a matrix.

The parts to be welded are prepared for welding as previously described, and a wax pattern of the exact form desired in the final weld shaped about them, care being taken to fill up the opening between frame ends with wax. After this is done, molding sand is tamped around the matrix in the usual manner, except that a small hole is left at the very lowest part of the mold, as shown in the illustration. It is advisable to bend a small piece of copper tubing through the wax leading from the small hole at the bottom into the riser. This will make a passageway for the hot gases from the torch and greatly facilitate melting out the wax.

The patterns for runner and riser are best made of wood. Their volume should equal the volume of the reinforcement or collar which is cast around the fracture, as the first steel running out of the crucible into the mold becomes chilled when coming in contact with the metal of the frame, which, even when preheated, has a considerably lower temperature than the thermit steel. The chilling effect can only be overcome by a sufficient quantity of thermit steel, so that the chilled portion is driven up into the riser and is replaced in the reinforcement by metal which has practically the full temperature it received during the reaction.



Sectional Views of Mold for Thermit.

When the mold box is completely filled, the wooden runner and riser are withdrawn and the mold is then ready for the preheating and drying operation, which is performed without removing the mold from the frame, the wax running out during the preheating.

Place crucible in position with bottom directly over pouring gate and not more than 4 in. away. Charge crucible, but do not put in ignition powder.

Now direct the flame of a powerful gasolene-compressed air torch into the hole at the bottom of the mold and continue heating until the frame is red hot. It is important that the frame be red hot at the moment of pouring the thermit steel in order that blowholes and shrinking cavities in the weld be avoided.

When it is assured, therefore, that the frame is at a good red heat, quickly remove the torch and plug up the preheating hole with a dry sand core, backing it up with a few shovelfuls of sand packed thoroughly. Place one-half teaspoonful of ignition powder on top of the thermit in the crucible. (Thermit will not ignite from the heat of the torch and the reaction cannot be started without ignition powder. Ignite this with a storm match, applying same immediately after striking. When the reaction has ceased the thermit steel may be tapped into the mold by giving the tapping pin a sharp knock upward with the tapping spade.

In about five minutes from time of pour, release the screw jack and allow the frame to return into its original alinement, as shown by the punch marks. It is advisable, however, to draw up on the weld by means of clamps, jacks or other means, in order to relieve this section from the strains incident to the cooling of the metal in the weld and adjacent parts of the frame

Do not disturb molds for at least two hours after pour.

After removal of mold, drill through riser and knock off gate and riser.

It is important to remember that if the weld is to be made on one member of a double-barred frame, it is necessary to heat the other member with a torch in order to get equal expansion and contraction in both members and prevent unequal strains.

One cubic inch of steel weighs 4½ oz. To produce 4½ oz. of liquid steel requires 9 oz. of thermit. Therefore, to calculate the amount of thermit to use for any repair, first find as closely as possible the number of cubic inches in the reinforcement to be cast about the defective part. Double this to allow for metal in runner and riser. This number multiplied by nine gives the number of ounces of thermit to use.

A simple method of determining the amount of thermit necessary, when wax is used for a pattern or matrix, is to weigh (in pounds) the quantity of wax on hand before and after building up the matrix. The difference multiplied by 32 gives the weight of thermit required in pounds.

It is necessary, when more than 10 lbs. of thermit are to be used, to mix steel punchings or particles of steel, free from grease, into the thermit powder. The intensity of the heat of the reaction will be moderated thereby without interfering with the efficiency of the weld. In all cases the punchings should be preheated before mixing with the thermit. For 10 lbs. or more of thermit a proportion of 10 per cent. of punchings should be added. For quantities of over 50 lbs. of thermit, as much as 15 per cent. of small, mild steel rivets may be mixed in.

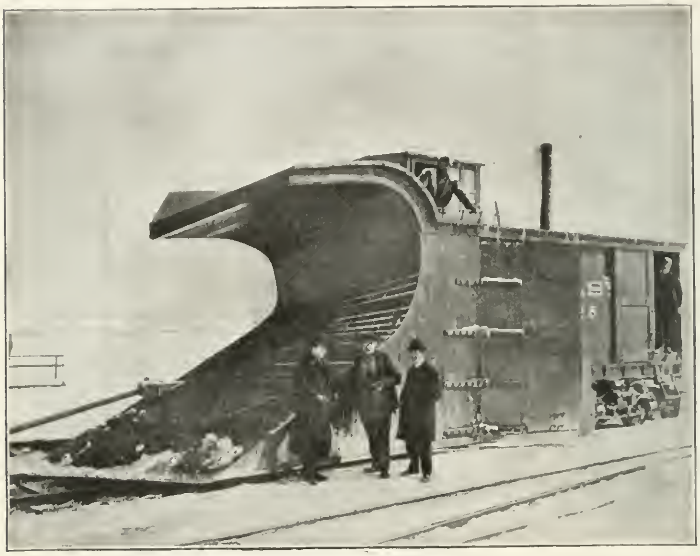
An addition of 2 per cent. of pure metallic manganese (based on weight of thermit) should in all cases be added, as this materially increases the strength of the thermit steel. Where metallic manganese cannot be had, however, ferro-manganese may be used, in which case 3 per cent. of the 20-80 alloy is recommended. The pure manganese is, nevertheless, preferred to the ferro-manganese, owing to the fact that where large quantities of thermit are used an addition of the latter tends to increase the violence of the chemical reaction.

The thermit reaction takes place in a magnesia-lined crucible, which has at the bottom a hard burnt magnesia stone. This latter again has a tubular opening, into which a small magnesia stone or so-called "thimble" of conical form is made to fit. This thimble provides the channel through which the liquid thermit steel is poured. The outlet must not be wider than ½in. After a few runs have been made the thimble should be replaced with a new one. It may be removed by carefully knocking upward and a new thimble, folded around with a layer of unereased paper, inserted in place.

The crucible is closed before charging with "plugging material," consisting of a tapping pin, asbestos washer, metal disk and refractory sand, made up in small paper packages and supplied ready for use.

First the tapping pin is suspended by its scarfed end, inside the "thimble." It must be cut down so that the end will project not more than 2 in. below the bottom of the crucible in order that it may be driven up when the crucible is to be tapped. With the pin cut to size and in place, close the top of the thimble first with asbestos washers and then with the metal disk. Ram firmly into place with the handle of a hammer, then cover with refractory sand. This is done to prevent the thermit steel from running out prematurely.

The crucible is tapped by knocking the tapping pin upward as previously described.



Type of Snow Plow Used on Quebec & Lake St. John.

Type of Snow Plow Used on Quebec & Lake St. John.

The Quebec & Lake St. John runs from Quebec north to Lake St. John, and from there east to the Saguenay river, crossing on the way several high ranges of hills. In this part of eastern Canada the winters are sometimes very severe. During the winter of 1907, for instance, there were very heavy snow falls, some great storms and almost continual drifting winds throughout most of the winter, yet through it all, while neighboring railroads were closed for days at a time, the Quebec & Lake St. John maintained its regular service.

This was accomplished by the efficiency of the snow plows used. One of these plows is shown herewith. They were designed and built by men on the road. They are built very solidly of heavy timbers. The wings and flanges are operated from the interior and thus form a combined head plow, wing plow and flanger. These plows exclusively have been used during the last 20 years and have done fine work.

For this information we are indebted to J. G. Scott, General Manager of the Quebec & Lake St. John, who built that road, as well as the Great Northern of Canada, now the Canadian Northern Quebec, which early in 1907 bought control of the Quebec & Lake St. John.

Car Surpluses and Shortages, March 18.

The following table is from bulletin No. 19-A of the American Railway Association's Committee on Car Efficiency. It summarizes the car surpluses and shortages from October 30, 1907, every two weeks to March 18, 1908, inclusive, being similar to the table published in the *Railroad Gazette* of March 27, 1908.

There is an apparent improvement in the general situation, the report for March 18 showing 17,950 less surplus cars. This decrease is more than covered in the coal car figures, the only other improvement of any consequence appearing in the flat cars, whose decreased surplus is more than offset by the increase in the surplus of miscellaneous cars. It is probable that a large proportion of the 20,000 less surplus coal cars can be accounted for by the action of railroads and coal operators in storing coal in anticipation of a suspension of labor at the coal mines on April 1.

The Southern, Middle Western and Southwestern groups show horizontal decreases in all classes of cars, indicating an actual improvement in all lines of traffic in those particular sections, which, however, have been somewhat behind the rest of the country in showing signs of a slight rally from the extreme depression shown in January and early in February. In the New England group the surplus equipment continues to increase. The Canadian roads also, which have heretofore shown the greatest improvement, are again accumulating idle cars. Except for those mentioned, there is little change in the group figures.

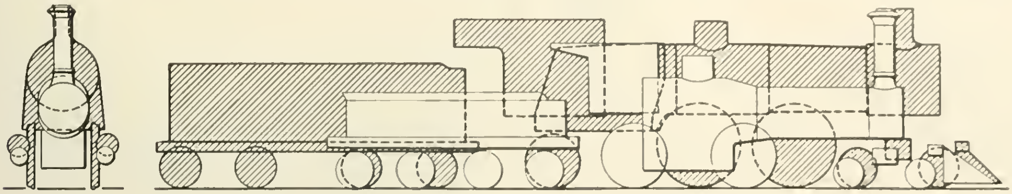
Surpluses and Shortages Bi-Weekly, from October 30, 1907, to March 18, 1908, Inclusive.

	Number of roads.	Surpluses. Box	Flat.	Coal, gondola and hopper	Other kinds.	Total	Shortages. Box	Flat.	Coal, gondola and hopper	Other kinds.	Total
March 18, 1908	160	103,509	25,122	119,205	49,206	297,042	533	151	250	73	1,007
March 4, 1908	162	103,905	27,232	139,223	44,632	314,992	943	19	600	57	1,619
February 19, 1908	161	113,776	30,088	134,217	44,432	322,513	697	141	249	162	1,249
February 5, 1908	158	112,046	30,312	156,634	44,936	343,928	737	281	15	67	1,100
January 22, 1908	161	124,622	27,328	142,338	48,292	342,580	392	132	79	135	738
January 8, 1908	163	149,664	23,087	127,138	41,874	341,763	457	34	42	120	653
December 24, 1907	158	87,714	14,740	64,556	42,300	209,310	187	81	191	265	724
December 11, 1907	153	18,977	9,888	27,462	33,012	119,339	2,506	420	746	848	4,520
November 27, 1907	160	16,246	3,645	10,028	10,429	40,348	11,908	868	2,964	2,224	17,964
November 13, 1907	164	4,103	1,208	2,365	4,525	12,201	37,473	3,066	10,914	5,550	57,003
October 30, 1907	161	786	600	1,285	1,275	3,946	61,592	3,546	15,987	9,632	90,757

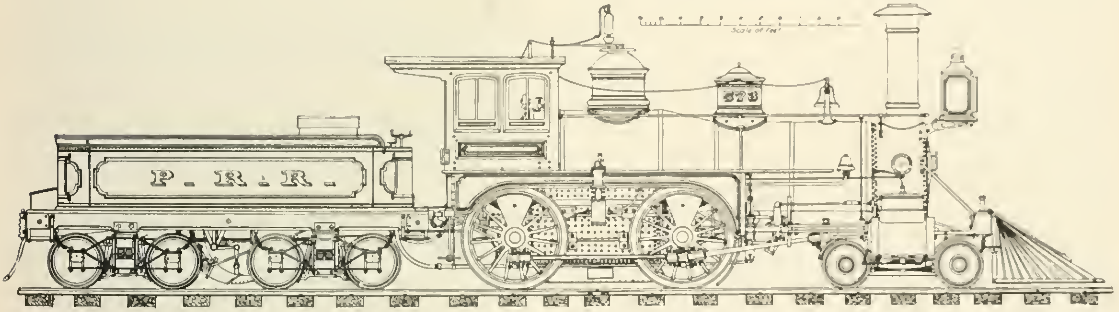
A Long Continuous Run of 1876, and the Engine That Made It.

BY C. H. CARUTHERS.

As early as 1875 the problem of making a run in 10 hours without a stop from Jersey City to Pittsburgh was considered by the officials of the Pennsylvania Railroad, and preparations were begun to carry out the idea. No. 573, one of the standard Class C^{III} (bituminous) passenger engines, the type at that time hauling nearly all through passenger trains on the various divisions of the road between Philadelphia and Pittsburgh, was selected for the trial. This engine had been built in 1872 at Altoona shops, and was in daily use on the Pittsburgh division. While exactly similar to all other engines of the class, it was believed to be a slightly freer steamer, and seemed to require less repairs than its mates. No particular changes were made on it except to equip the journal boxes of both engine and tender with rubber tubes which were carried to convenient locations to enable oiling to be done while running, and of course the entire engine was thoroughly examined and put in condition for such a run.



Comparative Sizes, Standard Passenger Engine of 1876 (C^{III}) and of 1908 (E3A).



P. R. R. No. 573. Built at Altoona Shops in 1872.

Cylinders, 17x24 in. Drivers, 62 in. Weight on drivers, 49,500 lbs. Total weight, 74,300 lbs. Firebox, 35x72⅝ in. Flues 155; 2¼ in. x 127½ in. Boiler, 48¾ in. diameter. Center above rails, 74½ in. Heating surface, 1,056.98 sq. ft.

To provide a sufficient amount of fuel, an ordinary baggage car was used as a storage room for coal and was also provided with a water tank. This latter was to enable the engine to maintain a sufficient supply of water between Huntingdon and Sang Hollow track tanks, a distance of about 75 miles, in which no provision had been made at that time for taking water without stopping, between the points named. The coal passers and other employees except those actually handling the engine also occupied this baggage car as a sort of waiting room.

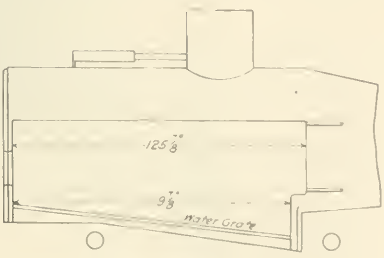
The coal used was especially mined for the purpose at one of the extensive bituminous coal mines near Irwin, in the famous "Pittsburgh" gas coal field. William Phillips, the regular engineman of 573, accompanied it during the entire trip but only ran it over his own division, as enginemen from each of the other divisions were on the train and ran it over their respective divisions.

The western enginemen were somewhat amused at hearing for the first time, during this trip, trips at a nomenclature prevailing at that time among some of the employees of the New York division, and which was evidently derived from the days of the hook motion, not then so very remote, when I believe it was customary for enginemen to say, "Hook her forward," or "Hook her back," and when these men referred to the position of the reverse lever in the quadrant, they substituted "Link her up" and "Link her down" for the western "Drop her down" and "Cut her back."

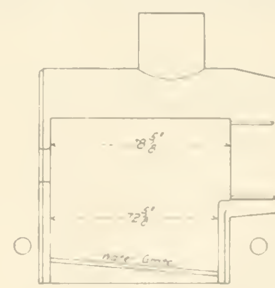
When the final preparations were completed, a start from Jersey City was made on an autumn day of 1875, and at first everything indicated a successful termination of the trip, but when the train was in the vicinity of Pomeroy, Pa., 131 miles west of Jersey City, a young man connected with the motive power department of the company, was struck by a milk shed and killed as he leaned from the car steps in an attempt to see a journal box which he thought was heating. Of course the train was stopped and the experiment was abandoned for the time, and it was not again attempted until during the early summer of 1876.

It was then taken up in connection with an attempt made by a theatrical organization to travel from New York to San Francisco in 84 hours. In addition to engine 573, and its special baggage car of the former trip, the train consisted of a P. R. R. combination car, a Pullman hotel car and one Pullman sleeping car. All the cars were fitted with rubber oiling tubes like the tender and engine, and also had openings provided in the floors to afford access to the journal boxes. The cars used on the first attempt were prepared in the same manner and it is singular that the young man who lost his life on that occasion should have attempted to watch a journal box from the steps instead of through these safe and convenient openings.

The start was made at 1.03 a.m. June 1, 1876, three minutes after the appointed time on account of waiting for some special newspapers which were to be sent along, and without any subsequent hindrance the train pulled into the Union Station in Pittsburgh promptly at 11 a.m.—just nine hours and 57 minutes after the start from Jersey City. The fastest time during the run was said to have been made over a strip of four miles on the New York division which was covered in three minutes, and the slowest speed was that of 20 miles an hour observed while passing through the Altoona yards.



Firebox of C^{IV} Anthracite.



Firebox of C^{III} Bituminous.

Engine 573 was disconnected from the train at Pittsburgh and also the three cars belonging to the Pennsylvania Railroad, but the Pullmans were in a few minutes started out over the Pittsburgh, Fort Wayne & Chicago Railway on their way to the Occident, the Pennsylvania Railroad conductor accompanying them. This latter part of the trip was claimed to have been made in such time as brought the entire trip within the 84 hours desired from coast to coast, but the interest of railroad men centered chiefly in the 10 hour run without stopping between Jersey City and Pittsburgh.

The line had been kept well cleared to insure success, and the long summer daylight prevailing at the time enabled over 300 miles of the distance to be run after sunrise, so that its progress was watched with enthusiasm by large numbers of people along that portion of the line.

The principal dimensions of 573 were:

Cylinders	17 x 24 in.
Driving wheels, diameter	62 "
Weight on drivers	(about) 49,500 lbs.
Total weight	74,300 "
Firebox	35 x 72⅝ in.
Flues	155
" outside, diameter	2¼ in.
" length	127¹/₁₆ "
Heating surface	1,056.98 sq. ft.
Boiler, diameter	48⅝ in.
Boiler, center above rails	74½ "
Driving wheel base	102 "
Total wheel base of engine	22 ft. 5⅝ "
Length over all of engine and tender	54 ft. 5⁹/₁₆ "
Steam pressure, maximum	125 lbs.
Fuel	Bituminous coal

A full-stroke pump on the right-hand side connected to the crosshead, and a non-lifting No. 7 Sellers injector on the left, furnished water to the boiler. Bridges had not come into use on the road when this engine was built and the tallow-cups, and valves for blower, heater and injector were tapped directly into the roof sheet at various points on its surface where it was projected into the cab. A surface cock, or "skimmer" as the men called it, was placed in the boiler head at about the same level as the upper compression gage cock. When first built the engine had no driver brake, but I think one had been put on before the time of this trip. It will also be noticed that the headlight numbers are wanting, that feature not having been introduced until two or three years later; and also that the smoke-box is of the pre-extension type, the extension having only been adopted on the road after 1880.

The stack, although of the straight type, contained a system of spark arresting devices invented by James Smith, an employee of the company, about 1870, and used thereafter on all passenger engines until the coming in of the extension front. The valves were of plain D type with a travel of 5 in. and ¾ in. lap.

Between 1873 and 1877 a large number of "C" engines were built to burn anthracite coal on the New York division, and only differed from the 573 in the firebox, which was 34½ in. x 119⅞ in., necessitating it being carried quite through the cab and against the cross frame at the rear, and in being furnished with bridges upon which the tallow cups, blower and valves for heater and injectors were placed. The throttle lever and glands were also on the rear end of this bridge, and the stem extended through the bridge and its pipe into the dome. These latter engines were known as Class Civ, anthracite.

All of both types have been off the road for several years, some having been scrapped and others sold. During the later years of their service several of the Civ type had 68 in. drivers substituted for the original ones of 62 in.

The writer is under obligation to Theo. N. Ely, Esq., Chief of Motive Power of the Pennsylvania Railroad, for courtesies which enabled the verification of a considerable portion of the data from which the foregoing article was compiled.

The Work of the Bureau of Explosives.

The report of the Chief Inspector of the Bureau of Explosives of the American Railway Association, Major B. W. Dunn, U.S.A., has been submitted, covering the work of the Bureau from June 10, 1907, to February 1, 1908. From the report we select the following extracts:

On June 10, 1907, the Chief Inspector's office was opened and there was presented to him the problem of organizing the work of the Bureau. In the many difficult situations that have arisen he has received from the executive committee, and especially from the President and Secretary, assistance and advice that have been invaluable and that have been given, not only without financial compensation, but without regard to the demand on their already overtaxed time.

A preliminary study indicated that sound judgment and tact would be necessary to secure success. The agents of the Bureau are invested with authority under specific circumstances, but it was realized that the unwise exercise of this authority would be more than objectionable. These agents are employees of each member of the Bureau and they work over any line under the direction and authority of its General Manager. It is a natural but a mistaken tendency to regard them as representatives of foreign authority. It was also appreciated that the Bureau would have to deal with both operating and traffic departments and that restrictions recommended by it might be unwelcome to those officials whose duties include the difficult one of placating customers. It affords me pleasure to report that, as a rule, hearty encouragement and support have been received from all railroad officials. It was also realized that manufacturers would suspect our motives in entering their property and criticising their methods. They are divided by competitive issues, and the fear that restrictions placed upon them may not apply with equal force to their competitors is natural.

Careful consideration of all these conditions led to the conclusion that while the policy of the Bureau would be to secure, ultimately, uniform enforcement of regulations, it would be necessary to recognize the fact that the introduction of radical changes requires time proportional to local conditions and obstacles. For example, to insist upon immediate correction of the custom of disregarding almost entirely the furnishing of cars that meet requirements, would paralyze the business of the shipper. After an appreciation of the facts by operating officials, some time is necessary for them to provide the necessary facilities for selection and preparation of cars. In a similar way, the manufacturer who has been violating most of the regulations, and shows a willingness to reform his methods as rapidly as possible, should be given a reasonable time to do so with the important provision that positively dangerous practices must cease at once, even if this requires an embargo on all of his shipments.

The organization of the Bureau includes a Special Agent and 17 Local Inspectors charged with the inspection service; a Chemist and one laboratory assistant and an office force of five in addition to the Chief Inspector.

The following statistics indicate the inspection service of the Bureau during the period stated:

Stations Inspected.	
Total number of stations inspected	1,116
Stations found not supplied with blanks and placards	628
Stations found where violations as to loading, handling, placarding, and forwarding explosives were observed	561
Stations found where leaking explosives had been accepted for shipment	30
Factory Inspections.	
Total number of factories inspected	141
Number found not complying fully with regulations	94
Number found failing only in minor details	47
Number found to be failing in important regulations, i. e., driers, boxes of less than required thickness, no lining to boxes, more than 60 per cent. dynamite made and shipped	47
Magazine Inspections.	
Total number of magazine inspections	583
Number of magazines in which black powder stored showed defects in marking	105
Number of magazines in which high explosives stored showed defective marking	60
Number magazines in which leaking kegs of black powder were found	9
Number of magazines in which high explosives were stored in boxes less than required thickness or not lined	134
Number of magazines showing dirty floors stained with nitroglycerine	119
Number of magazines in which high explosives stored were found in leaking and dangerous condition	59
Inspections of Cars in Transit.	
Total number of cars containing explosives inspected in transit or after arrival at terminals	178
Number of cars which did not comply with regulations as to preparation, loading, placarding, etc.	127
Number of cars showing movement of lading, account improper loading and staying, or conditions such as would permit an accident	99

The following are examples of cars inspected, showing some violations observed:

Car No. 69,333 containing over two tons of dynamite was inspected and found with cracks in roof, sides and ends; packages were insecurely braced, light material having been used, and this bracing had given away, permitting the packages to shift and slide about the car. Prohibited articles, consisting of loose iron pipe and roll of wire cable in upright position, were loaded in the car; placard on one side only.

Car No. 8,039 was inspected and following result shown. Car of 50,000 lbs. capacity, contained loose boards, cracks in roof and ends, doors not tight and not stripped to prevent entrance of sparks; floor not clean, and had projecting nails and bolts; king bolt not protected, extending ½ in. above car floor; packages of dynamite (6,850 lbs.) were not stayed in any way and had during transit been knocked about the car, one box having lid off and cartridges exposed. Prohibited articles, in form of blasting caps and fuse, were loaded with the dynamite. One door of car partly open, and car without required number of placards.

Car No. 1,060 on inspection was found to contain miscellaneous merchandise, black blasting powder, matches and oil; car had crack in end sufficiently large to permit entrance of sparks.

Car No. 88,513 loaded with 10,000 lbs. black powder (blasting) was found with large holes in end of car and over doors. Kegs had not been properly stayed and had shifted, breaking open some of the kegs and spilling powder on car floor.

Accidents in factories in 1907 are shown in the following table:

	Dynamite.	Black powder.	Other explosives.	Totals.
Number of accidents	26	20	20	66
No. of injured, but not fatally	15	33	14	62
Number killed	36	57	8	101
Property loss	$209,900	$17,100	$52,400	$279,400

It is difficult to get reliable information of the causes of accidental explosions, and especially difficult in factory explosions. The amounts stated as covering the property loss do not include many of the explosions and are therefore incomplete. The Bureau has no legal or other right to insist on investigations by its representatives, and manufacturers do not welcome the presence of strangers on such unfortunate occasions.

Among the accidents in transportation during the year 1907 were the following:

January 19, 1907. Sanford, Ind.—Car containing 500 kegs, 12,500 lbs. of black rifle powder, manufactured by American Powder Mills, West Acton, Mass., in train 21 cars from engine and 12 from caboose, between box cars loaded with merchandise—took siding at Sanford. A passing train, consisting of engine, express car and two coaches had reached point where express car was opposite car containing powder when it exploded. Six freight cars were destroyed; express and passenger cars destroyed. Fifteen persons killed; 30 injured; property loss, $30,000; equipment, $13,150; total loss, $43,150, exclusive of damages for loss of life.

Cause: Unknown. It was claimed to be due to criminal act of outside party. It is possible that cars had, during course of transportation, received shocks sufficient, with imperfect staying, to cause powder to leak from kegs, making a train of powder which was set on fire. It is stated lightning struck the car—no evidence.

March 24, 1907. Atlanta, Ga.—Eight boxes of blasting caps, weight 970 lbs., made by the Metallic Cap Mfg. Co., exploded while being handled by employees. Four killed; four injured.

Cause: Unknown. It is possible that one of the handlers used his hook and struck one of the caps which detonated and caused the others to explode. It is also possible that a box was dropped and exploded by concussion.

April, 1907. Covington, Va.—Car containing 16 bbls., 9,400 lbs., permanganate of potash caught fire and burned the car.

Cause: Probably caused by spilled material mixing on floor of car with some combustible substance. Such a mixture is inflammable and can be ignited by friction.

June 4, 1907. Reddick, Ill.—Six hundred (60-lb.) boxes of black powder exploded while in transit.

Cause: Tank car containing naphtha was derailed, causing a number of other cars to leave the rails; fire started and spread to car containing powder. Explosion occurred; three killed; 17 injured. Property loss, $25,279. Damages for loss of life, if any, not known.

July 21, 1907. Becks Hot Springs, Utah.—Car partly loaded with black powder on siding caught fire from spark of engine from train which passed about 3.28 p.m. Three other cars on siding contained dynamite (amount not stated, probably 2½ carloads), and these exploded at 4.15 p.m. Property and equipment loss $10,891.

Probable cause: Car with poor roof used.

Aug. 10, 1907. Boulder, Colo.—Two thousand one hundred lbs. Hercules dynamite and 200 lbs. Atlas du Pont powder. Hercules was manufactured July 25, 1907. Result: Three deaths; five injured; loss $200,000.

Cause: Fire started in freight depot which was destroyed; spread to car containing dynamite and explosion occurred. Regulations covering storage of cars containing explosives evidently not followed. This car should have been placed in safe place where there was no danger of fire. There were 38 freight cars destroyed.

Aug. 11, 1907. Essex, Ontario.—A shipment of 5,000 lbs. of 60 per cent. dynamite cartridges 18 in. long, exploded in a car located in a mixed train between the engine and a coal car.

Cause: During a hot wave of weather the shipment was loaded without staying, in a way car, at Black Rock, N. Y., consigned to Amherstburg, Ontario. During the trip conductor noticed several boxes standing on end, but did not correct the fault. About 24 hours after these boxes were observed to be on end, small explosions were heard which, by investigation subsequent to accident, were attributed to drops of nitroglycerine falling from car to wheel and exploding by pressure of wheel on rail. Conductor with two members of crew entered car and turned boxes on sides. It is probable that this uncovered some hole in car floor, previously partially closed by weight of box, and that a large enough quantity of nitroglycerine reached the wheel during the stop to make the next explosion, just after starting the car, strong enough to cause the explosion of entire lot. At this time the Bureau had not been able to inspect the railroad or instruct any of its employees in our regulations. It can be stated with confidence that a strict enforcement of these regulations would have prevented this unfortunate accident.

Aug. 17, 1907. Ohio street dock, Buffalo, steamer "Utica"—Barrel "liquid cement" in being loaded, fell, broke and scattered contents over floor of hold. Three men with shovels were being used to collect the cement, and a man was engaged in placing shavings around the wet floor. The gaseous vapors became so strong that some of the men complained and left the hold. One man stated he would put a head in the substituted barrel. An explosion then occurred and enveloped the hold of the steamer in flames. Three men killed; two injured.

Cause: Ignition of mixture of inflammable vapors and air by spark from hammer and nail or other source of fire.

Aug. 17, 1907. Kingston, N. Y.—Six barrels "cement" (rubber) loaded with merchandise, on arrival at Kingston were found to have leaked on car floor, and odor of naphtha was perceptible. Railroad employees entered car with lighted lanterns, fire started and burned freight house, several cars and contents, causing a loss of $139,841.

Test of cement from these shippers showed the solvent to be 80 deg. gasolene, the most volatile and inflammable grade on the market.

Recapitulation of the accidents in transportation in 1907 shows the following figures:

	Number			
	Accidents.	Injured, not fatally.	Killed.	Known property loss*
Dynamite and high explosives	6	27	9	$335,891
Black powder	3	47	18	68,429
Other explosives	2	2	..	
Inflammables	6	2	4	139,841
Totals	17	78	31	$544,161

*Including equipment

Respecting the relation of the Bureau to its members the Chief Inspector speaks as follows:

No friction of any kind has occurred in this relation. Our inspectors seem to have shown the good judgment and tact emphasized in the list of qualities that guided their nomination and appointment. Effort has been made to keep this relation as harmonious and intimate as possible. Several profitable conferences between the Chief Inspector and bodies of such important railroad employees as station agents and yardmasters have taken place with a view to perfecting the details of regulations. In many cases the Chief Inspector has served as a useful medium in conducting investigations to determine responsibility for violations, where the correspondence would otherwise have had to take place between the officials of different lines. The advisability of having a disinterested party conduct such correspondence is apparent.

In August, 1907, two cars containing a total of 40,000 lbs. of dynamite were held up in Buffalo, N. Y., because this dynamite was of the same grade and from the same factory as that which had exploded a few days previously while in transit at Essex, Ont. The switching road was unable to send the cars forward to destination or back to the factory; and in the meantime it was holding them illegally within the city limits. By report based upon careful inspections and chemical analysis of samples, the Bureau was able to secure forwarding of the cars to destination under immediate supervision of one of the local inspectors. If the shipments had been too dangerous to forward, it would have been necessary to destroy them, and this would have emphasized, to a still greater degree, the necessity for the services of experts of the Bureau.

It is intended to arrange to have the Chief Inspector, or a representative, attend as frequently as possible during the ensuing year, the stated meetings of operating officials of our membership lines, to discuss the transportation of explosives, answer questions concerning regulations, explain the general plans and policies of the Bureau, and in every proper way to stimulate interest in our work and increase knowledge of our regulations.

The relations of the Bureau to the Manufactures of Explosives are thus described:

It was soon appreciated that the good will and active co-operation of manufacturers are essential to an enforcement of our regulations among their employees. Without their co-operation we could not secure enforcement, even if we maintained an inspector at each of the 164 plants. The basic idea in seeking this co-operation has been to convince the manufacturers that our efforts for greater safety are in line with their interests and that we can be of material assistance to them. When we discover an explosive in bad condition, we endeavor to locate the cause and to furnish full information in regard to it to the manufacturer, with such suggestions as our experience may indicate to improve the product. Our broad experience, based on our connection with all manufacturers and many railroads, will also enable us to place at the disposal of each manufacturer the best methods for loading explosives in cars. We do not disclose, of course, to one plant the improved manufacturing practices in vogue at others, where the information given would be adverse to the interests of the more progressive manufacturer, nor do we violate in any other way the confidence under which information of this kind is imparted to us.

As was anticipated, we were met at the beginning with a frank statement of suspicion that we would not apply our restrictions impartially and uniformly. The small and independent manufacturer could not conceive that a Bureau of this kind would be operated otherwise than in the interests of the larger plants. By exercising proper patience in dealing with individual cases, it is believed that we now have the complete confidence of practically all of the manufacturers. In November, 1907, there was a general acceptance by them of an invitation to meet the Bureau for the purpose of discussing proposed changes in regulations. They appreciated this opportunity to express freely their objections to all proposed restrictions. Each restriction was taken up in turn in the spirit of impartial discussion and with a view to indicating clearly the reasons that prompted it. One result of this conference was the appointment by the manufacturers, at the request of the Bureau, of a committee to represent them in order that future conferences with the Bureau could take place promptly, each member of the committee representing a number of allied interests. The knowledge that through this committee they will have an opportunity to present, in friendly discussion, their side of any controversy, has had a very salutary effect. It has been made plain that, since the responsibility for any explosions in transit rests entirely on them, the railroads, through the American Railway Association, must retain the right to make a final decision on regulations.

The importance of proper staying of packages of explosives in cars is stated below:

The best of packages are liable to receive injury during transit if not properly stayed. While our regulations have required proper staying, no standard methods have been prescribed, and those in practice are almost as varied as the number of manufacturers. Different methods are used even by plants under the same general management. It is evident that some one method is the best for a particular style of package. The members of this committee of manufacturers were invited to study this subject and to bring to a conference that took place on January 17, 1908, detailed descriptions, drawings and photographs. A day was spent in discussing various suggestions, and arrangements were made for a practical test of what seemed to be the best methods. In these tests, cars loaded with dummy packages will be given as rough treatment as a car should receive in transit, and in due time we shall know what the best methods are. A pamphlet will then be prepared for general distribution describing these methods in order that all staying by manufacturers and railroad employees may be in accordance with them. The result will be a material increase in safety, and, in many cases, this will be obtained by a saving of some labor and material heretofore expended.

The regulations for the safe transportation of explosives and other dangerous articles in their present and in the proposed revised form are treated at length. In this connection the report has the following statement:

The exhaustive and able work of the committee on transportation of explosives during the spring and summer of 1905 resulted in the regulations that were adopted by the American Railway Association in November, 1905, and have been in force since that time. It is natural that an experience of about 2½ years should indicate a number of advisable changes. With the assistance and co-operation of the executive committee, the Chief Inspector has endeavored to revise these regulations. The first revision was published in the proceedings of the Association for October, 1907, and since that time additional changes have been made as a result of the various suggestions received. A galley proof embodying these changes has been distributed to General Managers, and it is anticipated that the final revision can take place in the near future. It is natural that the anticipation of revised regulations should interfere with the enforcement of the present ones, and it is earnestly hoped that the new regulations can be put in effect not later than March 1, 1908.

The following are some of the general ideas that governed the revision:

(1) Definitions and information to be used principally by manufacturers, shippers and inspectors have been collected in Section I. The rules governing the action of all concerned have been placed in Section II. All of the rules referring to packing and marking, and to preparation of a car for any particular explosive, have been brought under one head.

(2) Some relaxation of requirements affecting small shipments of the more dangerous explosives, and large shipments of the safer ones has been permitted in order to facilitate a more strict enforcement of precautions in handling the more dangerous shipments. Even if an explosion of one of these small shipments should occur as a result of this relaxation, the damage will be relatively small, and we shall be benefited, on the whole, if we prevent an explosion of a large shipment. When a large proportion of cars require special treatment it is natural that trouble should be experienced in securing it. The more limited the number of such cars, the easier will it be to secure it.

(3) Elements included under the general head of ammunition have been separated and will be shipped under their proper names.

(4) The authority to use an annual certificate, heretofore granted for small-arms ammunition, has been extended to all kinds of explosives. It is believed that a general certificate from a responsible party will be as effective as the special one so many of which have been required that their use has become perfunctory.

(5) Some relaxation has also been introduced in the requirements affecting the loading of different kinds of explosives in the same car. It is believed to be a correct general principle that any vacant space in a car containing explosives, with a certain attending risk, can properly be used for any other explosive having no greater risk and not bearing to the explosives in the car a special relation which would increase the risk for both. Such a relation is found in the transportation together of detonators and high explosives.

(6) At the end of the regulations is introduced a condensation of rules arranged for the various railroad employees. This should be of material assistance to them and will save the time required to extract the paragraphs referring to them.

It was intended to have the Bureau supervise the transportation of dangerous articles other than explosives. These articles are included under the general term "inflammables." It is well known that while many railroads have published regulations for this traffic, their employees as a rule treat these articles as ordinary merchandise. Where the regulations are enforced, it is usual to require employees to attach to packages labels conveying general cautions for handling. The attachment of these labels is followed by the attachment to the car of placards calling for special treatment of the car. For guidance of employees in labeling packages it is usual to furnish a list giving the trade names of various articles whose natures bring them within the class of inflammables. This list is long and, even if railroad agents were accomplished chemists, they would not have the time to determine accurately in any given case, whether a package required a label. The result is that they either neglect the regulations, or, to be on the safe side, they label all suspected packages. The latter is the usual case, and it results in placarding so many cars that the regulation defeats itself and special treatment for these cars is not obtained.

While adopting the general principle of labeling packages and placarding cars, the regulations proposed by the Bureau place on the shipper the duty of attaching labels and furnish him with definitions for his guidance. It will be the duty of our inspectors to check the performance of this duty by the shipper in conjunction with the check afforded by the general knowledge of station agents. It is manifestly impracticable to require these labels on all packages of the defined articles without recognizing the fact that very small quantities, even of some of the dangerous ones, can be carried without great risk, and without recognizing also the unnecessary hardship of requiring shipments from the retail drug trade and other sources, containing small quantities of inflammable materials, to have labels attached. At the same time a general limit for the maximum quantity that can be transported without a label will not be applicable in all cases, and some elasticity in the regulations is necessary. This has been obtained by the suggestion that the Chief Inspector be permitted to make an examination in any given case and, after consideration of all important factors, to prescribe for the given article, packed in a given way, the maximum quantity that can be received without a label. As in the case of explosives, it is permissible to transport limited quantities, even of labeled packages, without placarding the car. This limit has been placed at 100 lbs. gross weight.

Shipments from storage magazines form a considerable proportion of the explosives transported by the railroads. Concerning them, the report says:

So far as known, no attempt was made before the organization of this Bureau to locate these magazines, and the additional danger attending shipments of explosives offered by them was not thoroughly appreciated. To appreciate it it is only necessary to remember that many explosives are liable to deteriorate with age and at a rate dependent upon the conditions of storage. The shipments offered at factories are usually freshly made and comparatively safe. Shipments offered by magazines may have been stored for indefinite periods and under unfavorable conditions. It is recommended that Article VI. of the Constitution of the Bureau be amended to make storage magazines a basis for assessment.

The inspection service of the Bureau is its most valuable service. An idea of what has been and what is still to be accomplished may be had from the following extract:

In the first assignment of our inspectors one man was placed on duty on some railroad with instructions to make a general inspection of the whole line. These inspections included stations, factories, magazines and cars in transit. Separate blanks were prepared for his report under each head, and he made frequent summaries by letter of his observations, sending copies to the Chief Inspector and to the railroad officials under whose direction he was working. On completion of his general inspection of the entire line, a consolidated report of his observations was prepared in the office of the Chief Inspector and sent to the General Manager of the line for his information, and such action as seemed to him advisable. During this work the inspector acted somewhat as a skirmisher in advance of an army. It was his duty to locate the points where the inspection work of the Bureau is needed and his search for these points was frequently attended by loss of time, especially in sections of the country where train service is infrequent.

The second step in regulating the work of these inspectors, now in progress, is to divide the United States and Canada into 17 districts, assigning each man to a district and requiring him to become familiar, as soon as possible, with the conditions in his district, so that his time can be used to the greatest advantage. This system was started at the beginning of the present year. When an inspector becomes familiar with the points in his district where shipments of explosives originate, and acquainted with the railroad employees connected with these shipments, he will know where his services are needed and he will be able to follow up his inspections to secure correction of violations discovered by him. Experience shows that practically all of the violations of regulations that have been discovered at stations can be included in a comparatively short list of about 16 paragraphs. The blanks have been revised to show these violations and an inspector will have only to check off on the printed list the violations discovered at any station. Under the new system he will leave a copy of this checked list with the railroad agent in order that this agent may not forget the faults to be corrected. Copies will also be sent to the Superintendent, to any other railroad official who may be designated to receive them, and to the Chief Inspector. On subsequent inspection of the station the inspector will call for the previous list of checked violations and will ascertain whether they have been corrected.

With a district covering, in the case of one inspector, over 20,000 miles of railroad line, it is evident that an inspector cannot reach all of the points in these extended districts as often as is desirable. In some sections it is probable that little traffic takes place in explosives, and that the number of points requiring periodical visits from him will not be proportional to the mileage of his district. Until all of these districts are worked over, it will be impracticable for the Chief Inspector to state exactly where his inspectors are needed and how often. As soon as it becomes evident that the points in any one district are too numerous to be checked properly by one inspector, it will be advisable to put another inspector into this district, or to snb-divide it. This will mean an increase in our expenditures. It will be for the members of the Bureau to decide whether these increased expenditures will form a profitable investment.

The volume of inspection work necessary to secure uniform enforcement of regulations is shown by experience to be much larger than was appreciated when the organization of the Bureau was proposed. It was estimated that five or six inspectors might suffice. We now have 17 on duty. The following statements are instructive:

Total number of lines which are members of bureau.......	93
" lines which have received first general inspection....	32
" " " have received partial inspection	9
" " " are now being generally inspected and not included in above......	25
Lines assigned to inspectors and which will, as soon as practicable, receive inspection.	27

Based on data now available, it is estimated that, even with our present membership, the services of our inspectors will be required periodically at 3,000 widely distributed stations, factories and magazines. In 1,663 "one man working days" we have inspected, since August 1, 1907, 1,840 points, an average of over one point per man per day. If we have an inspector visit each point once in three months (see Section 2, Article IV. of by-laws) we shall need, at the above rate, 40 inspectors. With our present force we cannot expect to visit each point once in six months. We are about to issue regulations for the transportation of inflammables, and the volume of this traffic is many times that of explosives. The work of checking the proper use of labels by the shippers of inflammables is essential, and it cannot be done satisfactorily by station agents. Our inspectors should be numerous enough to secure periodical inspection of the packing departments of the large shippers of inflammables, and at least some supervision of the small ones. An increase in our force of inspectors will necessitate increases in our office and laboratory employees to meet the increases in correspondence and in number of samples submitted for analysis.

The questions opened by this glance into the future are serious. The Bureau has undertaken a work of unsuspected magnitude. If it does not secure the financial support required, how shall we decide what to neglect? If our neglect of the larger part of our natural work is evident to all, shall we not be voted a failure, irrespective of any excellence in our limited efforts? The Chief Inspector undertook the organization of the practical work of the Bureau under the impression that the task would be completed within a year, after which he would be free to return to the duties of his profession, and he views the matter now from a standpoint that would be entirely disinterested if it were not for a pardonable pride in his work and a desire, before surrendering this work to a successor, to see the Bureau well established in its field of usefulness. It must, at this critical stage, either advance or recede; it cannot stand still. It has not been forgotten that the executive committee authorized, on October 29, 1907, an increase of our inspecting force to 25. This has not been done because of the strong impression received from the treasurer, and confirmed by correspondence of this office, that a rapid increase in our assessments, while members were in doubt as to the value to them of our work, would seriously endanger the life of the Bureau.

Our records for 1907 show six major accidents from explosives and one large fire from a shipment of inflammable liquid. The total of the known losses was over $500,000. The value of property destroyed and damages paid do not represent by any means the total loss. We must consider, although we cannot evaluate, the losses to delays in traffic, loss of business and, most of all, loss of confidence and of prestige. To ensure the uniform enforcement of the regulations as adopted, regular inspection of the manner in which they are being enforced is necessary. The promulgation of the regulations, which has been wanting, however, in a few instances, is not by itself sufficient, as has been ascertained, to ensure uniformity or efficiency in their observance. Expert instruction in the requirements of the regulations has been and will be essential, in order that they may be understood and applied in their entirety by the different classes of railroad officials and employees responsible for their execution as well as by the manufacturers and shippers of explosives. Approved methods of handling, loading, etc., must be communicated by the inspectors. Stations at which explosives are received, forwarded or delivered, require inspection in every detail of the requirements for safe transportation. Factories and magazines must be located, their methods ascertained and brought up to the standard of the regulations. Violations of regulations, whether resulting from ignorance or negligence, must be discovered, corrected and provision made against their recurrence. In order to guard against the shipment of explosives in a dangerous condition, either through deterioration or by improper packing, station agents must be instructed in the methods by which deterioration may be known by its evidences, and compliance with the required specifications for the packages must be rigidly insisted upon. It is through the inspectors that the information is communicated, and it is by them that the Bureau is informed as to the observance of the regulations by the different lines.

There are more than 160,000 railroad employees whose duties bring them in contact with the handling of explosives. These men have been found, for the most part, anxious to be instructed and ready to profit by the instructions given them. The difficulties encountered in the construction of the regulations are often cleared up where the reasons for them have been explained. The determination of the condition of shipments of explosives presents little difficulty after the causes of bad condition have been explained, and instruction given as to the evidences of it. In this way knowledge produces confidence, and, at the same time, impresses the necessity for the careful observance of the safeguards prescribed for transportation. That the results obtained in the directions stated are what they are, is a high tribute to the zeal, intelligence and efficiency of the inspectors, the most of whom have acquired their experience in the transportation of explosives since their connection with the Bureau. The wide extent of the field covered by their inspection, the limited number of the inspectors, the organization of the system literally from the beginning during a period of only seven months, are all to be considered in estimating the value of their work, which is full of the promise of usefulness, enriched by experience, and under conditions of improvement already apparent in many directions. With its present force and necessary increases in clerical and laboratory force, the cost of the Bureau for the year 1908 will be about $80,000, with 25 inspectors, $105,000; with 40 inspectors, $150,000.

In the suggestion for a campaign for the education of railroad employees, the Chief Inspector reports that steps have been taken to have some of the traveling agents of the railroads assist the Bureau in the enforcement of the regulations. These agents are to receive instruction from the Local Inspectors and will be used to aid in the work of the inspectors on the lines on which they are employed. The employees who could assist in this way are Traveling Auditors, Traveling Freight Agents, Traveling Car Agents, Division Agents, Insurance Inspectors, etc. A majority of the membership has approved this suggestion, and has arranged to put it into effect. This will prove in time a valuable auxiliary to the inspection service of the Bureau.

Arrangements are also being made in a preliminary way for representatives of the Bureau to attend as often as practicable meetings of classes of railroad employees to be formed at the railroad branches of the Young Men's Christian Association, for the purpose of studying the general features of explosives and their safe transportation. Popular lectures will be given on these occasions and the opportunity afforded to have the employees ask questions in regard to the regulations and to be fully informed as to the reasons for them. Among the 160,000 railroad employees of this country a large percentage have duties in connection with the transportation and freight traffic departments and thus have to do with the direct handling of dangerous articles. Their education about dangers to be avoided and the way to get greater security for life and property can be thus readily afforded.

The report concludes with the recommendation that the present and prospective conditions be brought forcibly to the attention of the members in order to learn their wishes in regard to the amount they are willing to spend in the support of the Bureau. Assuming financial support, it is recommended that the Chief Inspector be directed to increase the force of inspectors at once to 25, and to make thereafter, during 1908, such further increase, not to exceed 40, as may be necessary to secure, as often as once in three months, a thorough inspection of all factories and storage magazines, and of all stations on the lines of the members where shipments of explosives are handled.

An interesting exhibit of the territory included in the assignment of the Local Inspectors accompanies the report.

Freight Tank Engine of the Prussian State Railroads with Schmidt Smoke-Tube Superheater.

The saving in water and coal by the use of highly superheated steam on locomotives is particularly important in tank locomotives, as in this way their radius of action can be considerably increased. The management of the Prussian State Railroads use highly superheated steam on tank engines extensively, having, already, 277 superheated steam tank engines in service and 120 building. One of the most successful types, an 0-10-0 simple engine with Schmidt smoke-tube superheater, is illustrated herewith. This engine was designed and constructed by the Berliner Maschinenbau-Akt.-Ges. vorm. L. Schwartzkopff, of Berlin, with the assistance, and under the supervision, of R. Garbe, of the Prussian State Railroads.

The principal dimensions of the engine are:

Boiler pressure	170 lbs.
Cylinders, diameter	24 in.
Piston, stroke	26 "
Diameter of drivers	53.2 "
Heating surface, firebox	120.0 sq. ft.
" " tubes	1,332.0 "
" " superheater	458.0 "
" " total	1,910.0 "
Grate area	24.2 "
Weight, empty	129,800 lbs.
Weight in service	162,800 "
Coal capacity	2 tons
Water capacity	2,520 gals.
Tubes, number, 5¼ in. diameter	21
Tubes, number, 1⅝ in. diameter	150
Tubes, length	14 ft. 9¼ in.
Tractive effort (American formula)	40,700 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 4.00$$

$$\frac{\text{Tractive effort} \times \text{diameter of drivers}}{\text{Heating surface}} = 110.80$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 78.92$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 6.28^{*}$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 85.23$$

Volume of 2 cylinders = 13.61 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of both cylinders}} = 140.34$$

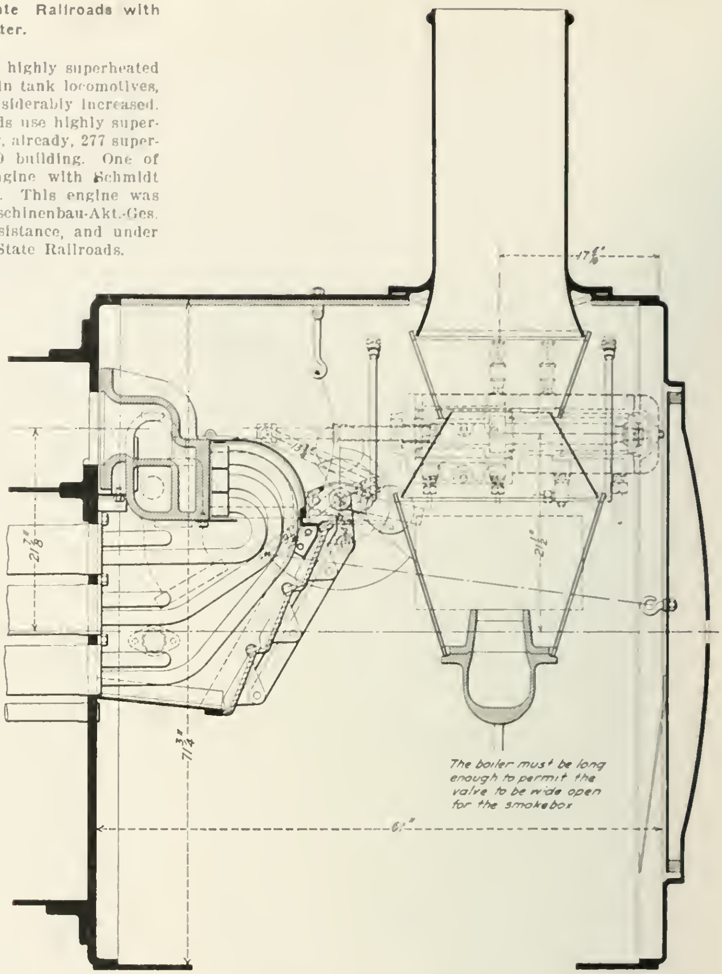
$$\frac{\text{Grate area}}{\text{Volume of both cylinders}} = 1.76$$

Tube heating surface equated to firebox heating surface (Vaughan formula), sq. ft. 346.00

Total equated firebox heating surface, exclusive of superheater, sq. ft. = 466.00

$$\frac{\text{Total actual heating surface}}{\text{Total equated firebox heating surface}} = 3.12$$

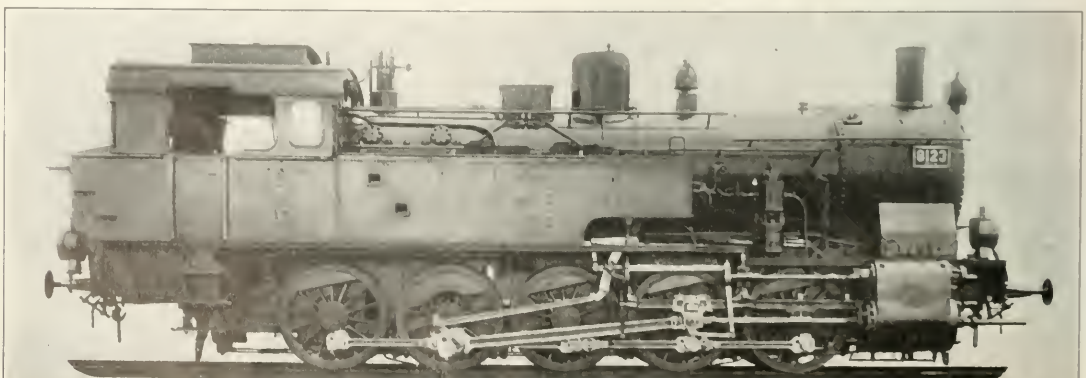
*Per cent.



Arrangement of Superheater Dampers.

The boiler has, except for the superheating arrangement, no feature of special interest.

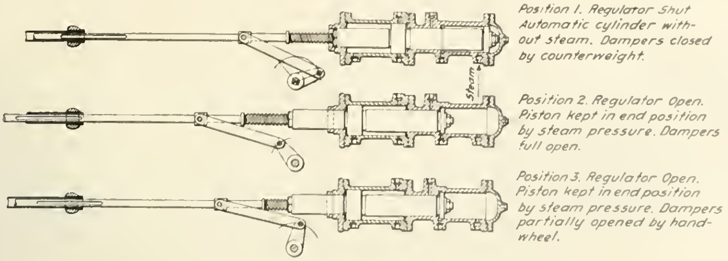
The upper part of the boiler barrel is fitted with three rows of large smoke-tubes of 4⅞ in. inside diameter, this being reduced to 4 in. near the firebox. Inserted in each of these smoke-tubes is a superheating unit, consisting of two sets of pipes, $1^{1}/_{16}$ in. in diameter and $^{5}/_{32}$ in. thick, bent in the form of an "U" and connected at the smoke-box end to a header, thus forming a continuous double-looped tube. The steam has to pass back and forth through each unit. The double looping of the superheater pipes has the advantage of increasing the velocity of the steam through the tubes, with the result that the temperature of the tubes is lowered, and their life correspondingly increased. The open ends of each unit in the smokebox are expanded into a common flange, which is in-



Tank Locomotive for Freight Service, with Schmidt Smoke-Tube Superheaters; Prussian State Railroads.

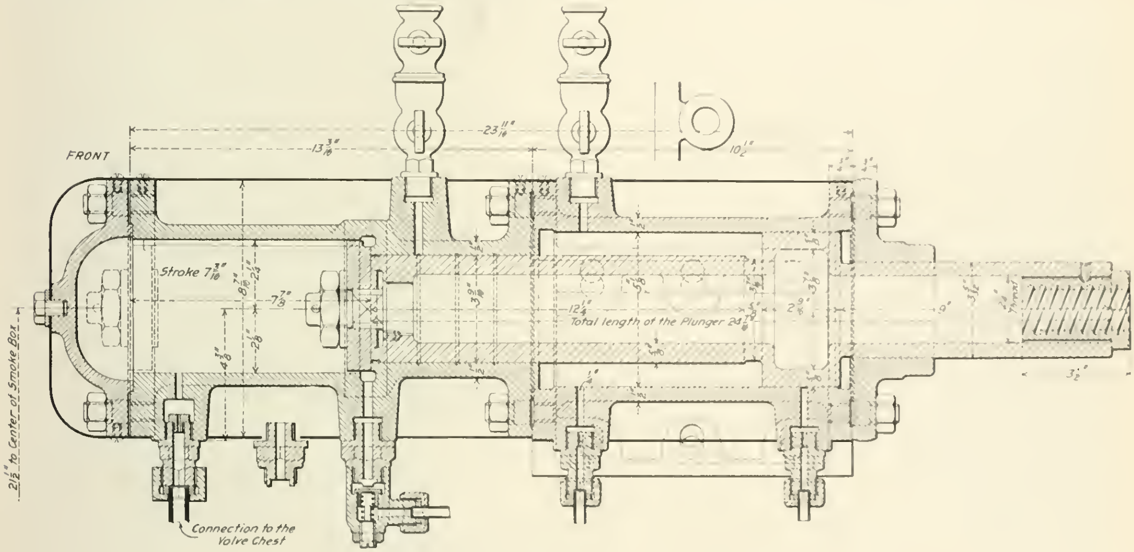
dependently secured to the face of the steam collector by a single stud. The stud is centered in the flange and thus makes, with two copper-asbestos rings, an even joint all round.

Most other railroads prefer a different method of arranging the superheater pipe ends in the smokebox. The pipes are bent upwards only, and the flanges are horizontal and fastened by vertical bolts, the heads of which are movable in slots in the bottom of the collector casting.



Damper Regulator.

There are only as many superheater elements as smoke-tubes, i.e., 21 on the engine illustrated and therefore only 21 1-in. bolts are needed to attach the whole superheating device to the collector casting.



Automatic Steam Cylinder for Superheater Dampers.

To regulate the amount of superheat and to protect the superheater pipes against overheating while the engine is standing or drifting, dampers are arranged in the smokebox which automatically close when the regulator is shut; but as soon as steam is turned on they are opened simultaneously by a piston working in a small steam cylinder which is connected with the valve chest by a small steam pipe. If desired, the superheater dampers can also be worked by hand from the footplate, so that any desired degree of superheat may be obtained. When open, the dampers allow a clear view through the superheater. The smoke-tubes can be cleaned from soot and ashes by either steam or compressed air with a hose and nozzle, the operation being carried out either from the firebox or from the smokebox. The superheater parts are all interchangeable and accessible. Each unit can be removed without disconnecting the whole arrangement by loosening a single nut.

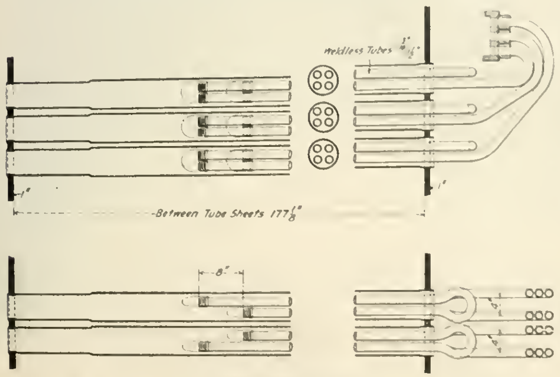
The engine is designed for heavy mountain service, especially on sharp curves. To get the necessary flexibility without excessive wear of either tires or rails, 1 in lateral play is given to the first, third and fifth axles, the second and fourth axles are rigid, the latter being the main driving axle. The piston rod is extended back of the front driver and supported by an intermediate slide bearing; an excessive length of connecting rod is thus avoided.

It is a two-cylinder simple engine with Schmidt patent piston valves and a by-pass connecting both cylinder ends. This passage is kept closed by a cylindrical cock when the engine is running under steam.

On trials with a 1,515-ton train behind a somewhat lighter engine of this type (67 tons) on an 0.83 per cent. grade, an indicated drawbar pull of 37,000 lbs. at 60 per cent. cut-off was obtained, this giving a factor of adhesion of almost 1·4. Another locomotive of this type has been tested near Erfurt, Germany, on long gradients of 3.33 per cent. and 2 per cent. in the presence of representatives of the most important railroads of France and Belgium. These trials were elaborately described in an article in the *Verkehrstechnische Woche*, 1907, page 1,317, by Mr. Muller, Privy Councillor of the Prussian Ministry of Public Works.

As the engine was being used in regular service, no special trial trains could be made up and therefore the greatest tractive power and highest speed could be demonstrated; nevertheless the results, as indicated in the following table, must be considered exceedingly satisfactorily:

Gradient, per cent.	2.00	2.00	2.00	3.33
Length of gradient, miles	7.0	7.0	7.0	5.5
Weight of cars, tons	400.0	460.0	500.0	282.0
Weight of locomotive, tons	72.8	72.8	72.8	72.8
Average speed, miles per hour	11.3	12.4	10.6	8.1



Superheater Pipes.

The graphical records of two of these trial runs are reproduced. Mr. Müller, in his summary of the trials, made the following statements:

(1) The boiler pressure of 170 lbs. could be easily maintained.

(2) Superheat of 570 deg. F. was obtained after a few miles run and from 600 to 650 deg. could be maintained with great ease.

(3) The valve chest pressure going up hill was 150 lbs. on an average, so that the relative superheat was between 180 deg. and 300 deg.

(4) During the three days trials the engine slipped only once.

(5) The engine is perfectly able to pull without a helping engine 300 tons (55 axles), at 12.5 miles an hour on a gradient of 2.5 per cent. and curves of 650 ft. radius.

Mr. Müller adds that the results obtained with this engine in regular service practically agree with these results of trials. As a consequence, 74 engines of this type have already been put in service on, or are being built for, the Prussian State Railroads. The Paris-Orléans Railroad and the Southern Railroad of France, which were represented at the trials near Erfurt, have already ordered five engines each of this type from a German locomotive builder. The Swedish State Railroads also ordered five of them. In the middle of November, 1907, the total number of Schmidt superheater engines in service or in course of construction amounted to 2,427, representing 78 railroads.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XIV.

*Factors Affecting Ocean Line Freight Rates.**

The last article emphasized the freedom of competition and freedom of action that existed for the advantage of the man or firm who could load an entire ship. There is a radical difference in the rate question facing a man who would ship goods over sea in less than ship load lots. He is necessarily dependent upon some form of co-operative enterprise whereby his small freights may be combined with others. He is the natural meat of the line carrier and he must pay the current rates—the line traffic rates.

Rates in line traffic differ at many points from the full cargo traffic, yet they show the working out of the same principles. Competition is often present and the process of dickering in the bargain for each shipment is common. There is no more uniformity of rate for all the goods on a line steamer at one time than there is for all the many shipments that may fill a train. Valuable goods are charged a high rate and cheap ones a low rate, and different shipments of the same article often have different rates. A line steamer outward bound from an American port usually derives its freight profit from such commodities as machinery and manufactured articles, provisions, oil cake, flour and other prepared food-stuffs. Grain is also usually taken, but at rates that are rarely profitable and always below the full cargo rate for grain. Grain is heavy, but easily handled, because usually handled in bulk, and it makes very desirable ballast to steady the ship. Accordingly the policy is to fill the ship as full as possible with good paying freight and finish her off with grain, some hundreds or thousands of tons, as the case may be. The grain shipper does not especially desire these small irregular shipments. If the European grain market is favorable at all, it is favorable for a shipload of grain, and if the shipper must ship less he will have a concession in rates. This is the more easily obtained because he knows that the shipowner wants it to serve as ballast. Hence it comes about that the line steamers carry a certain and variable amount of grain at lower rates than the tramps.

The variety in rates is further increased by the practice of the managers of some lines to make as many long contracts as possible, sometimes for a year or a season, and secure other freight in advance during a certain month or within a certain week. The year contracts and the month contracts will probably differ in rate, and they are both likely to differ from the rate current at the time of sailing. The last shipments are contracted for in the light of the then existing market conditions, and may be high or low, according to the abundance or scarcity of freight at the time the vessel is finishing her cargo. If freight is scarce the final rate may be lower than the long contract rates, or if abundant the rate may rise. Freight may be shifted from one line to another so easily that it is actively sought. All the companies engaged in the trans-Atlantic trade have agents in the commercial centers like Buffalo, Chicago, St. Louis, and these agents in turn have their local connections. If freight promises to be scarce for a certain scheduled sailing, telegrams will be sent to the inland agents or sometimes a personal representative will be sent from New York, Boston or Philadelphia to Chicago or Minneapolis with power to make such contracts as he finds necessary to secure the freight for the otherwise empty space. So it is that competition dominates also in line traffic in those trades where combination has not relegated it to the limbo of history.

The fact that the steamship line represents an organized business gives it a tendency to greater steadiness of rates even in competition than prevails among the chartered vessels, but if fluctuations do not come as quickly they come as surely on routes where there is competition for the work.

As with the tramp, so with the liner—the controlling rate making fact is the fundamental freedom of the open sea, the highway of the nations. With the open roadway of the sea exists freedom of port facilities, and for all line traffic the fundamental rate-governing force is competition in the form of charter rates. If the line rate rises, tramps may flock in and even it up. This was clearly stated by Sir Thomas Sutherland at the sixty-third annual meeting of the stockholders of the Peninsular & Oriental Steamship Company in December, 1903. In commenting on the low rates received that year by the line steamers of his great company, he said:

"But as a matter of fact, it is the world's tonnage at large, the cargo carrying tonnage of the world at large, which dictates, or rather determines, the current rates of freight both by cargo steamers and by mail steamers and we are simply dragged into the wake of that great movement, as, I suppose, the great American combine* has already discovered by this time."

This statement of the influence of the charter vessels upon the rate for line ships is very easily understood by noting the ease with which a considerable share of line traffic may be diverted to charter vessels or charter traffic to line vessels if the gap between the two services becomes too great in one case or too small in the other. Within certain limits the two must rise and fall together.

This influence of charter upon line rates is the wide reaching influence of world rates upon each other. It should not be construed into any statement of similarity of service in general. The tramp competition exerts this influence by taking the line freight at the baser end of the traffic list. It also makes easy the formation of new lines, for the fact should not be overlooked that many freight lines are merely groups of chartered steamers, and if steamers get very cheap, and line rates stay high, there is the great temptation to rush in and get a share of the good things.

Despite this competitive influence line traffic upon the seas presents several distinct contrasts with the charter traffic in the matter of rates and the ease and extent of the competition which has been considered. One of these differences arises because of the size of the unit of competition. In charter traffic the unit is merely a ship, while in the line it is a number of ships—enough to give a rival service. This may include a number of large and expensive ships and an organization of agents on the land to manage and solicit traffic. This fact of the size of the unit is a deterring influence in competition merely because it is easier to do a small thing than a larger one of the same kind.

A second difference is that line competition has an element of vindictiveness, retaliation or penalization unknown in tramp competition. The tramp can cut under the current rates, get a cargo and go without suffering from the direct rate effects of her action, because there is no retaliation possible. If one line goes under the existing rate, it is almost certain that the others must do it also to get their share of the traffic. Then no one is any better off than before; all are worse off from the reduced income, and are ready to punish the party responsible for the loss. Consequently the rate-cut among lines usually leads to a rate war during the continuance of which both parties lose heavily. There is accordingly often a common rate without any formal agreement. No one wants to cut the rate and run the risk of a rate war. This situation thus resembles more closely an armed truce than any other relationship.

A third difference between the competition of the two types of service arises from the irresponsibility of the tramp manager with regard to demoralizing the market. As each bargain is a law unto itself, the manager may demoralize the market by his rate-making and sail his ship away into the great world. Her next contract may be made three months later in the antipodes, and under other conditions, probably little if at all affected by the rate resulting from the manager's last bargain. It is otherwise with the liner, which is practically fixed to a certain route, ordinarily sails from a certain port or series of ports, and comes back again to repeat the same voyage. The line manager who cuts rates must suffer the consequences, because his line continues to move upon the waters he has troubled, and he must do business in that port and must deal with the demoralized rates. The line has customers whose interests must be protected. Shippers, of course, prefer the regularity of the line; and the natural law which makes the tramp irresponsible and the liner responsible forces a certain amount of parallel if not united action among the managers of lines.

The common knowledge among a community of shippers drives to common action. It is necessary and inevitable that all ocean lines competing in the same port know what the others are doing. It is necessary because if they did not know of the actions of rivals, one carrier, by cutting the rate the smallest shade, would get the lion's share of the business. It is inevitable that they know,

*In this and the two succeeding numbers the writer has drawn upon two articles published by him, one in the *Political Science Quarterly*, and one in the *Journal of Political Economy*. Acknowledgment is hereby made of the assistance received from the Carnegie Institution, of Washington, in the collection and preparation of materials for this series of articles.

*A reference to the financial difficulties of the International Mercantile Marine Company, which, despite its great size, had had little or no beneficial effect on rates, to the great surprise and discomfiture of its organizers.

because of the constant search of the shippers and their brokers for cheap rates, and their diligent efforts to get contracts at the lowest possible rates.

Starting with this fact of common knowledge and parallel action among obstinate rivals there is great variety in the stages of mutual action among steamship lines, ranging from rate agreements and division of territory to freight and profit pools. Theoretically, it is easy to control the rates or traffic conditions among ocean lines. All that is needed is that the ocean lines that might compete shall agree on conditions and maintain them. In some trades, this is practised in all its simplicity, but the larger the trade the greater the difficulty, a difficulty amounting in the case of the trans-Atlantic trade to practical impossibility so far as rates are concerned.

This Atlantic situation, which will be presented in a special chapter, is an exception in the carrying trade.

The control of ocean line rates within certain limits by the carriers has been very widespread of late years. It may certainly be called the usual condition of affairs, for it prevails over much the greater part of the surface of the world's great sea. It should be noted that this reference is to the proportion of the ocean's surface, not to the proportion of its trade. The very heaviest trade is not controlled, as are the smaller trades which reach out to the remoter parts of the world.

The ocean steamer has made easier this line rate control, because it has enhanced the superiority of line sailings over independent sailings. In the old sailing vessel days, the superiority of the lines of uncertain packets over the tramp sailer was much slighter than that of the present precise steamer over the occasional rival. The slowness, irregularity and independable quality of the sailing vessel service gave the single ship an equality which it has lost in this day of steamer lines, when the importer is in instantaneous touch with the world through the cable, and knows when to count upon the arrival of the schedule steamer. Thus the importers of the world have become accustomed to an unprecedented speed and regularity in their business dealings which makes them less willing to abide by the service of the tramp, even though it should be a vessel of high efficiency. In its practical working out, this enhanced superiority of the line service over the tramp means that the shipper feels that he must have a line of steamers at his disposal.

Not only is the line service of the present possessed of a greater superiority over the tramp, but the three-fold to six-fold increase of carrying power of the modern steam tramp over its romantic but slow old prototype has limited its use to only the largest firms. The result is that the modern exporter of anything but a few bulky products like grain, ore, coal, oil and lumber is dependent upon the steamship line. This dependence will increase as the trade in manufactured articles increases, and with it the increase in ton value of goods, while at the same time the increase in the size of the tramp ship puts it more and more beyond the reach of the ordinary merchant.

It is easy to see that since it is harder for the individual to compete with the line than it was in earlier days, it is also harder for a line to compete with other lines over long routes than over short routes, for the evident reason that fewer steamers are required to make twelve 3,000-mile voyages than twelve 10,000-mile voyages. If there be added to this the fact that the trade to distant continents is sure to be lighter than to nearby continents, it becomes plain that the first and most natural stronghold of shipping trusts, rings and rate-controlling agreements is in the trade with the antipodes, where, at best, but a few lines suffice to do the work. A few men can agree easier than many men.

It is necessary for ocean carriers who might compete to be in one of four relations to each other: (1) They may be practically independent because they all have more goods than they can carry at profitable rates; (2) they may be active competitors; (3) they may be working under some mutually beneficial agreement with regard to rates or traffic; (4) they may be acting practically as though they had formally agreed, although the condition is only one of mere truce which none cares to break. The last is commonest in the Atlantic traffic where the barriers to agreement are greatest. The first condition—independence—is likely sooner or later to lead to the second—competition.

There is a peculiar ferocity attending a rate war among ocean line carriers, especially where the number of carriers is small and personal feeling can rise. It is primarily not competition to win trade, but to ruin the rival, to drive him off or bring him to terms. The competition literally hits the rival, whereas it often takes the form, in other enterprises, of being particularly attractive to customer or client. Lines rendering similar service are each acquainted with every move of the competitors, but each hesitates to make the move that starts a rate war, which can only make losses for all carriers and which can end only when one party surrenders or all agree to abide by mutual restrictions that will preserve peace. The element of warfare existing in rate competitions is evidenced by the fact that the competing companies often carry freight at heavy loss, when a general condition of world-prosperity exists among carriers. Competition causes temporary disregard of all relation between the cost of a ship and income from her. In November, 1902, it was stated that the 10s. rate then prevailing from New York to South Africa involved a loss of $10,000 to $15,000 per steamer.

The carriers evidently desire agreements if they can be had, and the shippers do not desire rate wars as much as the lay observer might at first think. "During an ocean rate war the rates are chaos, whereas trade thrives on regularity and certainty. The merchant in Cape Town, Buenos Ayres or Shanghai does not relish having in stock a large stock of goods secured at a normal rate and suddenly find his rival getting the same goods in at a much lower cut rate. The constant fluctuations of a rate war often cause neighboring merchants to receive the same kind of goods by the the same ship at different rates. One of them blames somebody, usually the export commission merchant, and he in turn blames his freight broker. It is no unusual practice for an importer to divide an order among several export commission men. If the goods come on the same vessel at different rates as they very likely may, he is dissatisfied. The irregularity and wildly fluctuating rates would make it difficult for the importer to calculate a "laying down" cost of goods without expensive telegraphing. An editorial in a shipping journal, defending European shipping agreements to control rates to the Orient, declares that "competition now based on careful lines would" (under conditions of non-agreement) "resolve itself into as hazardous a speculation as a chance in a lottery."*

Another thing unfavorable to the shipper is the common irregularity of sailing schedules in a rate war. The ships are managed, not to please the shipper, but to injure the rival, and with that object the sailing days are often made nearly to coincide. This does not give opportunity for an even flow of freight. The shippers prefer an even schedule, a rate as constant as possible, and the same for all shippers. These conditions are difficult to secure where lines do not agree.

The rate war sometimes disturbs distant trades, as when a quarrel among London owners in the United Kingdom-Australian trade is carried to New York-Australian trade where these same owners run steamers—an episode that occurred in 1905.

The combined result of all these influences is, that with the partial exception of the north Atlantic freight, there is in ocean line trades, both great and small, a normal condition of agreement among line carriers. This is disturbed by the frequent competitions that precede and end the agreements. The agreements are evidenced by the much greater constancy of line rates than of charter rates. These agreements are often reported in various journals, in consular reports, and in annual reports in the companies themselves. The annual report of the United Companies of Copenhagen (*Forenede Dampskibsselskab*) for 1901, stated, "that the continental lines in their war against the Cunard Line unfortunately chose territory of the Danish Company and cost it a round million. Peace was concluded in December, and the company made a friendly working agreement with the competing companies, so that the future in this territory may be looked upon with full confidence."

The 1903 report of the Kosmos Line, plying between Hamburg and the Pacific coast of both Americas, after stating that a combination of sailing-ship owners had helped the line by stiffening and steadying rates on Chilean nitrate, discussed in an annex to the report the announcement of a Hamburg firm's intention to run monthly sailings of English vessels from Antwerp to western South America. The Kosmos directors did not fear from this any successful encroachment upon their business. This would be prevented by the convention concluded a few years previously with the Hamburg-American Company and by the extensive system of rebates that had been established. Mr. Ellerman, one of the men who sold out to the International Mercantile Marine Company and afterward went into other shipping enterprises, told the stockholders of the Ellerman lines in annual meeting that six lines had recently been bought by the new company, and that in most cases there were working agreements with the other lines engaged in those trades. Sir Thomas Sutherland, chairman of the Peninsular & Oriental Company, told the stockholders in a recent annual meeting that his company was a party to conferences or working agreements with various lines rendering the same services, and that such had long been the common custom of shipping lines in nearly all trades.

The same forces that have produced these agreements have also driven to consolidation throughout the world, and made the carrying corporations grow, line upon line, service upon service. It has not been limited to the north Atlantic. Practically all of the German lines going to South America are consolidated or closely allied, so are also the German lines to East Asia. The North German Lloyd has recently bought out a Scotch and a German line that competed in the East Indies adjacent to Singapore. The two leading British South African lines have consolidated a host of

*Fairplay, July 31, 1902, p. 162.

small Danish lines have formed the United Companies of Copenhagen and the several long-struggling coasting lines of Finland have done the same thing. With the development of the telegraph, the simplification of direction and the reduction of number of owners, agreements become easier.

(To be continued.)

The Baltimore & Ohio's New Eastbound Freight Yard at Brunswick, Maryland.

The Baltimore & Ohio has recently opened a new classification yard for eastbound freight at Brunswick, Md., on the main line about 80 miles west of Baltimore. This yard is $3\frac{1}{2}$ miles long, has a capacity of 3,960 cars and extends from Knoxville, on the west, to East Brunswick, on the east, where it connects with the old 2,500-car yard at Brunswick, which extends $2\frac{1}{2}$ miles still further east. The total length, therefore, of the combined yards at Brunswick is six miles and the total capacity 6,460 cars.

The old yard at Brunswick, which has always been a classification point for both eastbound and westbound freight, was put in operation in 1891. The great increase in traffic during the last two or three years has made it necessary to more than double the yard facilities. The new yard is to be used entirely for eastbound freight and the old yard only for westbound business. The two yards together form, according to the Baltimore & Ohio officers, the largest individual freight terminal in the country.

Work on the new eastbound yard was begun in August, 1906, and finished in October, 1907, which is fast time for so large a piece of work. During these 14 months 900,000 cu. yds. of earth were removed, 3,000 cu. yds. of monolithic and 200,000 cu. yds. of concrete culverts built and 875 tons of cast-iron drain pipe laid.

The first work was to divert the old main tracks, which roughly bisected the new yard site, to temporary tracks around the south side of the yard. Since the excavation and embankment were about equal these were built on embankment on the permanent location of the eastbound passenger and freight tracks. This diversion was completed on December 1, 1906, and gave the contractor control, free from interference from trains, of the whole territory on which he was to work. The grade contour closely followed the location of the old tracks for a little over two miles. Two 70-ton Bucyrus steam shovels and two model A Marion steam shovels were put on this section and 12 locomotives and 160 dump cars were used in moving the material from the shovels. Star well-drilling machines were used to drill in advance of the shovels, the holes usually going to subgrade before being shot down to the shovel. There were 16 miles of narrow gage track laid to reach the various dumps. By January 1, 1907, the contractor had sufficient area graded to allow the company to begin tracklaying, which was carried on without interruption until all the track in the new yard was laid.

The slopes along the whole north side of the yard are $1\frac{1}{2}$ to 1. The surface ditch runs the whole length of the yard on top of the cut and concrete flumes have been built up the sides of the slope at the various ravines where the water flows down to the yard. Through them the water is carried down to cast iron pipes running under the yard and the canal on the south side of the yard. These flumes prevent the wash of the water from destroying the slopes.

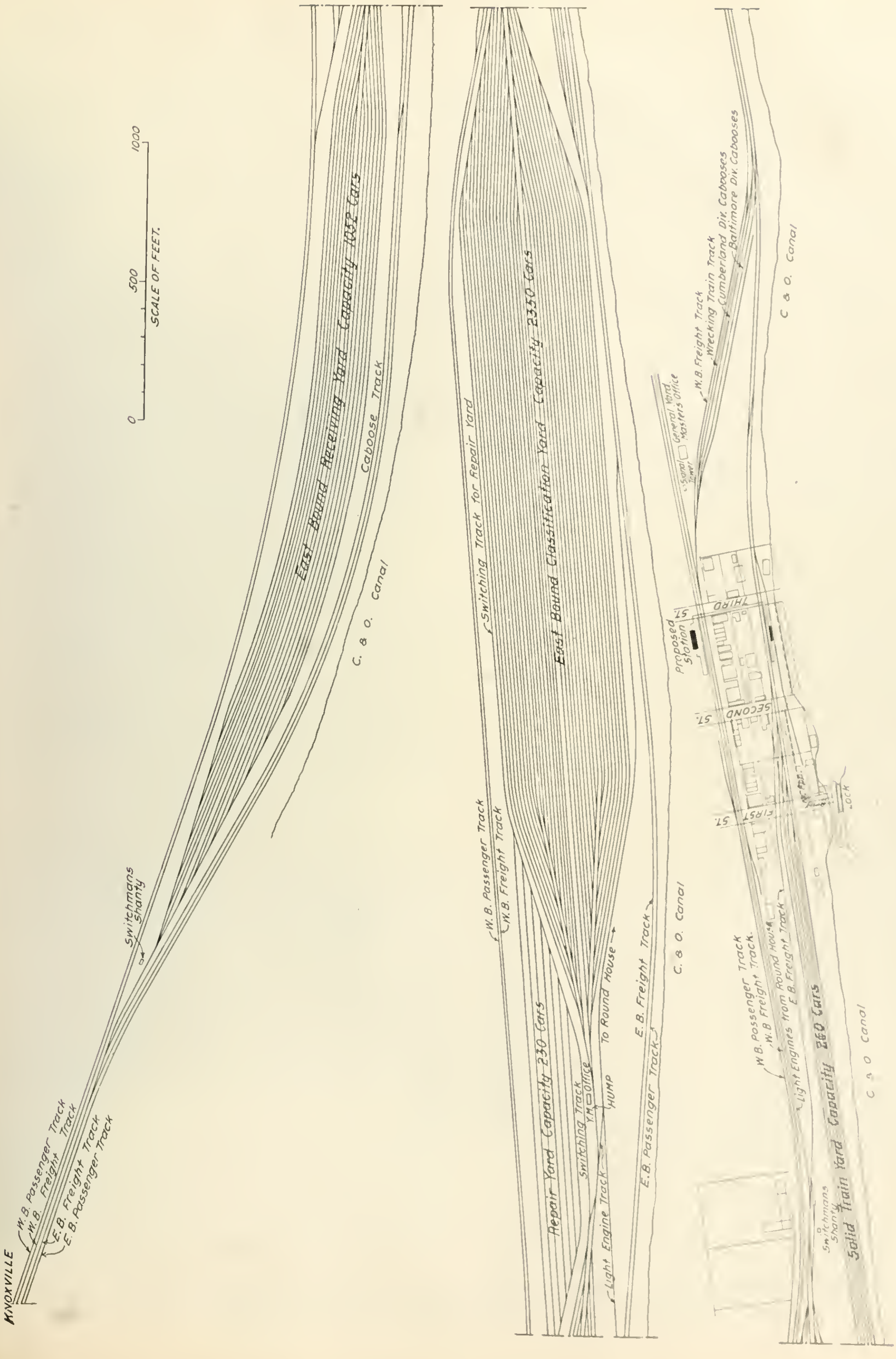
Brunswick is the eastern terminal of the Cumberland division and the western terminal of the Baltimore division. It is 102 miles east of Cumberland, W. Va., and 75 miles west of Baltimore, Md. All cars classified at Brunswick go through east to destination. Freight trains arriving at Brunswick from points west enter the new yard at Knoxville, the western end of the terminal, by a No. 20 turnout. The receiving yard has 16 tracks with a capacity of 66 cars each, or a total of 1,052 cars. It is reached by two outside ladders, one having eight switches, the other seven. On entering the receiving yard the caboose is cut off from the train. The caboose track turns off by a No. 16 turnout and the caboose is run by gravity around the receiving yard on the south. At the eastern end of the receiving yard it is picked up by the engine and run to the engine house by the engine track which runs to the south of classification yard. The western half of the receiving yard is on a $1\frac{1}{2}$ deg. curve and the east half is tangent.

The outlet of the receiving yard is by two inside ladders each containing seven switches. Cars from this yard are pushed up on a hump which is $14\frac{1}{2}$ ft. above the entrance and 12 ft. 5 in. above the general yard level of the receiving yard. Cars from the north half of the receiving yard reach the hump track by a No. 10 crossover connecting the two ladders, the south ladder leading directly over the hump. The grades leading to the hump are 3,600 ft. of 0.25 per cent., 1,050 ft. of level and 550 ft. through the south ladder of 1 per cent. grade. Pushers are used only on the hump grade. A road engine can pull a 65-car train into the yard without help.

New Eastbound Classification Yard at Brunswick, Maryland; Baltimore & Ohio.

The descent from the hump starts with 100 ft. of $3\frac{1}{2}$ per cent grade, then 1,000 ft. of 1 per cent. grade through the classification yard ladders and 0.3 per cent. grades through the classification yards. The hump is $22\frac{1}{2}$ ft. above the eastern end of the classification yard.

The eastbound classification yard has 36 tracks, 18 on the north and 18 on the south side, each with a capacity of 65 cars, or a total of 2,340 cars. It is set by two double ladders operated by an electro-pneumatic push button machine. Each ladder has nine switches. As the cars come from the receiving yard to the hump they are tagged by the brakeman which indicates to the switchman working the push button machine for which track they are bound. For example, if a train pulls into the receiving yard with the first 10 cars for Washington and the next 20 for Baltimore, a tag reading "10-4" is put on the front of the first 10 cars, indicating that there are 10 cars in the shift to go on the Washington track in the classification yard. The next 20 would be tagged in a similar way for Baltimore. The outlet from the classification yard is by double ladders through the center of the yard and a single ladder on each side, each ladder having nine switches. Trains from the northern half of the classification yard pull direct-



New Eastbound Yard System at Brunswick, Maryland; Baltimore & Ohio.

ly out on the eastbound freight track. Trains from the south half of the classification yard pull out on this track by a No. 10 turnout. The eastbound freight track runs along the north side of the solid train yard. The eastern end of this yard is joined to this track by a No. 16 turnout.

Through freight trains from the West run on a through track on the south of both the receiving yard and the classification yard and enter the solid train yard at a point southeast of the eastern end of the classification yard. The solid train yard has a capacity of 260 cars. Here the through trains are held while they are being inspected and changes of crews and engines made. The eastbound freight track is connected with the solid train yard at each end by a single ladder. In the receiving, classification and solid train yards No. 8 slide-wing frogs are used.

The repair yard is between the receiving yard and the classification yard on the north and opposite the hump. It consists of seven tracks spaced 25 ft. between centers and has a capacity of 230 cars. It is connected with the east end of the receiving yard. On the south of the repair yard is a switching track which is connected with the two ladders of the receiving yard and at its western end with the westbound freight tracks. By this, cars can be taken directly from the receiving yard or from the classification yard to the repair yard without fouling the tracks.

The old yard is located just east of Brunswick. It has 55 tracks, each with a capacity of 40 cars, or a total capacity of 2,200 cars. The increase in the train unit in the new over the old yard from 40 to 65 cars is notable as indicating the heavier train loads and consequent changes in yard design of 1907 over 1891. Now that the new eastbound yard has been finished, the old yard is used entirely as a westbound yard. The entrance to the old yard is at East Brunswick, where an interlocking tower is to be built. The exit is at West Brunswick, and is also controlled by an interlocking tower. At the western end of the yard are the worktrain track, the Cumberland division caboose track, the Baltimore division caboose track, and a coach track on which passenger cars are stored for local trains made up at Brunswick.

There are four main tracks running around the two yards from Weverton, which is one mile west of the western end of the eastbound receiving yard at Knoxville, to East Brunswick. A westbound passenger track and a westbound freight track run on the north side of the yards, and an eastbound passenger track and an eastbound freight track on the south side. There is an interlocking tower at Weverton governing the ends of this four-track system.

At Brunswick, between the eastbound and the westbound yards, is the office building for the Assistant Trainmaster, the General Yardmaster and the telegraph office. The building at the hump is 21 ft. x 34 ft., and is for the Trainmaster and the Assistant Yardmaster, who have offices on the first floor. The push-button machine is on the second floor and the compressor and batteries are in the cellar. The yard is lighted by electric arc lights, the line of which runs directly through the center of the yard where the tracks are spaced 18 ft. centers. The eastern end of the receiving yard, the double ladders, and both ends of the classification yard also have 18 ft. centers. The tracks are all laid with 85-lb. rail and cinder ballast, except the main tracks, which are laid with stone ballast. In accordance with the Baltimore & Ohio's policy of beautifying the right-of-way, the sloping elevation of the new yard has been sown with grass seed. As the yard is some feet higher than the main tracks which run around it, it will have the appearance from the passenger trains of the sides of a large banked flower bed.

The cost of the new eastbound classification yard, which covers 115 acres and contains 12 miles of main tracks and 40 miles of yard tracks, was $1,000,000. The contractors were F. H. Clement & Company, of Philadelphia, and the yard was built under the direction of the following officers of the Baltimore & Ohio: D. D. Carothers, Chief Engineer, A. M. Kinsman, Engineer of Construction, and J. T. Wilson, Assistant Engineer.

Passenger Rates in Russia.

The Russian Finance Minister reports that an investigation of the effects of the passenger tariff of 1894, which made extremely low rates for long distances, shows that it has had a very unfavorable influence on the net earnings of the railroads. The number of passengers carried has increased under this tariff from 44 to 103 millions, or 134 per cent., partly due to a large increase in the mileage of railroads; and even per mile of road the increase has been 38 per cent. Meanwhile the gross passenger earnings have increased about $30,000,000, and the expenses due to this traffic about $32,000,000, so that the net passenger earnings have decreased from $8,670,000 to $6,656,000. The much larger mileage has of course involved a much larger increase in capital. Taking in consideration the interest on the investment, the Russian passenger traffic nets a loss every year. The ministry estimates this loss to have been $7,530,000 even in 1894, rising to $24,355,000 in 1904. He purposes a new passenger tariff, which for distances of 200 miles and less would be slight for the third class, but considerable for the greater distances, and for the two higher classes large—for 265 miles 28½ per cent. for the second and 32 per cent. for the first class. The changes were still under discussion in January; but there seemed to be no opposition to an advance of some kind.

Pay of American Railroad Employees.

The report of the Interstate Commerce Commission for the year ended June 30, 1906 (full report just issued) gives the following table of the average daily pay of railroad employees for the years 1896-1906. The figures indicate dollars and cents.

Class.	United States.										
	1906.	1905.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.
General officers	11.81	11.74	11.61	11.27	11.17	10.97	10.45	10.03	9.73	9.54	9.19
Other officers	5.82	6.02	6.07	5.76	5.60	5.56	5.22	5.18	5.21	5.12	5.96
General office clerks	2.24	2.24	2.22	2.21	2.18	2.19	2.19	2.20	2.25	2.18	2.21
Station agents	1.94	1.93	1.93	1.87	1.80	1.77	1.75	1.74	1.73	1.73	1.73
Other station men	1.69	1.71	1.69	1.64	1.61	1.59	1.60	1.60	1.61	1.62	1.62
Enginemen	4.12	4.12	4.10	4.01	3.84	3.78	3.75	3.72	3.72	3.65	3.65
Firemen	2.42	2.38	2.35	2.28	2.20	2.16	2.14	2.10	2.09	2.05	2.06
Conductors	3.51	3.50	3.50	3.38	3.21	3.17	3.17	3.13	3.13	3.07	3.05
Other trainmen	2.35	2.31	2.27	2.17	2.04	2.00	1.96	1.94	1.95	1.90	1.90
Machinists	2.69	2.65	2.61	2.50	2.36	2.32	2.30	2.29	2.28	2.23	2.26
Carpenters	2.28	2.25	2.26	2.19	2.08	2.06	2.04	2.03	2.02	2.01	2.03
Other shopmen	1.92	1.92	1.91	1.86	1.78	1.75	1.73	1.72	1.70	1.71	1.69
Section foremen	1.80	1.79	1.78	1.78	1.72	1.71	1.68	1.68	1.69	1.70	1.70
Other trackmen	1.36	1.32	1.33	1.31	1.25	1.23	1.22	1.18	1.16	1.16	1.17
Switch tenders, crossing tenders, and watchmen.	1.80	1.79	1.77	1.76	1.77	1.74	1.80	1.77	1.74	1.72	1.74
Telegraph operators and dispatchers.	2.13	2.19	2.15	2.08	2.01	1.98	1.96	1.93	1.92	1.90	1.93
Employees—account floating equipment.	2.10	2.17	2.17	2.11	2.00	1.97	1.92	1.89	1.89	1.86	1.94
All other employees and laborers.	1.83	1.83	1.82	1.77	1.71	1.69	1.71	1.68	1.67	1.64	1.65

Foreign Railroad Notes.

Though there has been a noticeable slackening in business activity in Germany since October, traffic has kept up much better there than here. In December, the orders for open cars were nearly 11 per cent. greater than in 1906, and even for box cars they were 3.8 per cent. greater. There has been something like a coal famine, which partly accounts for this. The gross earnings of all German railroads in December, 1907, were 2 per cent. greater from freight and a trifle greater from passenger than in 1906. For the previous months of the year the freight earnings had been about 5 per cent. greater.

Further evidence of the industrial progress of Germany is given by its coal consumption, which increased nearly 40 per cent. from 1902 to 1907—from 163,663,000 to 228,984,000 short tons, and per head of population from 2.784 to 3.695 tons annually. There are considerable exports of German coal, but these are usually balanced by the imports. In 1907, the imports exceeded the exports. In that year the coal consumption was 9 per cent. greater than in 1906. More than a third of the consumption in 1907 was lignite, an inferior fuel.

During the year 1907 the additions to the Russian railroad system amounted to 1,167 miles, an increase of 3 per cent., bringing up the total to 40,438 miles. Of the whole mileage 67 per cent. belongs to the state. At the end of the year there were 1,600 miles under construction, included in which is a branch of the trans-Caspian line (Asiatic Midland), 118 miles, to the Persian border.

The new Italian passenger rates, which went into effect Nov. 1, 1906, made large reductions in the rates for long distances. The result has been for the first year an increase of 18 per cent. in journeys of more than 150 kilometers (93 miles), and an increase of 12.3 per cent. in passenger earnings.

GENERAL NEWS SECTION

NOTES.

The Missouri, Kansas & Texas shops at Sedalia, Mo., have been reopened with a force of 500 men.

Announcement is made that the Birmingham extension of the Illinois Central will be opened April 19.

The Canadian House of Commons has passed a resolution declaring that the time has arrived for building a railroad to Fort Churchill on Hudson bay.

The Wabash discontinued passenger traffic over its Pittsburgh West Side Belt line on April 4. An attempt to do the same thing was made two years ago but was given up.

Judge Lacombe, of the United States Circuit Court, has permitted the receivers of certain portions of the New York City Railway Co. to reduce materially the transfer privilege.

The brake-beam of an engine pulling out of the El Paso, Tex., yards dropped and wrecked the train. One of the five cars derailed was loaded with dynamite, but nothing happened.

The up-state New York Public Service Commission has denied the right of the New Haven to abandon 16 miles of the Central New England, which parallels the Poughkeepsie & Eastern.

The Canadian Society of Civil Engineers is urging upon the Canadian government the desirability of appointing a practical railroad engineer on the Board of Railway Commissioners.

A vote has been taken by employees of the Boston & Maine on the 5 per cent. reduction in wages proposed by President Tuttle, and the employees have declined to accept the reduction.

The Chapman & Dewey Lumber Co., of Kansas City, pleaded guilty on March 30 to the charge of having accepted rebates from the St. Louis & San Francisco and was fined $13,000 and costs.

A committee of the New York Assembly, on April 3, reported favorably a bill amending the New York City Rapid Transit law so that private capital can be interested in building new subways.

On March 31 Judge McPherson, in the federal court at Kansas City, held that the state officers can be enjoined from enforcing the Missouri 2-cent law if it is found to be unremunerative to the railroads.

The Oklahoma Corporation Commission has issued an order reducing express rates in Oklahoma about 40 per cent. Before this order goes into effect a hearing will be granted to all parties concerned.

On March 1, J. R. George was retired and placed on the pension list of the Lackawanna. Mr. George has been with the company 42 years and has been conductor on the same train for 32 years and 2 months.

The General Passenger Agent of the New York, Chicago & St. Louis announces that colonist tickets will be honored as first-class tickets from all points on that road to Chicago and will be accepted in Pullman cars.

At a meeting of the Kentucky Railroad Commission, April 3, attorneys for all railroads operating in the state made a motion that the Commission rescind its order of two years ago for a general reduction in freight rates.

On April 19 the New York Central will restore the 18-hour schedule between Chicago and New York for the Twentieth Century Limited. This schedule was temporarily abandoned last December, when one hour was added to the running time.

J. W. Midgley announces that the Railway Clearing House Bureau, of which he has been manager, has completed its seventh year and has gone out of existence. The bureau was supported by 18 railroads and by the banking house of J. P. Morgan & Co.

The chairman and engineer of the Texas Railroad Commission have recently completed their inspection of the 600-mile section of the Southern Pacific between El Paso and San Antonio, and are quoted as saying that this stretch of track is the finest in the Southwest.

President Roosevelt has made public a letter to Attorney-General Bonaparte directing proceedings by injunction to compel certain southern railroads to furnish colored passengers with as good accommodations as those furnished white passengers for the same money.

The Texas Health Department has accumulated some 2,000 cases against the Pullman Co. for alleged violation of the state health laws adopted a year ago, requiring fumigation of all sleeping cars at the end of each division and other extraordinary precautions.

The arbiters in the Southern Railway wage matter have reached an agreement by which the present wage scale for all organizations shall be continued until the first of July, with the understanding that if by that time the conditions shall not have improved the negotiations shall be resumed.

On April 3 the Senate Committee on Interstate Commerce, with the approval of the Interstate Commerce Commission, agreed to report favorably Senator Elkins' resolution extending the time for the application of penalties for violation of the commodity clause of the rate law until January 1, 1910.

The Massachusetts legislative committee on railroads on April 7 reported favorably on a bill accompanying a petition of the New York, New Haven & Hartford for the consolidation of the Milford & Woonsocket Railroad and the Milford, Franklin & Providence Railroad with the New England Railroad.

The New York, New Haven & Hartford is installing a fourth generating unit at the Cos Cob power station. Electric operation from Stamford to New York has been extended to include some of the through expresses; in all, 83 trains on week days and 33 on Sundays are now hauled over this section by electric locomotives.

Following a Supreme Court decision the Georgia Railroad will have to pay to the state of Georgia, to the city of Augusta and to Richmond county $335,000 in back taxes. The property upon which the taxes were claimed was 15,000 shares of Western Railway of Alabama stock, and the case has been in litigation for some six years.

Following the decision of Illinois railroads to test the constitutionality of the 2-cent passenger law in the state, George T. Nicholson, Third Vice-President of the Atchison, Topeka & Santa Fe; P. S. Eustis, Passenger Traffic Manager of the Burlington, and A. H. Hanson, Passenger Traffic Manager of the Illinois Central, have been appointed to manage the campaign.

The federal receiver of the International & Great Northern has been notified by the Texas Railroad Commission that he must invest every dollar of income of the property over actual operating expenses and fixed charges in making improvements ordered by the Commission prior to the receivership. Failure to obey will result in suit for forfeiture of the company's charter.

The threatened strike of the shopmen on the New York, New Haven & Hartford has been averted by an agreement on the part of the management not to enforce its order of March 10 extending the piece work system. Piece work will continue where it has been in operation, and as discharged men are re-employed the piece work plan will be extended gradually, but no radical change will be made.

The Missouri Supreme Court has denied Attorney-General Hadley's motion for the appointment of a commissioner to take testimony in his ouster suit against the Missouri Pacific, the Wabash and the Iron Mountain railroads; the Pacific Express Co., the Rich Hill Coal & Mining Co., and the Kansas & Missouri Elevator Co. for alleged violation of the state anti-trust laws. The case is set for argument in the April term.

The General Managers' Association has published figures showing that approximately 315,000 fewer employees are working for railroads in the United States than were working October 1, 1907. These statistics include actual figures of employees discharged by 17 roads having a mileage of 71,782. On these roads the decrease in employees amounted to 18 per cent. There is a lesson in these figures for people who make it difficult for the railroads to reduce wages.

The Great Northern was found guilty in the United States Circuit Court, April 7, of having paid rebates to the American Sugar Refining Co. in 1904 in violation of the Elkins Act, and was fined $5,000. The United States District Attorney called the court's attention to the fact that the transactions on the part of the railroad company did not involve to the same extent elements of fraudulent concealment as were disclosed in certain prior cases. In the case of the Great Northern the rebates had been entered in the regular books.

Chicago bankers have sent out a notice that after April 15 they will refuse to make advances against the usual "order" bill of lading containing the "care consignee" clause covering shipments of grain by lake, because this grain is delivered without surrender of the bill of lading. Trunk lines will be requested to discontinue forwarding lake grain without the surrender of the western carrier's bill of lading and in the meantime the Chicago banks are expected to suspend their notice until further consideration has been given the matter by a standing committee which has been formed.

Representative Esch, of Wisconsin, introduced a bill April 6, providing that no interstate railroad should, after it had been in operation for one year, issue any additional stocks, bonds or other instruments of indebtedness except when necessary for the acquisition of property, the extension or improvement of its lines and facilities, and the improvement and maintenance of its service. The bill forbids payment of dividends in anything but cash and the acquirement of control or interest in any other railroad corporation, except to establish, by consolidation of connecting lines, through transportation routes.

White Portland Cement.

Figures on two recent tests of White Portland cement are given below. These tests were made respectively by Robt. W. Hunt & Co., Chicago, and Henry S. Spackman Engineering Co., Philadelphia. In the former the sample showed a fineness through a No. 100 sieve of 95.56 and through a No. 200 sieve of 79.54. Initial set occurred in six hours and final set in 7 hrs. 5 min. The tensile strength for neat briquettes averaged at the end of 24 hrs. 368 lbs.; seven days, 710 lbs., and 28 days, 940 lbs.; the corresponding figures for a 1:3 mixture were 168, 223 and 310 lbs. respectively.

The second set of tests showed figures approximately the same as the foregoing as regards tensile strength and fineness. In addition there were constancy of volume tests which were all marked "good," steam and boiling water tests marked likewise, and a chemical analysis as follows, the figures being percentages: Silica, 25.1; alumina, 5.05; iron oxide, 0.43; lime, 65.68; magnesia, 1.54; sulphur anhydride, 0.96; loss on ignition, 1.24. It is also stated that this cement passes the specifications adopted by the American Society for Testing Materials.

It is claimed that this cement, which is of pure white color, will be found suitable for building ornamentation, concrete building blocks, interior decoration work, colored concrete, stainless mortar, and tile, mosaic, seats, railings, gateways, etc. It is made by the Sandusky Portland Cement Co., Sandusky, Ohio, a special factory having been built for its production at York, Pa.

Harriman Lines Reply to Government Suit.

The answers of the defendants in the suit of the United States to dissolve the Harriman system of railroads on the ground that the system is a monopoly in restraint of trade, were filed in the federal court at Salt Lake, Utah, April 6. Mr. Harriman denies in his answer that he with Jacob H. Schiff, Otto H. Kahn, James Stillman or others has owned or controlled a majority of the stock of the Union Pacific Railroad. He denies that the firm of Kuhn, Loeb & Co. was a fiscal agent of the Union Pacific Railroad. He denies that he and the other defendants conspired to restrain trade among the several states or foreign countries, to restrain competition among the defendants' steamship and railroad lines or to deprive the public of the advantages of trade and commerce through independent combination, if there was any such, or to effect a consolidation with the idea of monopoly, or restraining trade and commerce, admitting, however, that the Union Pacific acquired a majority of the capital stock of the various lines and steamship companies. He denies in each instance that acquisition of the stock was to kill competition or to monopolize trade, commerce or business. He denies that the Union Pacific has control in management of operation of the affiliated lines. He avers that in the transcontinental lines of railroads reaching the Pacific coast, south of Portland, the Union Pacific is but a link about 1,000 miles long, an intermediate carrier without any power to make rates on such traffic; that the Southern Pacific owns and controls lines between Ogden and the coast with no power to make rates for business east of Ogden; that no rates could be made from the Missouri river to the coast without the joint consent of the Southern Pacific and the Union Pacific; that, while the Union Pacific and its constituent companies separately owned connecting lines (operated as a single system from the Missouri river to Portland, Ore., and operated certain small steamships between Portland and San Francisco), yet such a route, via Portland, was not only impracticable as a competitor of the Southern Pacific, but any attempt to use it would have greatly injured the Union Pacific, because the Southern Pacific would thereupon have preferred the rivals of the Union Pacific in routing and interchanging traffic at Ogden, and the business in tonnage and revenue thus lost would have greatly exceeded the total volume of business received over such an impracticable route in competition with the Southern Pacific.

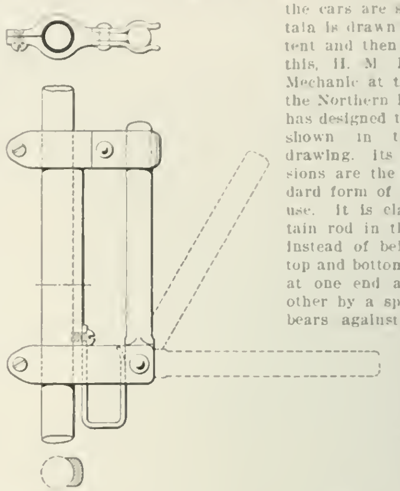
Mr. Harriman denies that the rail line of the Southern Pacific between San Francisco and Portland is in active competition with the ships of the Oregon Railroad & Navigation Company between the two cities, and explains that such competition is impracticable.

He denies that ships operated by the Portland & Asiatic Steamship Company between Portland and Asiatic ports, and connected with the rail lines of the Union Pacific, were ever in competition with the Pacific Mail Steamship Company. He denies that any competition ever existed between the system of railroads and steamships owned by the Union Pacific Railroad Company and the Southern Pacific, or if any such competition did ever exist, it was not substantial, or did not include a large volume of traffic of any kind.

He admits that the Union Pacific, in connection with the Central Pacific, is a competitor of the Atchison, Topeka & Santa Fe for a large volume of traffic to and from the Pacific Coast.

Self-Opening Handle for Vestibule Curtains.

There is considerable loss on all roads from the tearing of vestibule curtains when the trainmen do not detach the handles from the hooks of the next cars when the cars are uncoupled. When the cars are separated, the curtain is drawn out to its full extent and then torn. To prevent this, H. M. Robertson, Master Mechanic at the Como shops of the Northern Pacific at St. Paul, has designed the latching handle shown in the accompanying drawing. Its principal dimensions are the same as the standard form of handle in common use. It is clamped to the curtain rod in the same way, but, instead of being solid with the top and bottom clips, it is hinged at one end and caught at the other by a spring, which either bears against the heel of the handle bar or catches it at the end like a door holder. This spring is stiff enough to hold the handle in place when it is put on its hook. The rolling spring of the curtain is not strong enough to pull it out, but if left in place while the cars are being separated, the curtain when unrolled pulls the handle free, so that it straightens out as shown by the dotted lines. It then slips off the hook and the curtain rolls up in place.



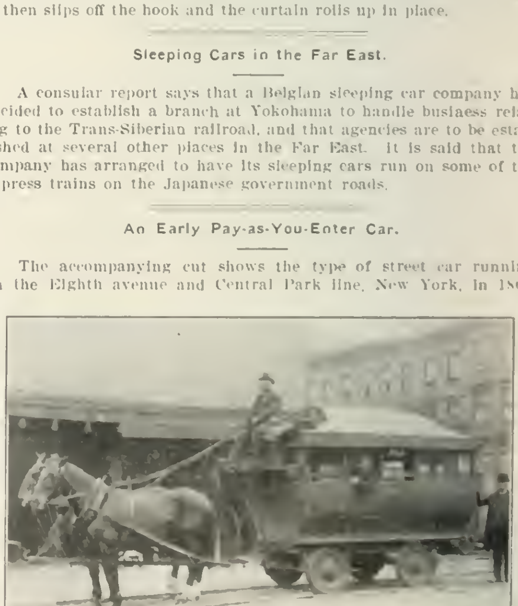
Self-Opening Handle for Vestibule Curtains.

Sleeping Cars in the Far East.

A consular report says that a Belgian sleeping car company has decided to establish a branch at Yokohama to handle business relating to the Trans-Siberian railroad, and that agencies are to be established at several other places in the Far East. It is said that the company has arranged to have its sleeping cars run on some of the express trains on the Japanese government roads.

An Early Pay-as-You-Enter Car.

The accompanying cut shows the type of street car running on the Eighth avenue and Central Park line, New York, in 1862.



A Pay-as-You-Enter Car of 1862.

There was no conductor, and the driver was responsible for the deposit of the passenger's fares.

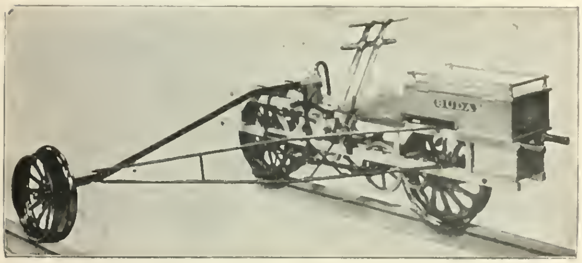
Principal Exports of 1907.

In the *Railroad Gazette* of January 24, the 1907 exports of wheat, beef and cotton, from the principal customs districts of the United States were given. The complete figures, compiled from the returns from all ports, are somewhat larger. There were 91,383,648 bushels of wheat exported valued at $86,089,946, an increase of 45 per cent. in bushels as compared with 1906, when 62,850,984 bushels, valued at $49,158,650, were exported. Wheat flour amounted to 15,276,506 bbls. as compared with 14,324,100 bbls. in 1906. Exports of canned beef decreased from 35,668,372 lbs. in 1906 to 22,145,993 lbs. in 1907: and of other preserved beef from 75,667,880 lbs. to 51,195,838 lbs. Cotton, unmanufactured, amounted to 4,192,054,144 lbs., which compares with 3,850,229,030 lbs. in the previous year. Exports of timber and unmanufactured wood were valued at $16,953,047 in 1907, and $17,471,670 in 1906. Lumber, however, increased, the values being $41,816,231 in 1907, and $34,598,304 in 1906. Logs and other unmanufactured wood imported, excluding pulp wood, decreased from $4,332,144 to $3,686,544. Imports of mahogany, however, increased from $2,895,825 to $3,365,727.

New Motor Inspection Car.

A new motor inspection car is shown herewith. One of its features is a method of limiting the speed to a predetermined maximum in accordance with the regulations of a road or the desires of department officers. This is done before the motor leaves the shop. Ordinarily, however, the speed can be graduated up to 30 m.p.h.

At starting, the car is propelled by the hand lever, until the car gets a certain momentum. Then the engine is started by throwing a switch and tightening a belt by a lever. The belt connects the front wheel of the car with the engine. Explosions start in the cylinder as soon as the flywheel of the engine begins to revolve. The hand lever is then thrown out of gear and may be locked in any position convenient for the operator as a hand grasp and foot rest.



Buda Gasolene Inspection Car.

The engine, which is 2¼-h.p., is air cooled, and has an automatic sight-feed lubricator. The air entering the carburetor is partially heated first, making the engine start more easily in damp or cold weather. Five dry cells supply ignition current. Enough gasolene is carried to run 200 miles. The wheels are pressed steel, with reinforced tread and M. C. B. flange. The main axles are ball-bearing. The car shown has three wheels, but it may be fitted with two guide wheels instead of one, if desired. The back brace on the guide wheel arm adds rigidity and strength, and, therefore, safety to the car.

The car is made by the Buda Foundry & Manufacturing Co., Chicago. It was exhibited at the recent Maintenance of Way convention.

Exhibit of Safety Devices.

The Exposition of Safety Devices at the American Museum of Safety Devices, 231 West Thirty-ninth street, New York, is to open April 13. Among the exhibitors are the Carnegie Steel Co., Pittsburgh, Pa.; Westinghouse Air Brake Co., Pittsburgh, Pa.; American Bridge Co., New York; Union Switch & Signal Co., Swissvale, Pa.; Yale & Towne Manufacturing Co., New York, and others.

Defects of Our Corporation Laws.

Dr. Woodrow Wilson, President of Princeton University, in an address before the Pittsburgh Traffic Club, April 3, objected to our corporation laws on the grounds that the methods of regulation are both inequitable and futile—inequitable because they impose penalties upon stockholders who are, in most cases entirely without legal blame, and futile because they do not stop the practices for which the fines and penalties are imposed. They strike at business instead of at transactions; they penalize bodies of persons instead of individuals, and they tend to accumulate discretionary power in the hands of the executive officers of the government.

Exports of Rails.

The shipments of rails to foreign countries during the eight months ended February 29, 1908, increased 25 per cent. over those of the corresponding period of last year. The average price was $31.84 a ton. The values of the exports were as follows:

Country.	1908.	1907.
Europe	$15,330	$12,859
British North America	1,055,692	806,373
Central America	601,267	169,017
Mexico	142,655	729,855
West Indies	493,866	532,433
South America	1,115,931	1,971,723
Japan	1,186,602	746,625
Other Asia and Oceania	2,135,251	600,118
British Africa	7,741	700
Other Africa	7,984	18,122
Total	$7,692,319	$5,588,125

The Development of Schenectady.

The following is from the *Troy Times:*

An event of historical importance was the charity ball recently given at Schenectady in the new Delaware & Hudson and New York Central & Hudson River union station. This celebration commemorated the beginning of steam railroading in this country as well as the elimination of all grade crossings in Schenectady. It is now the only city in New York state without a single dangerous railroad crossing.

It was on July 28, 1830, that ground was broken at Schnectady by Mayor Stephen Van Rensselaer for the Mohawk & Hudson Railroad. The first diminutive steam train made the trip between Schenectady and Albany, 17 miles, on August 3, 1831, in one hour and 45 minutes. In 1835 the Schenectady and Utica branch was constructed and in 1843 the Schenectady and Troy branch was built. In 1853 these roads were consolidated as the New York Central Railroad.

Since that time the historic old city has continued to occupy a large place in the annals of railroad history. As the site of the largest plant of the American Locomotive Company it became known the world over for its steam locomotives. Then the General Electric Company came, and a few years ago brought out the new electric locomotive. Not long ago this company introduced an innovation in short line railroading in the gas-electric motor car.

The work of eliminating the grade crossings at Schenectady took over three years and cost nearly $2,000,000. In excavating for the new union station and for the concrete work of the overhead crossings many old relics of pioneer railroading were brought to light. Among the finds were cedar ties of the old Utica & Schenectady road. Wooden rails, with streaks of rust along them showing that the wooden surface had been reinforced with iron plates, were found, which were used in the early days of the old Mohawk & Hudson. A number of these iron bands or strips are still preserved in the city and the old engine, the "DeWitt Clinton," and train is owned by the New York Central & Hudson River.

The new station is large and handsome and scientific. The celebration marked the first time that a new railroad station was opened with a charity ball and a public demonstration for the benefit of charitable institutions.

Still standing in Schenectady is the little, old, red brick building in which the travelers of the '30s anxiously awaited the tiny steam train from Albany. To-day the ancient building watches people waiting about the new union station for the Empire State Express and the Twentieth Century Limited, the electric engines going up to the test track above the city and the interurban trolley lines leading to the nearby cities of Troy, Watervliet, Saratoga Springs, Albany, Amsterdam and Gloversville.

Report on Brooklyn Bridge.

Bridge Commissioner Stevenson, of New York City, has transmitted reports on the Brooklyn Bridge by C. M. Ingersoll, Chief Engineer of the department; Professor Burr, of Columbia University, and L. S. Moisseiff, who reported for the United States government on the Quebec bridge failure. Professor Burr writes that the efficient system of inspection under which the structure is maintained has resulted in replacements, the correction of misfitting members originally placed in the stiffening trusses, and the improvement of many details, until it may now be confidently stated that the bridge has never been in as satisfactory condition of capacity to carry traffic as at present. Mr. Moisseiff likewise finds that the bridge is in as good a physical condition, if not a better one, than it ever has been since its opening. The following extract is from the report by Professor Burr.

"The heaviest Brooklyn Rapid Transit trains now running over the bridge consist of four motor cars and two trailers, the six cars loaded weighing 236 tons. This is the weight of train considered in the report of the Commission to which allusion has already been made. It was shown in that report that, with such trains moving at a maximum speed of fifteen miles per hour, with a headway of 45 seconds, and with trains separated by not less than 700 ft. between them, making a total of 80 per hour, the greatest stresses in the cables, suspenders, towers, anchorages and stiffening trusses would be 'safe and prudent,' it being the intention at that time to replace the floor system as soon as practicable, which work is now in progress. It is unnecessary to repeat here the details of this conclusion, as they will be found stated in full in the report of December 31, 1906. It is clear, therefore, that the present use of the bridge, with the Brooklyn Rapid Transit trains running in the manner described, up to a limit of 80 trains per hour, cannot be productive of any condition causing danger to the structure.

"It has been proposed to operate six loaded motor car trains, weighing 275 tons each, at the same maximum speed and with the same clear headway as with the trains consisting of four motor cars and two trailers. If this should be done, the resulting total cable stress would not be increased more than 2½ per cent., with other stresses throughout the structure increased in a somewhat greater percentage, but still remaining within safe limits."

INTERSTATE COMMERCE COMMISSION RULINGS.

Revised Tariff Regulations.

The Commission has issued tariff circular No. 15-A, containing the "Regulations Governing the Construction and Filing of Freight Tariffs and Classifications and Passenger Fare Schedules," as well as administrative rulings and opinions. This circular is a revision of and succeeds tariff circular No. 14-A and special circulars Nos. 1, 2, 3, 5 and 7, tariff department. It contains 90 pages of text and an 11-page index. It is effective April 15, 1908.

MANUFACTURING AND BUSINESS.

The offices of the Electric Welding Co., Pittsburgh, Pa., have been moved from 4 Smithfield street, to 316 Fourth avenue.

The offices of the Lehigh Valley Testing Laboratory, Pittsburgh, Pa., have been moved from 4 Smithfield street to 316 Fourth avenue.

The offices of Jacobs & Davies, Consulting Engineers, New York, will be moved on April 15 to the Hudson Terminal building, 30 Church street.

The office of Robert A. Cummings, Civil Engineer, M. Am. Soc. C. E., Pittsburgh, Pa., has been moved from 4 Smithfield street to 316 Fourth avenue.

William H. Donner has been elected Vice-President of the Westinghouse Machine Co., Pittsburgh, Pa., "in direct responsible charge of all of its activities."

All the bridges on the Guatemala Railroad, described in the *Railroad Gazette* of last week, were furnished by the Baltimore Bridge Co., Baltimore, Md.

A. E. Mitchell, heretofore Manager of Purchases and Supplies of the New York, New Haven & Hartford, has resigned to go to The Wyckoff Pipe & Creosoting Co., Stamford, Conn.

The offices of the United States Steel Products Export Co., New York, the foreign sales department of the United States Steel Corporation, will be moved on April 11 to the Hudson Terminal building, 30 Church street.

The A. Gilbert & Sons Brass Foundry Co., St. Louis, Mo., has moved into new quarters at 1015-1019 Forest Park boulevard. The new foundry is equipped with an overhead trolley system, oil furnaces, fireproof pattern vaults, etc. It has a daily capacity of 42,000 brass castings, and employs 50 men normally.

In a recent competitive test of track drills made on a large western railroad, the "Climax" drilled a hole in an 85-lb. rail, using a 1-in. flat bit at 168 r.p.m., in 2 min. 40 sec.; at 226 r.p.m., the time was 2 min. 25 sec. The drill was worked by two ordinary section men. These figures are furnished by Cook's Standard Tool Co., Kalamazoo, Mich., maker of "Climax" drills.

During the fiscal year ended February 1, 1908, the General Electric Co., Schenectady, N. Y., took orders for 325 Curtis turbines, aggregating 286,320 k.w. capacity. On December 31, 1907, there were orders on hand for 153, and up to that date 943 machines, in all, had been installed, their aggregate capacity being 867,610 k.w. Of all the plants for which Curtis turbines had been ordered or delivered up to the end of 1907, 201 were central station and electric traction plants, averaging 3,778 k.w. capacity, and 288 were industrial and miscellaneous plants, averaging 305 k.w. capacity.

A new plan of reorganization for the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., has been prepared by the creditors' committee and approved by the directors and the original reorganization committee. Under this plan no mortgage bonds will be issued, and the stockholders are to be required to subscribe to only $6,000,000 new stock instead of $7,000,000. In all $10,000,000 stock is to be issued, of which the creditors will take $4,000,000. Stockholders are to pay for new stock in instalments, the first due June 1, 1908, and the last, April 1, 1909. The cash accounts and bills receivable on February 29, 1908, amounted to $12,832,729, and working assets (materials and supplies, etc.), to $14,601,671.

Iron and Steel.

The Chicago, Burlington & Quincy, it is said, has ordered 900 tons of structural steel from the American Bridge Co.

The Isthmian Canal Commission has ordered 2,031 tons of rails for canal work from the R. C. Hoffman Co., Baltimore, Md.

The New South Wales Government has ordered 6,000 tons of rails from the Pennsylvania Steel Co., and it is understood that 20,000 tons more will be bought in the future.

OBITUARY NOTICES.

John G. Wilson, General Attorney of the Baltimore & Ohio, died on April 7 from cerebro-spinal meningitis.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Northern Quebec.—W. A. Kingsland, Auditor, with office at Quebec, has had his authority extended over the Quebec & Lake St. John, succeeding S. S. Oliver, who becomes Engineer of Maintenance of Way of both roads.

Georgia & Florida.—The offices of E. L. Bemiss, Second Vice-President; J. M. Turner, General Manager; A. Pope, Traffic Manager; W. H. Alexander, Auditor, and G. H. Hazlehurst, Chief Engineer, have been removed from Augusta, Ga., to Douglas, Ga.

Georgia Coast & Piedmont.—A. de Sola Mendes has been appointed Auditor, succeeding W. R. Basset, resigned.

Illinois Central.—B. A. Beck has been elected Assistant Secretary at Chicago, Ill., succeeding W. G. Bruen.
See Indianapolis Southern.

Indianapolis Southern.—O. F. Nau, Local Treasurer at Chicago, Ill., has been elected Treasurer, succeeding E. T. H. Gibson.

La Crosse & Southeastern.—P. Valier, Purchasing Agent and Superintendent, has been elected Vice-President and General Manager, with office at La Crosse, Wis.

Macon, Dublin & Savannah.—Homer Loring, President of the Fort Dodge, Des Moines & Southern, and of the Newton & Northwestern, has been elected also President of the Macon, Dublin & Savannah, with office at Boston, Mass., succeeding W. A. Garrett, Chief Executive officer for the Receivers of the Seaboard Air Line.

Missouri, Oklahoma & Gulf.—E. A. Chavannes has been appointed Auditor, with office at Muskogee, Okla., succeeding R. P. Dunbar.

National Railways of Mexico.—Pablo Macedo, Chairman of the Mexican Senate, has been elected temporary President of this new company, representing the Mexican government.

Oklahoma Central.—G. H. Parker, Assistant Auditor, has been appointed Auditor, with office at Purcell, Okla., succeeding E. I. Green. The office of Assistant Auditor has been abolished.

Panama Railroad.—Lieut.-Col. H. F. Hodges, General Purchasing Agent of the Panama Railroad, with headquarters at Washington, D. C., has been elected a Director, succeeding Gen. Peter C. Hains, retired.

Peoria & Pekin Union.—George E. Dayle has been appointed Auditor, relieving President H. K. Pinkney of duties temporarily assumed by him.

Quebec & Lake St. John.—See Canadian Northern Quebec.

Rio Grande, Sierra Madre & Pacific.—C. L. Montague has been appointed Secretary of the Sierra Madre & Pacific, succeeding J.

H. Martin, who remains Secretary of the Rio Grande, Sierra Madre & Pacific. D. J. Kerr has been appointed Auditor of the Sierra Madre & Pacific, succeeding W. Maurer, who remains Auditor of the Rio Grande, Sierra Madre & Pacific, both with offices at Madera, Chihuahua, Mex.

San Pete Valley.—J. W. Gilluly has been elected Treasurer, with office at Denver, Colo., succeeding E. A. Greenwood.

Seaboard Air Line.—See Macon, Dublin & Savannah.

Sierra Madre & Pacific.—See Rio Grande, Sierra Madre & Pacific.

Tampa Northern.—A. G. Brewer has been appointed to the new office of Auditor, with headquarters at Tampa, Fla.

Tonopah & Goldfield.—J. W. Reinhart has been appointed Assistant to the President, and Comptroller, with office at Tonopah, Nev. Mr. Reinhart will have direct control of the finances and accounts and will exercise executive powers over all departments, including operating and traffic, in the absence of the President.

Williamson, Greenville & St. Louis.—The officers of this company are now as follows: D. H. Glass, President; H. B. Montgomery, Vice-President; W. P. Druick, Secretary and Treasurer; C. A. Long, General Manager; G. A. Long, General Superintendent, and H. H. Rhodes, Auditor, all with offices at Greenville, Mo.

Operating Officers.

Ann Arbor.—K. A. Gohring has been appointed Superintendent, with office at Owosso, Mich., succeeding E. Hartenstein.

Arkansas Midland.—H. J. Schueing has been appointed Superintendent, with office at Wynn, Ark., succeeding J. F. Murphy.

Buffalo & Susquehanna.—G. H. Crissman has been appointed Assistant Superintendent, with office at DuBois, Pa. Mr. Crissman has direct charge of the despatcher's office at DuBois, the office of chief despatcher at that place having been abolished.

Canadian Northern Quebec.—John F. Spaidall, General Superintendent, with headquarters at Montreal, Que., has had his authority extended over the Quebec & Lake St. John and his office changed to Quebec.

Charlotte Harbor & Northern.—E. G. Bagwell has been appointed Superintendent, with office at Hull, Fla., succeeding C. B. McCall.

Chattahoochee Valley.—J. A. Avery is now General Manager as well as Traffic Manager of this road, with headquarters at West Point, Ga.

Chicago, Burlington & Quincy.—The appointments mentioned in the *Railroad Gazette* of March 27, in connection with the promotion of F. S. Ustick, Superintendent at Aurora, Ill., have not been made, owing to a change in plans. A. V. Brown remains Superintendent at Ottumwa, Iowa, and A. W. Newton, who has been General Inspector of Permanent Way and Structures, remains on the staff of the Second Vice-President, with headquarters at Chicago, Ill.

Cincinnati, New Orleans & Texas Pacific.—The office of Car Accountant has been abolished.

The office of W. S. Milton, Superintendent of Telegraph, has been removed from Chattanooga, Tenn., to Lexington, Ky.

Detroit, Toledo & Ironton.—H. E. Warner, Trainmaster at Springfield, Ohio, has been appointed Superintendent, with office at the same place.

Great Northern.—S. A. Walker, Superintendent at Havre, Mont., has been appointed Assistant Superintendent of the Willmar division, with office at Willmar, Minn., succeeding F. S. Elliott.

Illinois Central.—H. Battisford, Superintendent of Freight Terminals at Chicago, Ill., has been appointed Superintendent of the Chicago division, with office at Chicago, succeeding J. C. Dailey, now on the International & Great Northern. The title of H. P. Thrall has been changed from Superintendent of Mail Service to Mail Traffic Manager. Mr. Thrall also has the same position on the Indianapolis Southern.

P. Laden, Superintendent of the Peoria division, with headquarters at Mattoon, Ill., has had his authority extended over the Indianapolis Southern, succeeding L. W. Baldwin. Mr. Baldwin has been appointed Trainmaster of the Indianapolis Southern, with office at Indianapolis, Ind., succeeding R. A. Brown, appointed chief despatcher of that road, with office at Indianapolis, Ind.

Indianapolis Southern.—See Illinois Central.

Mexican Central.—D. F. Bucher, General Superintendent, has been appointed Car Service Superintendent, succeeding H. Putnam, who becomes Chief of Train Auditors, reporting to the General Manager. The office of Fuel Agent has been abolished, all reports being made direct to the General Manager.

Under the new divisional organization which went in effect April 1, Division Superintendents have charge of and are responsible for the discipline of all employees on their divisions, including those in the track department and the mechanical department, and all other employees except those directly under the traffic department. The employment of all forces on each division, increase or decrease in the number of men employed and all matters of discipline are handled by the Superintendents who are responsible to the General Manager in all such matters.

The El Pazo-Ciudad Juarez terminal is entirely in the charge of the Terminal Superintendent, reporting to the Superintendent of the Chihuahua division. The city ticket agent, station agent, customs agent, foreman, yardmaster, etc., report direct to the Terminal Superintendent. This does not, however, interfere with instructions that may be issued by the general freight department, general passenger department or auditing department in regard to freight or passenger rates or accounts. See Engineering and Rolling Stock officers.

Minneapolis & St. Louis.—H. G. Kruse, formerly Superintendent of the Peoria & Pekin Union, at Peoria, Ill., has been appointed Trainmaster of the Southern Des Moines division and of the Southwestern division of the Minneapolis & St. Louis, with office at Fort Dodge, Iowa, succeeding T. G. Hyland, resigned.

Quebec & Lake St. John.—See Canadian Northern Quebec.

Saratoga & Encampment.—B. F. Dunn, formerly division passenger agent of the St. Louis & San Francisco, at Wichita, Kan., and later Assistant to the Vice-President and General Manager of the Denver, Enid & Gulf, at Enid, Okla., has been appointed General Superintendent, with office at Saratoga, Wyo., succeeding LeGrand Young, Jr., resigned to go to another company.

Seaboard Air Line.—R. E. Boswell, Superintendent of Transportation at Portsmouth, Va., has been appointed Superintendent of the Sixth division, with office at Jacksonville, Fla., succeeding W. J. Jenks. H. W. Stanley, Assistant General Superintendent at Portsmouth, succeeds Mr. Boswell.

Tampa & Jacksonville.—A. L. Glass has been appointed General Superintendent, with office at Gainesville, Fla., succeeding J. B. Cutler, resigned.

Tennessee & North Carolina.—A. J. McMahon has been appointed Superintendent and Auditor, with office at Newport, Tenn., succeeding P. T. Bauman.

Traffic Officers.

Atchison, Topeka & Santa Fe.—H. B. Gregory, Acting General Agent at Santa Barbara, Cal., has been appointed General Agent at that place.

Beaumont & Great Northern.—G. R. Wansborough has been appointed General Freight and Passenger Agent, with office at Onalaska, Tex.

Canadian Northern Quebec.—Guy Tombs, General Freight and Passenger Agent of the Canadian Northern Quebec, with headquarters at Montreal, Quebec, has had his authority extended over the Quebec & Lake St. John, succeeding A. Hardy.

Central Vermont.—See Grand Trunk.

Chattahoochee Valley.—See under Operating Officers.

Colorado & Southern.—See Colorado Springs & Cripple Creek District.

Colorado Springs & Cripple Creek District.—F. C. Matthews has been appointed General Freight and Passenger Agent of the Colorado Springs & Cripple Creek District Railway, the Florence & Cripple Creek and the Midland Terminal, with office at Colorado Springs, Colo.

Florence & Cripple Creek.—See Colorado Springs & Cripple Creek District.

Grand Trunk.—Robert L. Burnap, General Freight Agent of the Central Vermont, has been appointed Assistant General Freight Agent of the Grand Trunk, with headquarters at Chicago, Ill., succeeding C. A. Hayes.

Maine Central.—The office of Fred V. Berry, Assistant General Passenger and Freight Agent of the Somerset Railway, has been abolished, and Mr. Berry has been assigned to special service in the general office of the Maine Central at Portland, Me.

Midland Terminal.—See Colorado Springs & Cripple Creek District.

Philadelphia & Reading.—B. H. Bail, General Freight Agent, has been appointed Freight Traffic Manager, a new office, with headquarters at Philadelphia, Pa.

Quebec & Lake St. John.—See Canadian Northern Quebec.

Rio Grande, Sierra Madre & Pacific.—W. T. O'Donnell has been appointed General Freight and Passenger Agent of the Sierra

Madre & Pacific with office at Madera, Chihuahua, Mex., succeeding B. F. Seggerson, who remains General Freight and Passenger Agent of the Rio Grande, Sierra Madre & Pacific.

Sierra Madre & Pacific.—See Rio Grande, Sierra Madre & Pacific

Somerset Railway. See Maine Central

Engineering and Rolling Stock Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

Canadian Northern Quebec.—A. E. Doucet, Chief Engineer of the Quebec & Lake St. John, has resigned to give his whole time to his work as District Engineer of the National Transcontinental Railway Commission, with headquarters at Quebec.

S. S. Oliver, Auditor of the Quebec & Lake St. John, has been appointed Engineer of Maintenance of Way of the Canadian Northern Quebec and the Quebec & Lake St. John.

Cincinnati, New Orleans & Texas Pacific.—The office of C. Dougherty, Assistant Chief Engineer at Cincinnati, Ohio, has been abolished.

Detroit, Toledo & Ironton.—The office of R. Tawse, Superintendent of Motive Power of the Detroit, Toledo & Ironton of the Ann Arbor, has been moved from Jackson, Ohio, to Toledo.

Idaho & Washington Northern.—W. C. Smith has been appointed Chief Engineer, with office at Coeur D'Alene, Idaho, succeeding L. F. McCoy, resigned.

W. J. Spearman has been appointed to the new office of Master Mechanic, with office at Coeur D'Alene, Idaho.

Mexican Central.—Under the new divisional organization which went in effect April 1, the authority of Ben Johnson, Superintendent of Machinery, is outlined as follows:

The Superintendent of Machinery will instruct the Master Mechanics in regard to methods of handling work in the mechanical department, will advise them fully from time to time of all standards adopted, and will see that these standards are followed. In order to preserve uniformity, the Superintendent of Machinery will have, through the Superintendents, general supervision over the wages paid in the different shops and to other employees in the mechanical department. He will also have charge of and be responsible for the stock of material carried on hand for the mechanical department, and will keep up the supply by requisition or by deliveries from the general store at Aguascalientes, as his judgment may dictate. The general shops at Aguascalientes and everything pertaining thereto within the shop walls, including the tie treating plant, will be under the direct charge of the Superintendent of Machinery. See Operating Officers.

National Transcontinental Railway Commission.—See Canadian Northern Quebec.

New York Central & Hudson River.—D. R. MacBain, Assistant Superintendent of Motive Power of the Michigan Central, at Detroit, Mich., has been appointed Assistant Superintendent of Motive Power of the New York Central & Hudson River, with headquarters at Albany, N. Y.

Quebec & Lake St. John.—See Canadian Northern Quebec.

Tehuantepec National.—Ernest H. Mitchell has been appointed Acting Chief Engineer, with office at Rincon Antonio, Oaxaca, succeeding D. Coe, Chief Engineer.

Purchasing Agents.

Algoma Central & Hudson Bay.—T. H. McGillivray has been appointed Purchasing Agent, succeeding W. H. Cowell.

New York, New Haven & Hartford.—The title of J. H. Sanford is Purchasing Agent. As previously announced, he succeeded to the duties of A. E. Mitchell, Manager of Purchases and Supplies, which title has been abolished.

LOCOMOTIVE BUILDING.

The Idaho & Washington Northern has ordered one 75-ton ten-wheel passenger locomotive, cylinders 19 in. x 26 in., from the Baldwin Locomotive Works. It will be a duplicate of two of those ordered last spring.

The New York Central Lines, as noted in the *Railroad Gazette* of March 27, have ordered from the American Locomotive Co. 12 electric locomotives, 20 Pacific, 22 in. x 28 in., 45 consolidation, 23 in. x 32 in., and 29 six-wheel switch engines, 21 in. x 28 in., for the N. Y. C. & H. R., and 12 Pacific, 20 consolidation and 10 six-wheel switch engines for the B. & A. These locomotives will be similar to those of the same types previously built.

The H. K. Porter Co. has the following recent orders: Winston-Dear Co., four 3 ft. gage contractors' locomotives, 11 in. x 16 in.; Pennsylvania Salt Manufacturing Co., two standard gage switch engines, one of which will have cylinders 14 in. x 20 in., and the other 16 in. x 24 in.; O'Brien & Mullarkey, Montreal Canada, one 3-ft. gage contractors' locomotive, cylinders 9 in. x 14 in.; Cummer Lumber Co., Newberry, Fla., one 3-ft gage, four-driver saddle tank locomotive, 8 in. x 14 in., Dugas & LeBlanc, Louisiana, one Forney locomotive for plantation service, cylinders 7 in. x 12 in.

CAR BUILDING.

An Argentine road has ordered 125 or more cars from the Middletown Car Works.

The Pennsylvania has ordered 200 all-steel class GLA gondolas from the Middletown Car Works.

The Idaho & Washington Northern has ordered 12 wooden frame refrigerator cars, 36 ft. 6 in. long, from Haskell & Barker.

The Mexican Central has ordered eight combination passenger and two combination baggage and express cars from the American Car & Foundry Co.

RAILROAD STRUCTURES.

BEAVER, PA.—The Pittsburgh & Lake Erie it is said, has started work on the proposed steel bridge over the Ohio river at the mouth of Beaver river. The plans call for a two-track structure instead of a three-track, reducing the amount of steel needed from 18,000 tons to 14,000 tons, contract for which has not yet been let. The bridge is to have a total length of 1,787 ft., and will cost, with the necessary changes in the tracks and approaches, about $2,000,000. Some of the work is reported let to the Dravo Construction Co., of Pittsburgh, Pa. The value of the contract is said to be about $500,000. (Jan. 24, p. 136.)

CALGARY, ALB.—The Canadian Pacific, according to reports, will this summer replace many of the wooden bridges on its main line between this place and Vancouver, B. C., with steel structures.

COEUR D'ALENE, IDAHO.—The Idaho & Washington Northern is building brick passenger stations 28 ft. x 70 ft. at Rathdrum, Idaho, and at Newport, Wash.

CULIACAN, MEXICO.—Work on the Southern Pacific's extension down the Pacific coast to Mexico involves the construction of 22 large bridges. Work is now under way on several of these structures. One of the largest is now being built over the Culiacan river, at Culiacan. It is to be steel, 1,500 ft. long.

KENORA, ONT.—Contract is reported let to Kelly Bros., of this place, to build 17 bridges on the section of the Grand Trunk Pacific from a point east of Winnipeg, east to the junction with the Lake Superior branch, under contract to J. D. MacArthur. Grant & MacDonald, it is said, have been given contracts for several bridges on the section from Saskatoon to Edmonton, under contract to Foley, Welch & Stewart.

NEW YORK, N. Y.—The Board of Aldermen has just appropriated $1,200,000 for paving the roadway, flooring the footpaths, placing tops on the towers, laying tracks and painting the Blackwell's Island bridge. It is thought that this will be sufficient to finish the construction of the superstructure.

The new subway terminal of the Williamsburg bridge, at Delancey street, Manhattan, has been finished. There are eight loops in the street terminal, separated by partitions, each with individual entrance and exit from the street.

SOUTH NORWALK, CONN.—The freight house of the New York, New Haven & Hartford here was destroyed by fire April 5, also 30 cars standing on the siding. The loss is estimated at $100,000.

WINNIPEG, MAN.—J. S. MacArthur, it is said, will sublet the contract for the large steel bridge over the Red river here. Soundings have been finished and the location definitely decided on. It is to run from the foot of Lombard street to St. Boniface. Work is to be started at once.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BIENVILLE & QUITMAN.—An officer reports that contracts have been given by this company to Richardson-Taylor Lumber Company for work on the line it is building from Bienville, La., east to Quitman, 12 miles. Track has been laid on about two miles. D. C. Richardson, President, Shreveport, La.; E. E. Scott, Chief Engineer, Bienville, La. (Mar. 27, p. 461.)

COPPER RIVER & NORTHWESTERN.—According to reports from Seattle, Wash., about 1,500 men are to be put at work by M. J. Heeney, the contractor who is building this line from Catalla, Alaska, through Copper River valley to the interior of Alaska (Mar 13, p. 390.)

CHICAGO & MILWAUKEE ELECTRIC.—This company, building an electric line from Chicago, Ill., north to Milwaukee, Wis., for which contracts have been let to the MacArthur Bros. Co. and the Republic Construction Co., has received authority to issue receiver's certificates on the Wisconsin division to continue the line to Milwaukee, so that through trains from Evanston, Ill., can be put in operation by June. Two miles of track out of the 3½ to be built in the city of Milwaukee have been finished; track is also laid to a point 12 miles north of Racine, and grading is finished on eight miles additional. (Mar. 13, p. 390.)

Grand Trunk.—Surveys reported under way for a new double-track line from Midland, Ont., east to Port Hope. The proposed line is to be built north of the present line, with easy grades, to haul grain from the company's elevator at Midland, which has a capacity of 2,000,000 bushels.

Great Western.—This company has finished an extension from Liberty, Colo., southwest to Longmont, six miles.

Idaho Northern Railroad.—This company, which was organized to build 76 miles of line in the Coeur d'Alene district, Idaho, has work under way from Enaville on the Wallace-Tekoa branch of the Oregon Railroad & Navigation Company, near Kingston, Idaho, northeast to a point six miles east of Murray, 33 miles, of which about one-fifth is finished. This section is expected to be ready for operation this year. Branches aggregating 43 miles are to be built. B. F. O'Neil, President of the State Bank of Commerce, at Wallace, is President, and E. P. Spalding, 416 Lindell Block, Spokane, Wash., is Vice-President and General Manager. This company has no connection with the Idaho Northern Railway, operating 59 miles of railroad in Idaho.

Kentucky & Ohio River Interurban.—An agreement, it is said, has been made by this company with the Royal Investment Company, of Minneapolis, Minn., to build 50 miles of electric line to connect Cairo, Ill., with Paducah, Ky.

Missouri & North Arkansas.—This road has been extended from Seligman, Mo., northwest to Neosho, Mo., 41 miles (Mar. 13, p. 392.)

Nevada Northern.—This company has opened a new line from McGill Junction, Nev., to McGill, three miles.

Oklahoma Central.—This company has extended the operation of trains on its road from Blanchard, Okla., west to Chickasha, 22 miles. (Nov. 8, p. 573.)

Pittsburgh, Shawmut & Northern.—This company has finished the line between Brockwayville, Pa., and Brookville, 18.9 miles, and trains are now in operation between St. Marys and Ramsaytown.

Spokane, Portland & Seattle.—This company's line from Pasco, Wash., west to Vancouver, 221 miles, was opened for freight and passenger traffic on March 16. At Vancouver connection is made for passengers with the Portland Railway, Light & Power Company's electric line to Portland. A bridge is being built across the Columbia river at Vancouver, and the road is to be extended over this to Portland.

RAILROAD CORPORATION NEWS.

Buffalo, Rochester & Pittsburgh.—Gross earnings for the last week in March, 1908, were $206,000 against $210,000 in the corresponding period of 1907, a decrease of $4,000.

Canadian Pacific.—This company is reported to have recently sold 20,000 acres of irrigated land to settlers at $17.50 an acre, and 15,000 acres at $37.50 an acre, a total of $912,500 recently received from sale of irrigated lands.

Carolina, Clinchfield & Ohio.—This company, formerly the South & Western, is to make a mortgage covering $15,000,000 5 per cent. 30-year first mortgage bonds dated January 1, 1908, of which $3,000,000 will be reserved to retire the bonds of three constituent railroads, and another $3,000,000 reserved for equipment. The rest of the issue will be used in paying the cost of construction of the line. (Mar. 20, 1908, p. 130.)

Chesapeake & Ohio.—Gross earnings for February, 1908, were $1,576,000, against $1,931,000 in 1907. Net earnings were $446,000, against $582,000 in 1907. The operating ratio was 71.7 per cent., against 69.9 per cent. in 1907.

Chicago & Milwaukee Electric.—The receivers have been authorized by Judge Grosscup of the United States Court, of Chicago, to issue $900,000 receiver's certificates covering the amount necessary to finish the line into Milwaukee. These certificates will be issued by the Chicago & Milwaukee Electric Railroad of Wisconsin and will be a prior lien to all the other securities of that company. They will not be a prior lien, however, to the securities of the Chicago & Milwaukee Electric Railroad of Illinois, which is the controlling company.

Chicago City Railway.—E. H. Rollins & Sons, of Boston, Chicago, Denver and San Francisco, have offered at 96½, yielding about 5.3 per cent., $1,000,000 first mortgage 5 per cent. bonds due 1927, of the Chicago City Railway. These bonds are a first mortgage on 244 miles of track, covering the south side of the city of Chicago.

Chicago, Rock Island & Pacific.—Gross earnings for February were $4,270,000 against $4,630,000 in 1907, a decrease of $360,000. Net earnings were $670,000 against $1,200,000 in 1907, a decrease of $530,000. See Rock Island Company.

Cincinnati, Hamilton & Dayton.—The bondholders' committee announces that on April 2, 1908, over 74 per cent. of the holders of the 4 per cent. refunding mortgage bonds of 1954 had exchanged their bonds for the new 5½-year collateral trust 4 per cent. notes dated January 1, 1908. These notes are secured by the refunding mortgage bonds for which they are exchanged. (Jan. 10, 1908, p. 74; Mar. 27, 1908, p. 462.)

Delaware & Hudson.—The New York Public Service Commission, Second District, has granted the application of this company for authority to acquire the one outstanding share of the New York & Canada Railroad, not already owned by it. (April 3, 1908, p. 493.)

Gross railroad earnings for February were $1,340,000, against $1,270,000 in 1907, an increase of $70,000. Net railroad earnings after taxes were $449,000 against $427,000 in 1907, an increase of $22,000. The January gross and net earnings increased at about the same rate.

Erie.—At a meeting of the directors, held April 4, 1908, the following plan was adopted for meeting the $5,500,000 discount notes which fell due on April 8. The $15,000,000 three-year collateral notes authorized March 31, 1908, by the Public Service Commission, Second District (April 3, 1908, p. 494), were to be issued for the following purposes:

First, $5,500,000 to be exchanged at par for the same amount of discount notes.

Second, Not less than $5,000,000 to be sold at par for cash on condition that all of the $5,500,000 unsecured notes shall have been exchanged for the new notes.

Third, Not more than $4,500,000 to be reserved for future issue, according to the judgment of a committee, consisting of Charles Steele, George F. Baker and E. H. Harriman.

These new notes are secured by:

General lien 4 per cent. bonds	$9,457,000
Convertible 50-year 4 per cent. bonds, Series B	985,000
Mutual Terminal Co. of Buffalo, N. Y., first mortgage 4 per cent., 20-year bonds	625,000
Erie Railroad, Pennsylvania collateral 4 per cent. bonds	336,000
Hocking Valley common stock	1,154,000
Temple Iron Co. stock	145,700
Lehigh & Hudson River stock	134,000
Total, par value	$12,836,700

On April 8 considerable amounts of the discount notes were presented for payment, their holders refusing to exchange them for the new notes. During the day it became evident that the plan outlined above could not succeed. Toward the end of the day an offer was made by E. H. Harriman to buy not more than $5,500,000 of the new 6 per cent. collateral notes at 95 to the extent required for providing funds for payment of the discount notes. Holders of the discount notes now may receive cash for their notes or, until April 15, the same amount of the new 6 per cent. collateral notes and 5 per cent. in cash.

Hocking Valley.—For stock of this company pledged as collateral, see Erie.

Intercolonial.—The legislature of Nova Scotia has passed a resolution calling on the government of Canada to acquire all the railroad lines in that province and turn them over to the Intercolonial Railway.

Lehigh & Hudson River.—For stock of this company pledged as collateral, see Erie.

Louisville & Nashville.—Gross earnings for the eight months ended February 29, 1908, were $31,115,000, against $31,519,000 in 1907, a decrease of $404,000. Operating expenses increased from $21,346,000 to $23,639,000, a rise of $2,293,000. Net earnings after taxes were $6,560,000, against $9,357,000 in the eight months ended February 28, 1908. The operating ratio was 75.98 per cent., against 67.72 per cent. in the earlier year.

Macon, Dublin & Savannah.—W. A. Garrett, President of the Seaboard Air Line, has been succeeded as President of the Macon, Dublin & Savannah by Homer Loring, of Boston, Mass., President of the Fort Dodge, Des Moines & Southern, and of the Newton & Northwestern.

Metropolitan Street Railway.—See New York City Railway.

Mexican Central.—See National Railways of Mexico.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Gross earnings for February were $680,000, against $702,000 in February, 1907, while operating expenses were $512,000, against $579,000 in 1907, leaving net earnings of $168,000, against $124,000 in 1907. The month of February 1907, was one of exceedingly severe winter weather in the territory of this road, as may be seen from the fact that maintenance of way and structures cost $127,000 in that month, as against $73,000 in February, 1908.

MISSOURI & NORTH ARKANSAS.—Francis Bro. & Co., of St. Louis, have offered at par, yielding 6 per cent., $300,000, and the Mercantile Trust Co., of St. Louis, on the same terms, $600,000 of the 6 per cent. "John Scullin collateral trust" 3½-year notes dated April 1, 1908. These two blocks comprise the total issue of these notes, which are secured by $1,123,000 5 per cent. collateral trust notes due October 1, 1911, of the Allegheny Improvement Co. This is a construction company which has the contract to build 211 miles of extensions of the Missouri & North Arkansas. The notes of the improvement company are secured by the securities of the 122 miles of the Missouri & North Arkansas now in operation. The bankers state that they have absolute confidence and belief in the ability of Mr. Scullin to pay these notes at maturity.

NATIONAL OF MEXICO.—See National Railways of Mexico.

NATIONAL RAILWAYS OF MEXICO.—The terms of exchange of securities of the Mexican Central and the National of Mexico for securities of this new company which is to take over these two roads, were announced on April 8, 1908. The securities of the National Railways of Mexico are as announced in this column on July 12, 1907, page 54, as follows:

Prior lien, 4½ per cent. bonds	*$225,000,000
General mortgage 4 per cent. bonds, guaranteed by the Republic of Mexico	†160,000,000
Non cumulative, 4 per cent., first preferred stock	30,000,000
Non cumulative 5 per cent., second preferred stock	125,000,000
Common stock	75,000,000
Total	$615,000,000

*$6,000,000 additional may be issued in exchange for $6,000,000 (£1,200,000) prior lien bonds of the Mexican International, or an equal amount of prior lien bonds of the National of Mexico, into which these may have been refunded.

†Additional bonds may be issued to refund an equal amount of consolidated mortgage bonds of the Mexican International or of consolidated mortgage bonds of the National of Mexico, into which these may have been refunded. Also to refund an equal amount of consolidated mortgage bonds of the National of Mexico into which prior lien bonds of that company may have been refunded.

No arrangements have yet been made for exchange of the following securities for payment of both principal and interest of which, however, the new company is to become liable:

National of Mexico:
Prior lien 4½ per cent. bonds.
First consolidated mortgage 4 per cent. mortgage bonds.
5 per cent. (extended) gold notes.
Mexican Central:
4 year 5 per cent. gold notes.

The basis of exchange of the other securities of the two companies to be merged is as follows:

National of Mexico. Stock per $100 share.
First preferred stock..$100 new 1st pref. stock and $10 cash.
Second " " ..$110 new 2d pref. stock.
Common stock (old)..$73⅓ new 2d pref. stock and $33⅓ new com. stock.
Deferred stock........$100 new common stock.

Mexican Central. Bonds, per $1,000.
Priority 5 per cent....$700 new 4½ per cent. prior lien bonds and $175 new 4 per cent. general mortgage bonds.
First mort 7 per cent bonds and scrip.*..1,000 4½ per cent. prior lien bonds.
Consolidated mortgage 4 per cent. bonds.. $600 4½ per cent prior lien bonds, $325 4 per cent general mortgage bonds and $75 new second preferred stock.
Reg income bonds and scrip ....$1,100 new second preferred stock.
2d cons. income bonds $1,000 new second preferred stock.
Stock ($100 shares)...$100 new second preferred stock.

*Assented.

The cash requirements of the consolidation plan, including the $3,200,000 to be paid on the first preferred stock of the National of Mexico as exchanged, the payment of floating debt amounting to about $5,500,000, the compensation of the bankers, and the provision of new working capital, are to be met by the purchase by the bankers of $10,000,000 prior lien 4½ per cent. bonds and $6,750,000 guaranteed general mortgage 4 per cent. bonds. The "readjustment managers" are: Kuhn, Loeb & Co.; Ladenburg, Thalmann & Co.; Hallgarten & Co., and Speyer & Co., of New York; Speyer Bros., of London; the Bank fur Handel und Industrie and the Berliner Handelsgesellschaft, of Berlin.

NEW YORK CITY RAILWAY.—The receivers of the Metropolitan Street Railway have announced that not including the dividends or interest on securities of the Third Avenue Railroad which is now being separated from the Metropolitan Street Railway, nor the guaranteed dividends on Metropolitan Street Railway stock, nor the interest on the general mortgage and collateral trust 5 per cent. bonds and the refunding mortgage 4 per cent. bonds now in default, nor expenses charged to construction, but only operating expenses, taxes, dividends, rentals and the interest on securities of lesser companies other than the Third Avenue there will be a deficit of about $1,000,000 for the year ended June 30, 1908.

The Metropolitan Street Railway was on March 31 authorized by Judge Lacombe in the United States Circuit Court to discontinue transfers between its lines and the lines of the Third Avenue Railroad and its subsidiary companies on 10 days' notice, except in certain places, where the lines are used in common for over 1,000 ft.

NEW YORK CENTRAL LINES.—The following table has been made by the *Wall Street Journal* from the annual reports of the five companies mentioned, showing the value of equipment received by each company through the sale in January of $30,000,000 fifteen-year 5 per cent. equipment notes. In each case 10 per cent of the total value of the equipment is to be paid in cash.

	Principal of certificates.	To be paid in cash	Total value of equipment
New York Central	$12,150,000	$1,350,000	$13,500,000
Lake Shore	6,750,000	750,000	7,500,000
Michigan Central	3,780,000	420,000	4,200,000
Cleve., Cin., Chic & St. L.	3,510,000	390,000	3,900,000
Chicago, Ind. & Southern	3,780,000	420,000	4,200,000
Totals	$29,970,000	$3,330,000	$33,300,000

A list of equipment covered by these certificates was published in this column on January 24, 1908, page 138.

The earnings for February of the four most important of the New York Central Lines are shown below. For purposes of comparison with the previous year these figures are compiled on the same basis as heretofore, and differ from those reported to the Interstate Commerce Commission under the new methods of accounting.

	1908.	Change	
New York Central & Hudson River.			
Gross earnings	$6,045,538	Dec.	$516,575
Expenses	5,199,766	"	374,907
Net earnings	$845,771	Dec.	$141,669
Lake Shore & Michigan Southern			
Gross earnings	$2,934,982	Dec.	$328,846
Expenses	2,065,306	"	288,221
Net earnings	$869,676	Dec.	$40,625
Michigan Central.			
Gross earnings	$1,786,391	Dec	$302,597
Expenses	1,523,623	"	142,003
Net earnings	$262,768	Dec.	$160,593
Cleveland, Cincinnati, Chicago & St Louis			
Gross earnings	$1,773,771	Dec	$47,480
Expenses	1,547,623	Inc.	112,958
Net earnings	$226,148	Dec.	$160,438

NEW YORK, ONTARIO & WESTERN.—Gross earnings for February were $515,000, against $519,000 in 1907. Net earnings were $72,000, against $104,000 in 1907. There was an increase of $12,000 in net charges, leaving a deficit of $14,000 against a surplus of $30,000 in February, 1907. The operating ratio, including taxes in operating expenses, was 86 per cent., against 80 per cent in 1907.

NORFOLK & WESTERN.—Gross earnings for February, 1908, were $1,818,000, against $2,439,000 in 1907, a decrease of $620,000. Operating expenses decreased from $1,570,000 to $1,193,000, a saving of $377,000. Net earnings were $625,000, against $868,000 in February, 1907, a decrease of $243,000. The operating ratio was 66 per cent., against 64 per cent. in 1907.

ROCK ISLAND COMPANY.—Gross earnings for February of all lines, including the Chicago, Rock Island & Pacific, the St Louis & San Francisco, the Chicago & Eastern Illinois and the Evansville & Terre Haute, were $7,910,000 against $8,860,000 in 1907, a decrease of $950,000. Operating expenses and taxes decreased $189,000 so that net earnings were $1,745,000 against $2,504,000 in 1907, a decrease of $759,000. For the eight months ended February 29, 1908, gross earnings were $75,976,000 against $73,456,000 in 1907, an increase of $2,520,000, and net earnings $19,660,000 against $24,000,000 in 1907, a decrease of $4,340,000.

SEABOARD AIR LINE.—See Macon, Dublin & Savannah.

SOUTHERN PACIFIC.—Gross earnings for February were $8,475,000, against $10,133,000 in 1907. Net earnings after taxes were $1,842,000, against $3,289,000 in 1907.

TEXAS & PACIFIC.—Gross earnings for the first three months of 1908 were $3,460,000, against $4,460,000 for the corresponding month of 1907, a decrease of $1,000,000.

THIRD AVENUE RAILROAD.—See New York City Railway.

TOLEDO & INDIANA (ELECTRIC).—C. F. M. Niles has been appointed receiver of this company, the January 1 interest on whose $1,650,000 first mortgage 5 per cent. bonds is in default. The road runs from Toledo, Ohio, west to Bryan, 55 miles. An extension and a branch have been under construction.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 16. FRIDAY, APRIL 17, 1908.

The presence of "strong" state railroad commissions all over the country, active in making rates, and making them always on a distance basis, is so new a thing that we have as yet scarcely had opportunity to study the actual workings of the system. The paper by Robert Mather, which we print in full this week, takes up the interstate effect of state rates with admirable clearness, and the accompanying rate charts show the far-reaching effect of ignorant local tinkering with rates. It is entirely idle to assume any longer that a state is so isolated that its own special brand of railroad regulation has no effect on its neighbors. State rate-making has tremendous power to change traffic currents and to build up or break down one set of ports or distributing centers at the expense of another set. But the competition between states is always at the expense of the railroads. Rates are always changed down, and this process brings its own limit when confiscation is reached. Even the most casual examination of Mr. Mather's analysis shows what a chaos our national system of railroad regulation is in. The states have created a tangle of authority and of jurisdiction that it will require years of patient work by the courts to straighten out.

The information given in the Interstate Commerce Commission's report of block signal mileage, just issued, is so condensed and so varied as to defy both the editor and his blue pencil, and we print the tables in full. The roads which largely increased their signal equipment in 1907 are literally too numerous to mention, though the Union Pacific system and the Southern Pacific Company, reporting a total of 3,750 miles of road equipped with automatic block signals, almost three times as much as in the report of the preceding year, cannot escape being prominent. The second, third and fourth tables give highly interesting details never before published. The fourth, telling of imperfect practice, seems to be an imperfect table, for there are items which appear to indicate that the signaling on certain roads is much more thorough and complete than it really is. This is due, no doubt, to careless use of signaling terms by the railroad officers reporting, a thing which has made difficult the preparation of statistics on this subject in the *Railroad Gazette* office. To readers not familiar with the practices of some of the single-track western lines the last column of Table 4 should be explained as meaning stations where trains are allowed to disregard the stop signal to the extent of running past it far enough to make a convenient station stop. While this practice is unscientific, it is a money-saver; and by the enforcement of proper speed-limit rules and meeting-point regulations it has been managed with success. The extent to which controlled manual apparatus is used without track-circuit locks is one of the significant things shown by Table 3, though here again we suspect that there are errors, making the total too large. The other salient fact in this table is that there are now a dozen roads on which the Morse telegraph is no longer supreme in manual block signaling, telephones or electric bells being used.

An examination of the cases in our column of "Interstate Commerce Commission Rulings" this week will show any one who is not already aware of the fact that the Commission by no means always favors the shippers in its decisions, and also that it is not, as some of its critics declared in advance that it would be, making every effort to extend its powers to the uttermost. There are, to be sure, in the list decisions lowering classification, reducing rates and awarding reparation, as well as condemning the practice of inserting obscure and general clauses affecting rates in voluminous tariff publications. But, on the other hand, the Commission upholds a competitive rate adjustment between Trunk Line and Central Freight Association territory, in an important decision upholding the principle that the effect of competitive conditions must be taken into account in fixing rates and must often be held superior to the long and short haul clause. In three of the decisions the Commission definitely limits its authority. It declares that it has no authority over steamship lines to Cuba or to require roads to establish special passenger fares based on less than the normal rates, or any authority whatever over routes and shipments in Indian Territory and Oklahoma Territory before their incorporation as the state of Oklahoma. The work of the Commission under its extended powers is one gratifying result of the agitation for greater control of railroads. It is generally admitted by railroad men and by shippers that the Commission is attempting with all the fairness and ability at its command to work with even-handed justice as between shippers and carriers.

The annual report for the year ended December 31, 1907, of the Grand Rapids & Indiana, just issued, makes the following statements in regard to its passenger earnings for the year.

The total number of passengers carried was 2,340,475, an increase of 12,878, or 0.55 per cent. The average rate per passenger per mile was 2.08 cents, an increase of 0.02 cents. Reduction in passenger fares became effective in Indiana on April 10, 1907, and in Michigan on September 28, 1907. During the first nine months of the year, when the maximum legal intra-state rate on the Grand Rapids & Indiana, in the state of Michigan was $2\frac{1}{2}$ cents a mile, passenger earnings increased $77,189, or 8.39 per cent.; the number of passengers decreased 59,887, or 3.97 per cent.; the passenger mileage increased 3,017,737, or 6.90 per cent., and the passenger train mileage increased 3,759 or 0.12 per cent. In the three months ended December 31, during which the maximum legal intra-state was 2 cents per mile, the passenger earnings decreased $16,449, or 5.29 per cent.; the number of passengers increased 50,118, or 15.11 per cent.; passenger mileage decreased 387,033, or 2.51 per cent., and the passenger train mileage decreased 2,101, or 0.79 per cent. For the entire year there was an increase in passenger train miles of 1,658. It cannot, therefore, be maintained that the Grand Rapids & Indiana has suffered a decrease in its passenger earnings because of any diminution of service, and the results from passenger traffic as shown above do not bear out the prediction of the advocates of the 2-cent fare that the lower rate would be supplemented by such an addition to the travel as to compensate for the difference in charge.

THE ERIE SAVED FROM RECEIVERSHIP.

The Erie Railroad, owing to its financial history and to the nature of its geographical location, has perhaps to work harder for a living than any other American railroad system at all comparable in mileage or importance. It has a through line from New York to Chicago, with branches to Cleveland, Buffalo and Rochester, but the handicap of the capital charge placed upon it by former generations has kept it from perfecting its physical requirements to enable it really to meet on even terms the severe competition of its neighbors, particularly of the New York Central and Pennsylvania systems. In round figures the Erie is capitalized at $186,000 a mile and earns $23,800 a mile; the Pennsylvania Railroad is capitalized at $152,268 per mile and earns $42,719 a mile from operation, in addition to which there are very important earnings derived from interest on investments, and the New York Central is capitalized at $114,807 a mile and earns $26,010 from operation. In the case both of the New York Central and of the Pennsylvania important "other income" not included in the above figures is only partially offset by rentals.

The relation between the earning power of the Erie and its annual burden of interest, as compared with that of its principal competitors, is clearly shown by these figures. The road went into the hands of receivers at the outset of the 1893 panic and emerged in 1895. Prior to that and since the opening of the line from Piermont, N. Y., to Goshen in 1841, it went into receivers' hands in 1841, 1859 and 1875. In the last few years, under the very able administration of President Underwood, its earnings have surprised even its admirers, increasing from 38 millions in 1899 to 51 millions in 1907 on substantially unchanged mileage, while generous appropriations have been made annually out of income for the physical betterment of the property. In the last five fiscal years $8,847,733 have been added to the assets in this way without corresponding increases in the liabilities, while maintenance, both of way and structures and of equipment, has been above the strict necessities of upkeep; but, in spite of this good work, the line has been, and still is, far behind the physical standard necessary to enable competition to be met effectively, and it was necessary for the company to increase its capital pretty fast year by year and add new charges so that interest could be earned on old and new alike. It was estimated, doubtless very roughly, last year, that the requirements to put the property in really first-class shape were not far from $25,000,000.

The surplus above preferred dividends for the 1907 fiscal year was equal to almost 3 per cent. on Erie common stock if this surplus be credited with the sum charged off for betterments; otherwise it was equal to about $1\frac{1}{2}$ per cent. on the common stock. But at the same time that the road was making this good showing with its current earnings it was being very much embarrassed by the fact that some of its capital debt was maturing at a period when it was almost impossible to do any new financing. On April 8, 1907, $3,000,000 of notes matured, and $2,000,000 more had to be taken care of between April and July, 1907. The bond market at that time was in a deplorable condition, and it would have been manifestly impossible even for a strong road to finance long-term bonds on a basis that the directors would consider. The note market had also been glutted, because nobody cared to pay 6 per cent. or more for permanent funds, and notes had been issued in such abundance and by so many strong and thoroughly solvent companies that the outlook for the notes of a financially top-heavy company was not good.

Therefore, the Erie adopted the very unusual expedient of issuing notes discounted in advance, after the manner of commercial paper, and by this device it obtained the necessary $5,000,000, although at high cost. These notes fell due April 8, 1908, but no plan for taking care of them was announced until April 4. At that time the directors authorized a $15,000,000 issue of new 6 per cent. three-year notes to take up the old notes and provide additional cash, and they announced that the sale and purchase of these notes at par had been underwritten without commission or cost to the company, but upon the express (and impossible) condition that all the $5,500,000 notes of 1907 should be exchanged, par for par, for the new 6 per cent. notes within four days. The announcement laid great stress upon the requirements that all outstanding notes must be deposited before 3 o'clock on April 8, and as this gave the noteholders four days and a few hours in which to deposit their notes, European investors would have required a kind of rapid transit at present unknown, in order to fulfil the condition.

Consequently, when April 8, the day of the climax, arrived, only a small part of the notes had been deposited, and the Erie was perhaps as close to a receivership as any road avoiding one has ever been. It was not until late Wednesday afternoon that the public learned that E. H. Harriman had that day offered to purchase $5,500,000 of the new 6 per cent. collateral trust gold notes at 95, provided the Erie would pay all the old notes at par by April 15, allowing holders of the 1907 notes the choice of cash or new 6 per cent. collateral trust notes at par, together with a cash bonus to the amount of 5 per cent. This dramatic offer was promptly accepted by the railroad company, and the notes rose so fast on the market that they squeezed the shorts and sold at two or three points above par.

The receivership having thus been averted by Mr. Harriman, the syndicate headed by J. P. Morgan & Co. forthwith announced that it would take $5,000,000 of the new notes at par in accordance with its original plan, thus financing the company's requirements for the present. So far as can be humanly predicted, therefore, the Erie is safe from receivership this year, but what the future of the property is to be is a matter of the greatest interest. It may frankly be stated that the record of the last five years has been so good that the capitalization per mile does not look as high as it used to, and another long-continued period of prosperity with the same scrutinizing, careful management of the property might quite conceivably place it on a plane of earnings where it would be reasonably safe; but the physical disabilities have got to be overcome; money has got to be spent to overcome them, and it will be difficult to find any keen and eager purchasers for new Erie bond issues. The suggested "bloodless reorganization," by means of which it was proposed to change some of the interest-bearing debt into some other form of security, thus lessening the chance of insolvency and foreclosure in dull times, would doubtless furnish one kind of relief. Another kind of relief could be obtained if anybody could be found strong enough and rich enough to make the future of the road his personal interest, to finance its rehabilitation, and to give it traffic. Mr. Harriman is better able to do this, if he cares to, than anybody else in the country, and we have a strong impression that under vigorous Harriman methods a way could be found to make the Erie profitable. Whether or not his interest in it is anything more than temporary, assumed for the good of the general situation, is one of the interesting questions in railroad strategy which the near future is likely to determine.

THE NEW PENNSYLVANIA RAIL SECTION.

We show this week two new rail sections, one adopted by the Canadian Pacific, the other by the Pennsylvania. The Pennsylvania has been making an exhaustive examination of the entire art and practice of rail making, taking it up almost as if it were a new subject, and in June, 1907, it appointed an able committee, consisting of the ten men whose names are given in another column. To make a practical test of the work of the committee the company placed an experimental order for 10,000 tons of rails in December, 1907, to be rolled in accordance with the new sections and specifications. The experience with these rails has resulted in some slight changes in the specifications, but no change has been made in the sections, and the Pennsylvania system has adopted as a standard for its 1908 orders the new sections and specifications as revised

February 4, 1908. It will be observed that the angle of the line under the head of the rail has been increased to give more draw to the splice and to allow better work on the head; that the radius at the ends of the top of the head has been made as large as possible to reduce the strain on the overhanging part of the head and to occasion less wheel wear at the bottom of the flange, and that the width of the base has been reduced and its thickness has been increased in order to balance the section and to counteract, so far as possible, the rapid cooling of the base as compared with the head, which requires the head to be finished too hot. In calculating the depth of the base the committee worked with the size of the head and the width of the base as constants, and with the total height of the rail as a variable. The following table shows a comparison of the principal dimensions of the 100-lb. rail as compared with the present standard of the Pennsylvania Railroad and with the A. S. C. E. section used on the Lines West:

	Penn. R. R. New specificatn. (100 lb. rail).	Penn. R. R. Pres. standard. (100 lb. rail).	Am. Soc. C.E., Lines West. (100 lb. rail).
Head, area, sq. in.	4.09	4.48	4.15
Web, area, sq. in.	1.85	1.99	2.02
Base, area, sq. in.	4.03	3.49	3.65
Actual weight	.....	101.5	100.2
Moment of inertia	41.9	38.34	44.09
Section modulus, head	13.71	13.40	14.60
Section modulus, base	15.91	14.30	16.20
Width of head	2½ in.	2 13/16 in.	2 14/16 in.
Radius, top of head	10 in.	10 in.	12 in.
" top corners head	7/16 in.	7/16 in.	[illegible]/16 in.
" bottom head	1/16 in.	[illegible]/16 in.	1/16 in.
Angle, sides of head	....	4 degs.	Vertical.
Angle, under sides, head	15 degs.	13 degs.	13 degs.
Splice bearing under head	23/32 in.	23/32 in.	25/32 in.
Depth of head	1 52/64 in.	1 56/64 in.	1 45/64 in.
Depth of web	2 50/64 in.	2 41/64 in.	3 5/64 in.
Thickness of web, thinnest part	9/16 in.	10/16 in.	9/16 in.
Fillet where web joins head & base	5/16 in.	1/4 in.	1/4 in.
Radius of web	10 in.	8 in.	12 in.
Angle at top of base	13 degs.	13 degs.	13 degs.
Depth of base at center line	1 3/32 in.	30/32 in.	31/33 in.
Radius of fillets at corner of bars	1/16 in.	11/64 in.	1/64 in.
Width of base bearing	....	5 5/32 in.	5 20/32 in.
Width of base	5 in.	5 4/8 in.	5 6/8 in.
Depth of rail	5 11/16 in.	5 4/8 in.	5 6/8 in.

In preparing the new specifications the point of view which the company took was that nobody knows just how great the discard ought to be, hence that it is better to specify that "there shall be sheared from the end of the bloom formed from the top of the ingot sufficient discard to insure sound rails," than to attempt to describe this discard in detail. It is noteworthy that a drop of 15 feet is prescribed for the drop test, and that the dimensions of the testing machine are carefully set forth. The specifications are printed entire on page 539 of this issue.

THE FLAT-SPOT LIMIT ON CAR WHEELS.

The maximum allowable length of flat spots on car wheels was fixed at 2½ in. by the Master Car Builders' Association in 1878, and has never been changed. Recommendations to reduce this limit have been made at various times but the association has always rejected them. Last summer G. W. Kittredge, Chief Engineer of the New York Central, addressed a letter to the president of the American Railway Engineering and Maintenance of Way Association, stating it to be his belief that the present allowance is too great; that the effect of a spot of the maximum allowable dimension under a 100,000-lb. car at high speed must be very bad, and in the interest of safety the rule should be modified. He suggested that the Maintenance of Way Association indicate this feeling to the M. C. B. Association. President Johnson agreed with Mr. Kittredge and thought the relative effect of flat spots under light and heavy cars should be determined. The matter was taken up with the Executive Committee of the M. C. B. Association, who referred it to the Arbitration Committee with instructions to confer with a committee from the Maintenance of Way Association. The president of the latter association designated as this committee the one on Iron and Steel Structures, and from this a sub-committee of three members was appointed to take charge of the matter. This committee, consisting of A. J. Himes, C. D. Purdon and A. D. Page, made a progress report at the recent convention of the Maintenance of Way Association.

At the time the 2½ in. limit was set the largest freight cars carried 40,000 lbs. and weighed 22,000 lbs., giving a load of 7,750 lbs. per wheel. With present 100,000-lb. cars, which, with the permissible 10 per cent. overload will have a total gross weight around 150,000 lbs., the load per wheel will be about 18,750 lbs., or 2.4 times the load of 1878. While it is not easy to say what the increase in maximum speed of freight trains has been, the report assumes about 100 per cent. Two things must be known in order to determine the economic effect of reducing the M. C. B. limit: the probable increased expense, and the benefit to be received. The lack of records has made it impossible to estimate the increase in number of wheel renewals a change would cause, and the other expense incident thereto. It was decided at a joint meeting of the two committees in December to gather during January and February statistics from which to make such an estimate, but the results were not available at the time the report was prepared.

To estimate the benefits to accrue from such a reduction of the flat spot limit is probably impossible in figures. While it is known that a flat wheel delivers a pretty hard blow to the track at each revolution, the force of the blow and the damage done are hard to determine. On this point the report says: "It is easy to conceive of much possible damage to frogs and switches and to rails, and of occasional broken rails, and, likewise, of damage to rolling stock and delays to traffic and injuries to the surface of the track, but to collect statistics of specific cases of such damages, and conclusive evidence of the cause of the injury, is something that is very hard to accomplish. On many railroads numerous cases of broken rails are charged indefinitely to flat wheels, but, admitting the correctness of the charge, it generally appears that the wheels are those of a locomotive or tender carrying loads in excess of those on ordinary car wheels and having spots in excess of those specified by the M. C. B. rules. It is quite evident, however, that if a locomotive with 40,000 lbs. on an axle is the cause of broken rails, a heavily loaded gondola car, having about the same weight on the axles might just as readily produce the same effect."

The report contains a theoretical discussion of the force of the blow resulting from a flat spot, in which an expression for the impact is deduced. This impact is shown to be proportional to the square of the length of the flat spot, so that by reducing the latter one-half, the blow would be only one-fourth what it is at present. The reduction actually recommended to the M. C. B. Association is from 2½ in. to 1¾ in., which would reduce the impact approximately one-half. As regards the relative strength of wheels, load per wheel, and increased impact from flat spots, it is stated that the first drop test specified for car wheels, which was in 1889, was a 140-lb. weight falling 12 ft., or 1,680 ft.-lbs. At present for 700-lb. wheels it is a 200-lb. weight falling 12 ft., or 2,400 ft.-lbs., an increase of about 43 per cent. But since the flat-spot limit was established the load per wheel has increased 240 per cent. and the impact from a flat spot therefore 960 per cent.

Prof. Benjamin, of Purdue University, has devised a plan for an apparatus to measure the effect of flat spots. He proposes using only one wheel, on which flat spots of different lengths can be made and the effect of the impact recorded. An ordinary pair of wheels mounted on an axle will be used, with one wheel running on a friction wheel and the other—the one to be tested—running on a rail curved to circular form in a horizontal plane. Beneath this rail will be a recording mechanism in the form of a suitable hammer, which will indent a strip of soft metal. These indentations will be calibrated by an impact machine and the exact magnitude of the blow thus determined. The machine could be run any length of time, with different applied weights, lengths of spots and speeds, and any number of records taken. This sort of apparatus could also be used for determining the effect of counterbalance blows. The committee recommended that the association take some action with regard to carrying out such a series of tests. The cost of installing the apparatus was estimated at $1,500. The committee further suggested that the impact tests to determine the effect of moving loads on bridges include observations on the effects of flat spots. Tests such as are proposed to determine the force of impacts from flat spots might also be helpful in throwing light on the magnitude of service stresses in cast iron car wheels. These stresses are greatest, of course, when running through frogs and crossings, but there would seem to be no practical difficulty in producing these effects in the test apparatus.

NEW PUBLICATIONS.

Automatic Block Signals and Signal Circuits. By Ralph Scott. New York: McGraw Publishing Co. 243 pages, 6 in. x 9 in. Price, cloth, $2.50.

This is a copious collection of diagrams of electric circuits such as are used in automatic block signaling, including the complicated arrangements for electric locking by track circuit control at interlockings, with examples taken from many situations, few of which, however, are named. Circuits for controlled manual block signaling are also shown, together with an example of the Taylor electric interlocking. The author describes all these circuit combinations and gives some brief instructive comments, but his material appears to have been put together with little regard for any systematic plan, and many of his descriptions are useful only to readers already thoroughly versed in the subject treated. "Railroad terms have been omitted," he says, "because they are meaningless to the average reader", but the "average reader" would find less fault with railroad terms than he will at the absence of the elementary information that he needs on such a technical subject. The dozen pages on maintenance constitute perhaps the best chapter in the book; and maintenance is an important subject, for (we read) "when any serious trouble occurs, its results increase with great rapidity, owing to the momentous position which signals possess in a competent aggrandization."—(!)

An Italian Unit of Locomotive Performance.

BY LAWFORD H. FRY.

During the spring of last year the Italian Government Railroads introduced a unit previously employed on the Adriatic Railroad for use in the comparison of locomotive performances. For the purpose of instituting comparisons of fuel and water consumption between various classes of locomotives, and as a basis for the coal premiums of the enginemen, it was considered desirable to have a more logical unit of work done than is afforded by the "ton-mile." With this object in view, the idea of the "virtual kilometer" was introduced and the work done by the locomotives is now measured in "virtual ton-kilometers," which are found by multiplying the weight of the train in tons, not by the actual distance through which it is hauled, but by a virtual distance which brings into account the grades and curves over which the train is moved. This obviously gives a more logical measure of the work done than the actual ton-kilometrage does. The practice of measuring locomotive performance by the actual ton-mileage is widely extended, but in making any comparison of results on this basis, it must be borne in mind that the work done by a locomotive is dependent on the ton-mileage, on the class of service, and on the character of the road over which the ton-mileage is produced.

The American Railway Master Mechanics' Association decided in 1901 that while it is desirable to keep a record of locomotive performance on a ton-mileage basis, yet it is improper to make comparisons between the results on different railroads on this basis, or even between the results on different divisions of the same line; the only fair comparison on a ton-mileage basis being between locomotives on the same division of a railroad.

In calculating the virtual distances on the Italian railroads the mean train resistance on a straight and level track was assumed to be 4.5 kilog. per metric ton. This was, however, increased about 10 per cent. to 5.0 kilog. per ton in order to make an allowance for that part of the fuel which is consumed while running, but which is independent of the work done at the drawbar, as for example that which is required by the losses of heat by radiation from the boiler, by leakages and for the steam required by special appliances.

On this basis, on a falling gradient which is sufficient to keep the train in motion, the minimum virtual distance would be one-tenth of the actual distance, but to cover the coal burned while accelerating and stopping the train, the minimum virtual distance on any grade is taken as one-fifth of the actual distance, and as an allowance for starting, the minimum distance between any two successive stations is taken as one kilometer.

The train resistance on the level being taken as 5 kilog. per ton, or one-half of 1 per cent. of the train weight, it follows that the virtual distance, inclusive of the effect of curves, is the actual distance increased by one kilometer for each five meters of rise, or decreased by one kilometer for each five meters of fall between the points considered. In English measure this corresponds to a mile added or subtracted for each 24.1 ft. of difference of level.

The curves are taken into account by considering them as replaced by rising grades in accordance with the following table:

Radius of curve.	Equiv. rising grade in per 1,000 ft or resistance in kg. per metric ton.	Radius of curve	Equiv. rising grade in per 1,000 ft. or resistance in kg. per metric ton
1,000 meters	0.5	400 meters	2.0
900 "	0.6	350 "	2.4
800 "	0.8	300 "	2.8
700 "	1.0	250 "	3.4
600 "	1.2	200 "	4.2
500 "	1.5	180 "	4.5
450 "	1.7		

The foregoing is expressed in the formula—

$$L_v = L_a + \frac{h + \Sigma p l}{5}$$

where L_v is the virtual distance in kilometers,
L_a is the actual distance in kilometers,
h is the difference in level in meters, positive if the grade rises and negative if it falls,
l is the length in kilometers of each curve,
p is the grade corresponding to the curve in the table above.

In English measure this formula is

$$M_v = M_a + \frac{d}{26.4} + \frac{\Sigma p k}{26,400}$$

where M_v is the virtual distance in miles,
M_a is the actual distance in miles,
d is the difference in height in feet with the proper sign,
k is the length of each curve in feet,
p is the grade corresponding to the curve in the above table.

This formula is used to determine the virtual distances on rising grades and on falling grades less than 0.4 per cent., while on steeper descents the virtual distance is taken simply as one-fifth of the actual. For use on the Italian railroads a small book has been compiled showing the actual and virtual distances for all parts of the system. By means of this it is a simple matter to calculate the virtual ton-mileage of any train.

It may be of interest to analyze somewhat further this conception of the virtual distance, using for the purpose English measures. In the first place, to restate the definition. The virtual distance between two points is the distance through which a train must be drawn on a straight level track, with a train resistance of 11.2 lbs. per ton (0.5 per cent.) for the work done to be equal to that required to take the train over the actual distance with its grades and curves. Leaving for the moment the question of whether or no the figures chosen for the train resistance are correct, it is obvious that each virtual ton-mile represents a definite measured expenditure of work. To move one ton of train requires a force of 11.2 lbs., so that each virtual ton-mile requires the expenditure of 11.2 × 5,280 = 59,136 ft.-lbs. of work. If the train speed were 10 miles an hour, the rate of working would be very nearly 0.3 h.p. for each ton of train weight.

In this lies the value of the virtual distance as a basis of comparison; the virtual ton-mileage is a measure of the mechanical work required for the train movement and is, therefore, a logically correct standard by which to measure the coal and water consumption, etc. The coal consumption per virtual ton-mile is in a sense a measure of the mechanical efficiency of the locomotive, but it does not measure the commercial efficiency of the railroad.

In other words, the virtual ton-mileage measures the work performed by the locomotive, but does not measure the amount of transportation effected, which is the commercial product of the railroad.

For the latter purpose the actual ton-mileage is the proper measure.

Now, as to the accuracy of the assumption that the mean train resistance on straight and level track is 11.2 lbs. per ton. It is obvious that, as in all the attempts to express the conditions of railroad operation by a simple formula, no very high degree of accuracy can be attained.

For average results the assumed train resistance appears to be well chosen. It must be borne in mind that the ordinary service on the Italian railroads does not involve any very high train speeds, so that it is not likely that the actual train resistance will exceed the assumed figure.

The mean resistance on the level has been put at the rather high figure of 11.2 lbs. per ton, with the object of making allowance for the various heat losses which are not dependent on the work being done by the locomotive. As no corresponding increase has been made in the resistance due to grade curves, the virtual distances as calculated have a tendency to give too little weight to the effect of grades. This is to some extent compensated for by the fact that usually the speed is reduced on the grades and the rolling resistance is thus somewhat lower than it is on the straight and level track.

There seems to be no doubt but that the use of the "virtual ton-kilometer" is a valuable step in the direction of recording locomotive performance on a logical basis.

How the States Make Interstate Rates.*

BY ROBERT MATHER,
President Rock Island Company.

The widespread efforts of state legislatures and railroad commissions within the past two years to reduce railroad rates have presented many interesting phases to public observation. The extent and severity of the proposed reductions, the novel expedients adopted to prevent or to make difficult a review of the state action in the federal courts, the resulting conflict of judicial authority and the recent decision of the Supreme Court of the United States holding these expedients unconstitutional have kept the movement constantly in the public mind. Out of the many questions which discussion of the situation has evolved none are more interesting or important than those relating to the effect of state-made rates upon rates for interstate transportation. It is the purpose of this article† not to show that the rate-making power of the states should be diminished or destroyed, or that this object, if desirable, can or cannot be accomplished under the federal constitution, but merely

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†Much of the matter and all the maps for this article were prepared by Mr. Theodore Brent, of the Traffic Department, Rock Island-Frisco Lines, Chicago.

to state and to illustrate the proposition that, in fact, the states *do* make interstate rates.

The great movements of traffic in this country are eastward and westward. The volume of the westward movement has always been high-class merchandise—dry goods, wearing apparel, groceries, hardware and like articles. Formerly this was all produced in the East or imported through Atlantic ports; it is only within recent years that the larger cities in the West have become manufacturing centers.

When the evolution of our rate fabric began New York, Boston, Philadelphia and Baltimore were the bases of supply. Chicago, St.

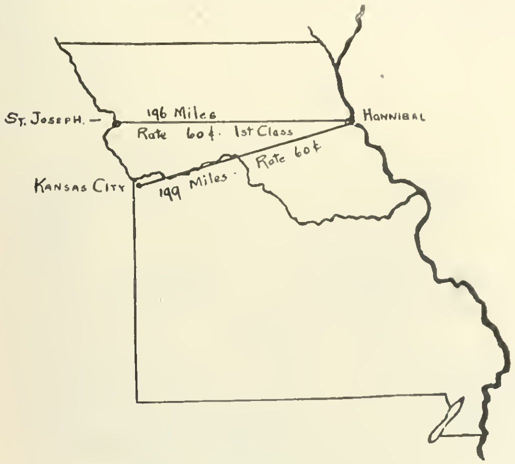


Fig. 1.

Louis, St. Paul, Omaha and Kansas City owe their development as trade centers primarily to strategic location at the head of navigation, or at points where the transcontinental trails left the watercourses for the West, Northwest and Southwest. They commenced as outfitting points for prospectors and settlers; their business was that of distributing through the new western country the articles of commerce manufactured in or imported through the East, and that still constitutes a large part of their trade.

When railroads found their way to Chicago and St. Louis their rates were fixed largely by the water competition which met them on

Fig. 2.

their arrival. Gradually railroads were constructed westward from these points and, as they reached common territory, the force of competition began to be felt. Intense rivalry developed between the distributing houses of Chicago and St. Louis, and pressure was brought to bear upon the railroads, both East and West, to keep the rate fabric so adjusted that goods, stored in and distributed from either city, might be laid down at any of the Missouri river points at substantially the same freight cost. The class rates from New York to Chicago thus became the basis of measurement for all class rates. The St. Louis rate was a fixed per cent. higher, approximating the difference in the cost of reaching that point by water. The rates between the Mississippi river and Chicago on the one hand and the Missouri river on the other were fixed not at what would be a reasonable rate for the distance, but at what it was necessary to maintain in order that St. Louis and the lines leading through St. Louis might compete with Chicago for the expanding business of Kansas City, Atchison, St. Joseph and Omaha.

In the territory west of the Missouri river the same process has been repeated, and rates are maintained in such relation not only that Kansas City, St. Joseph and Omaha may compete with each other, but that goods distributed from St. Louis and Chicago, as well as from the eastern cities, may be handled through Kansas City, St. Joseph or Omaha and laid down at the several consuming points at practically the same freight cost. In the Northwest this same competitive adjustment is maintained between Chicago, Duluth, Minneapolis and St. Paul. In the Southwest, Chicago, St. Louis and Kansas City must be kept on an even keel, and when Texas is reached the whole adjustment is modified to meet the competition of coastwise steamers plying from New York to Galveston. To Colorado and Utah the routes through all these gateways are kept in constant adjustment, and the rates so arranged that Denver and Pueblo are enabled to do a distributing business.

What is true of westbound merchandise is equally true of the

Fig. 3.

movement to the East of the great staples raised in the West. The grain territory is so divided and rates are so made that grain may move freely to the Mississippi river, the lakes and the gulf, through the great storage centers of Minneapolis, Duluth, Chicago, St. Louis, Omaha and Kansas City. In like manner live stock rates are so arranged that the traffic may move freely to the rival packing centers of Kansas City, St. Joseph, Omaha, St. Paul, Chicago and St. Louis.

These rate relations are not the work of the traffic departments of the railroads. They do not exist by virtue of acts of legislatures or of orders of commissions. They are the resultants of the commercial growth of the country. Trade is established along these lines, industries and communities are founded on the basis of these adjustments, and their existence and prosperity depend upon the continuance of these rate relations. They are the controlling facts in all rate disputes, more stubborn than disaster and as immovable as mountains.

There is hardly a rate on any article of commerce but feels the force of these competitive conditions. They absolutely dictate the traffic policy of the railroads operating in the territory affected by them. The carrier makes no rates that are not effectively controlled by these conditions, and the rate-making power of the Interstate Commerce Commission itself cannot ignore them. The only rate regulating body that makes rates without reference to these conmercial conditions is the legislature or the railroad commission of a single state. Its field of operations includes but a fraction of the territory whose traffic is controlled by these conditions; contains but few of the larger distributing centers which compete for that traffic, and is usually circumscribed, either wholly or in part, by imaginary boundaries fixed without regard to factors which exercise controlling influence upon the trend of traffic and of rates. The influence of lakes, of rivers and canals, the competition of rival markets, the relation between manufacturer and dealer, and other like forces that, in the making of rates, confront the traffic officer of an interstate railroad and the Interstate Commerce Commission itself, enter but slightly, if at all, into the calculations of the state. In every case, in the exercise of its rate-making power, distance is the one factor given serious consideration, and the result of its labors is invariably the production of a distance tariff.

This state distance tariff is, on its face, a simple and a harmless thing. The right of the state to make it and to change it at its will seems to be amply buttressed by the conceded principle of law that the power of Congress over interstate commerce leaves untouched the power of the states to regulate their purely internal commerce. And no simpler or less obnoxious method of exercising that power would seem possible than to describe the rates at which traffic shall move from point to point within the state.

But when the traffic officer of an interstate railroad comes to apply this state distance tariff, made for state use on purely local considerations, to the traffic that actually moves over his rails, he finds that he cannot confine its influence to traffic within the state, and that, against his will and without his action it readjusts his rates into and out of and through the state, and determines his revenues on traffic that never traverses the borders of the state. This is illustrated by the action of the following states:

MISSOURI AND IOWA.

Missouri has a far-reaching control over interstate rates by reason of the situation of the state at the point of least distance between the Mississippi river—the basing line for rates from the East—and the Missouri river, the base line for rates to the West.

There are three factors which go to make up the rates from the East to the western territory—whether or not they are published as through rates—namely, the rate from the seaboard to the Mississippi river or Chicago; the rate from the latter base line to the Missouri river, and the rate west of the Missouri river. Reduce the rate between the Mississippi river and the Missouri river and you reduce the rates on all business either locally or through or beyond these base lines.

The first-class rate between the Mississippi and Missouri rivers practically determines the interstate rates on all classified articles moving between the East and West. It is at present 60 cents per 100 lbs., this being the figure fixed by the Missouri Railroad & Warehouse Commission as a reasonable maximum rate for the short-line haul of approximately 200 miles across the state from the Mississippi to the Missouri river—the distance from Hannibal to St. Joseph being 196 miles—and from Hannibal to Kansas City 199 miles. Note the chart:

Though this rate is based on the distance of 200 miles, competitive conditions outside the state apply it at once to all hauls across the state, no matter what their distance. The short line from St. Louis to St. Joseph is 302 miles, and lines operating between these cities would be privileged, under the commission's maximum scale, to charge 74 cents, first class. The short line between St. Louis and Kansas City is 277 miles, for which distance the commission's scale is 71 cents, first class. But here considerations enter which are entirely outside the horizon of the Missouri commission. The rates from New York to Hannibal and St. Louis are the same. There are routes leading from New York to St. Joseph and Kansas City, through both Hannibal and St. Louis. Kansas City and St. Joseph, compete in the same territory, and the rates to both points from New York must be kept the same through all gateways. Consequently the commission's maximum rate for the shortest distance becomes the rate between all four crossings.

Thus the element of distance even between points within the state is immediately modified by outside forces, controlling with the carriers, but which exerted no influence upon the commission when it fixed the nominal measure of rates.

Just north of Missouri lies the state of Iowa. To the untutored mind there would seem to be no reason why traffic of the same class should move within the state of Iowa for a less charge than within the state of Missouri. Yet the maximum charge under the Iowa distance tariff for hauling first class merchandise 200 miles is 40 cents,

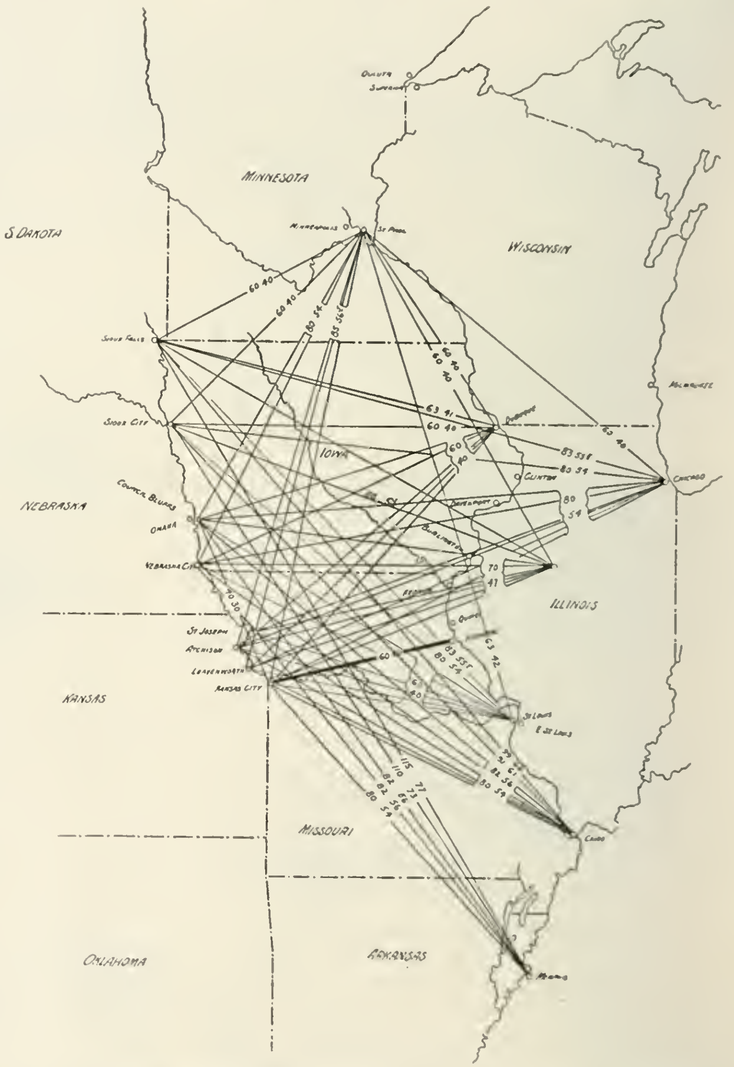


Fig. 4.

Broad line indicates short line distance of 199 miles across state of Missouri, between Hannibal and Kansas City, which measures and controls all western rates. Left hand figures are present rates. Right hand figures indicate approximate rates were Missouri commission to prescribe Iowa scale as the Missouri maximum.

as against 60 cents fixed by the Missouri tariff. The railroads in Iowa must haul the same class of merchandise 350 miles to be entitled to charge 60 cents, but, significantly enough, the 350 miles measure the distance in Iowa between the Mississippi and Missouri rivers, so that the rate between the two base lines is the same in both states. Should Missouri adopt the Iowa scale, the Missouri rate from the Mississippi river to the Missouri river, between all the points in Missouri that we have been considering, would, for the reasons already given, at once become 40 cents, regardless of distance.

The effect within the state of Missouri, however, is only the beginning. The rate between the Mississippi and Missouri rivers being, as previously explained, one of three factors of a through adjustment from points of production in the East; the rates from the East to all Mississippi river crossings being the same; there being competitive routes from the East to all Missouri river points passing through all of these Mississippi river crossings; and the merchants and manufacturers in the Mississippi river cities maintaining trade relations with all of the Missouri river cities and with the territory reached through them; it follows that the rate between Dubuque, Iowa, and Kansas City, Mo., cannot be higher than the rate between Dubuque and Council Bluffs (both points within the state of Iowa); nor can the rate between St. Louis, Mo., and Omaha, Neb., be higher than the rate between St. Louis and Kansas City or between St. Louis and St. Joseph (movements wholly within the state of Missouri).

Thus from the act of the Missouri commission in reducing its charge for its haul of 488 miles between St. Louis and Omaha through Missouri, Kansas and Nebraska, and in like manner the rate of the Illinois Central Railroad for its haul of 703 miles between the same points, through the states of Missouri, Illinois and Iowa. (See the map.)

Thus, within the territory enclosed by the Illinois Central, Missouri Pacific and Rock Island as outlined on the map, any reduction made by the Missouri commission in the class rates for the 200-mile distance between Hannibal, Mo., and Kansas City, Mo., has the effect of bringing all rates to the level so fixed, not only between the crossings themselves but, with very slight exceptions, between all intermediate points.

This, again, is but a preliminary glimpse at the inevitable results of this action of the Missouri State Commission.

The first class rate from Chicago to the Missouri river has for many years been 20 cents per 100 lbs. higher than the rate from

Fig. 5.

The shaded field indicates the territory immediately affected by any change in the Missouri Commission's maximum rate for the [illegible] of 199 miles between the Mississippi river and Missouri river base lines. [illegible] the controlling factor in western trunk line territory be [illegible] action in Missouri, the entire revenue on east and west business falls automatically in proportion. The water lines indicate the [illegible] rates operated by the rail and water carriers, which move upward or downward automatically with any fluctuation in the all-rail rates.

distance tariff from 60 cents to 40 cents for 200 miles, the following results directly flow:

(*a*) The local *Missouri* rate from points on the Mississippi river to points on the Missouri river, regardless of mileage, is reduced from 60 cents to 40 cents;

(*b*) The local *Iowa* rate from points on the Mississippi river to points on the Missouri river (say Clinton to Council Bluffs, 350 miles) is reduced from 60 cents to 40 cents;

(*c*) The *interstate* rate from points on the Mississippi river in Missouri to points on the Missouri river in Iowa or Nebraska (say St. Louis to Council Bluffs or Omaha) is reduced;

(*d*) The *interstate* rate from points on the Missouri river in Missouri to points on the Mississippi river in Iowa (say Kansas City to Davenport) is reduced.

Not only this, but this Missouri commission rate for 200 miles fixes the maximum rate which the Missouri Pacific Railway may

the Mississippi river. The competitive adjustment would require that there be no greater difference under the new scale. Indeed, the rates from the seaboard to Chicago and the Mississippi river remaining as at present, it is doubtful if Chicago and the routes through Chicago could compete should the present arbitrary difference be maintained under the reduced adjustment. The present rate of 80 cents, first class, from Chicago, is one-third higher than the rate from the Mississippi to the Missouri river. It is probable that not more than one-third greater would be practicable under the lowered scale, which would make the first class rate from Chicago 54 cents per 100 lbs.

Peoria must be maintained at one-half the difference between Chicago and the Mississippi river. Milwaukee must be kept on the same rate basis as Chicago. The rates from Minneapolis and St. Paul must be kept the same as Chicago to the upper Missouri river crossings (Omaha, Council Bluffs and Nebraska City), and 5 cents higher than Chicago to the lower crossings (St. Joseph, Atchison, Leavenworth and Kansas City). Duluth takes fixed arbitraries above St. Paul. The intervening territory in Wisconsin, between Milwaukee and St. Paul, is built on arbitraries over either Chicago, Milwaukee or St. Paul, and would call for readjustment accordingly. From Memphis, Tenn., not higher than Chicago rates can be maintained to lower Missouri river crossings, and to the upper crossings the first class rate from Memphis cannot be more than 2 cents higher than Chicago. To Sioux City the rate from Chicago, St. Louis and Peoria must be kept the same as from Chicago to Omaha. The first class rate from Memphis to Sioux City is to-day 30 cents higher, and from Minneapolis and St. Paul 20 cents less, than from Chicago to Sioux City, and the same percentage relation must be maintained on the lowered scale.

The immediate result, then, of the fixing by the Missouri Commission of a maximum charge of 40 cents, first class, for the distance of 200 miles between Hannibal, Mo., and Kansas City, Mo., is to fix interstate movements throughout the whole territory pictured in the outline.

The illustration thus far deals only with the change in rates on business which may be termed purely local to the territory immediately embraced in the illustration—that is, business which has both origin and destination within the territory. We have not yet touched upon that volume of eastern business to the Missouri river cities, to St. Paul and Duluth, and to the territory beyond as far West as the states of Utah, Idaho and Montana, or to the Southwest, including the state of Texas and territory of New Mexico. Yet the rates on this business are quite as vitally involved. The competitive adjustment between Chicago, Peoria, Memphis, the Mississippi river, and the head of the lakes, as previously described, was originally evolved and has since been maintained in a measure to permit this merchandise to move freely by all routes to this trans-Missouri, northwestern and southwestern territory. Whenever the western factors of the through rates to this territory are reduced,

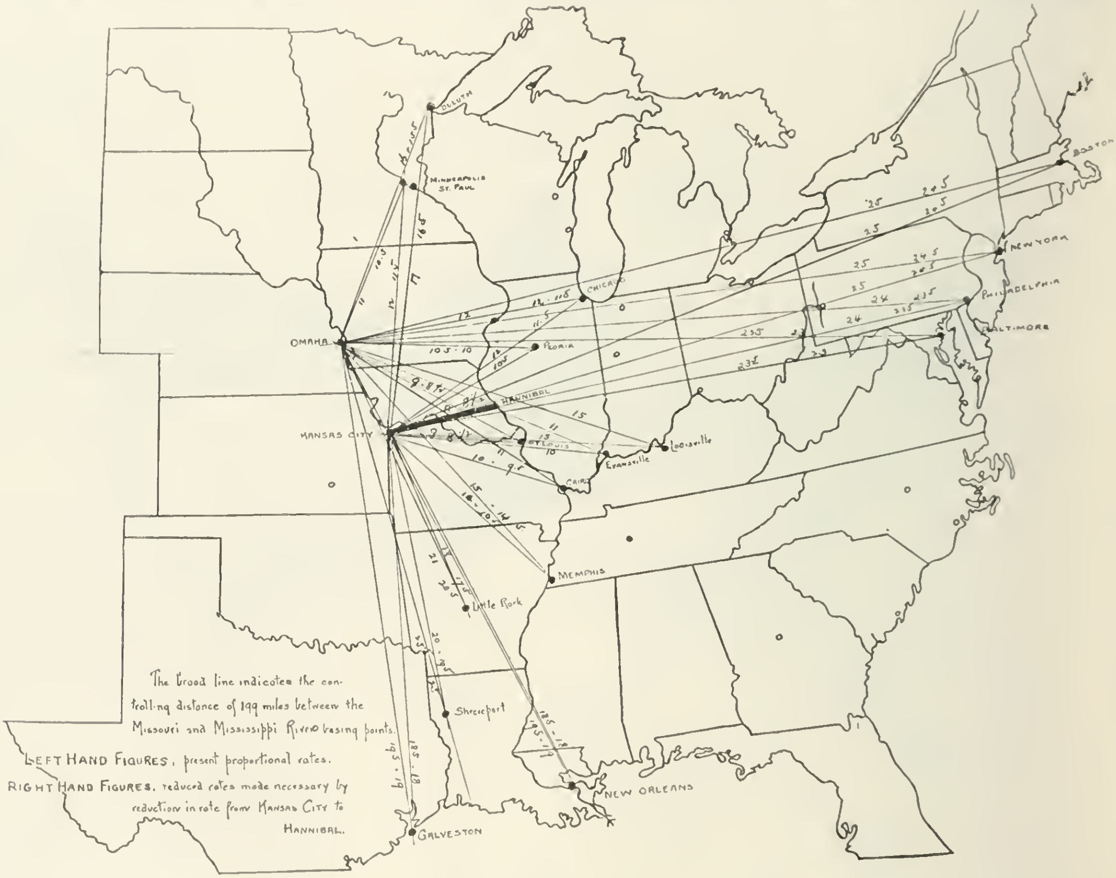


Fig. 6.

the rates for all routes shown on the accompanying map of what is termed western trunk line territory.

The foregoing outline illustrates only the adjustment of first class rates. In Western Classification territory there are five numbered and five lettered classes, and the other classes all bear a certain percentage relation to the first class rates. This is true to the extent that any considerable reduction in the rate on first class involves necessary proportionate reductions in the rates on other classes—the severity of any such reduction lessening, of course, as the rates themselves grow less; but the rates on all classes must go down if one goes down, so that the same fixed relation between the classes may be maintained on the lower as on the higher basis.

Similarly, the outline only illustrates the change in the adjustment between the principal basing points in western trunk line territory. But around these basing points are grouped all the adjacent cities and towns; so that an adjustment once reduced from Chicago, or Peoria, or the Mississippi river to the upper or lower Missouri river points, a corresponding reduction results from all points, both of origin and of destination, held common with these basing points. So the reductions become automatic covering all the rates on such through business fall simultaneously with the rates on the local business.

Merchandise for this western territory moves from the East by every conceivable route. Every all-rail line and every conceivable combination of rail lines publish the rates. During lake navigation daily boats carry this merchandise to Chicago, Milwaukee and the head of the lakes. It is handled by steamer in connection with rail lines from every South Atlantic port from Norfolk to Jacksonville. There is a steamer load despatched daily from New York and given to the rail lines at the port of Galveston, Texas. The rate fixed by the authority of the state of Missouri, between Hannibal and Kansas City, and based on purely local considerations, has its leveling effect upon the rates on every pound of this vast traffic. The next map shows the ultimate reach of the rate-making power of Missouri.

It is true that the illustration has proceeded thus far on the assumption that Missouri might make a reduction in its existing class rates, and not on the fact that such reduction has been made. But Iowa has precisely the same control over interstate adjustments that the illustration demonstrates Missouri to have, and as matter of fact East and West class rates are what they are to-day because Iowa some years ago prescribed 60 cents as the maximum charge, first class, for the haul within its borders between the Mississippi and the Missouri rivers. The Iowa distance tariff of 1887 actually measures to-day the revenues of the Interstate railroads on all interstate freight passing into or out of or beyond that state.

Besides, Missouri has actually made radical reductions in other rates that illustrate as well the principle of our contention. The legislature of 1905 ordered drastic reductions of rates on grain, flour, lime, salt, cement, stucco, lumber, agricultural implements, furniture, wagons and live stock, and the legislature of 1907 added 100 lbs. on all grain. The state's action also calls for a reduction of a half cent per 100 lbs. in the proportional rate on wheat between Kansas City and Hannibal. This proportional rate of 9 cents is the rate applied on all wheat coming from beyond the Missouri river, and, as in the case of the class rates, it is the pivotal rate in the whole adjustment. If the legislature's action is finally upheld, a readjustment of the whole rate fabric on western grain will result. There is no more sensitive adjustment in existence than the grain rates. No single part of any of the through rates can be disturbed without disturbing the revenue on a large part of the whole movement.

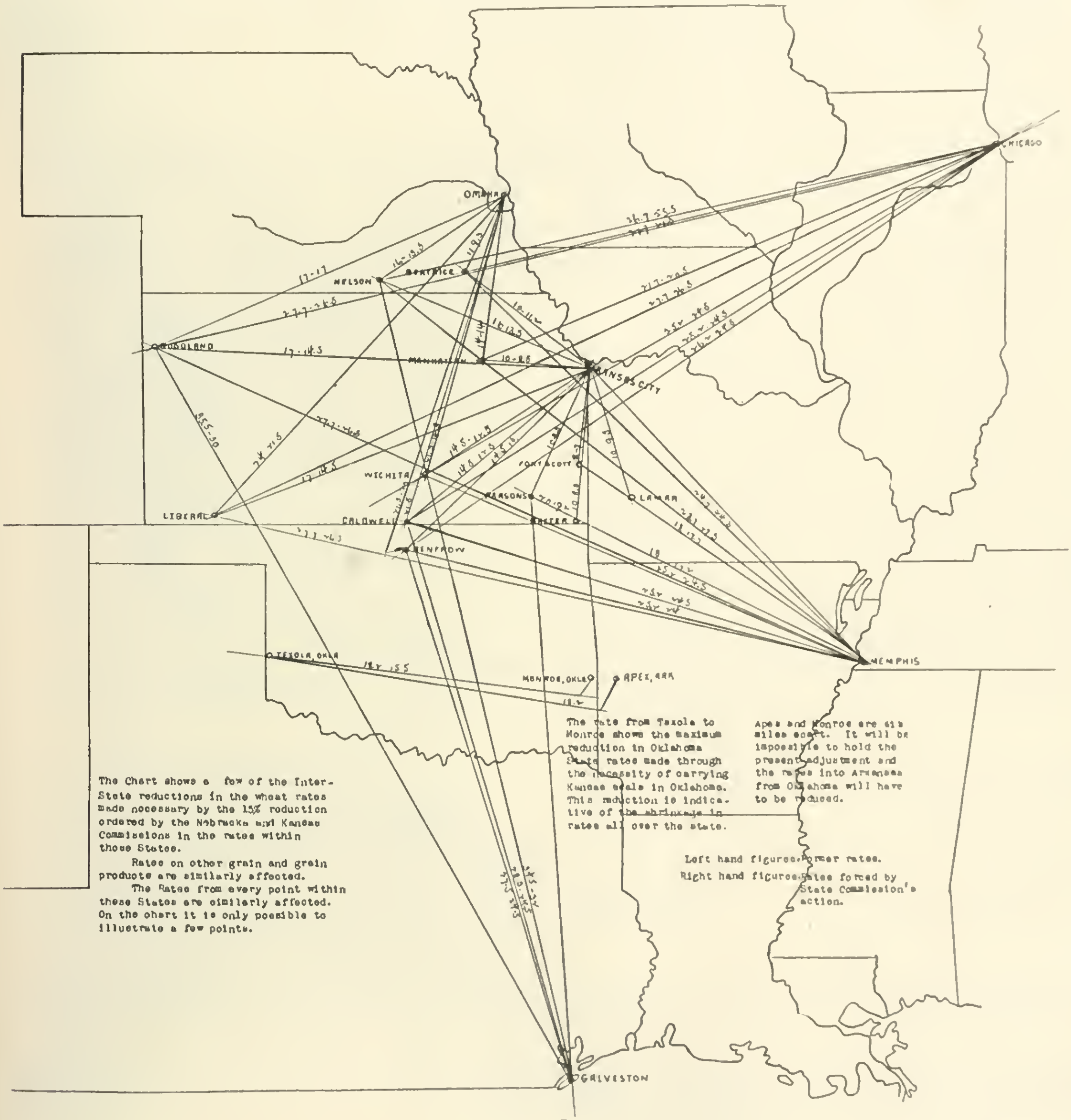


Fig. 7.

stone, gravel and other commodities. The rates have not been published, as the constitutionality of the legislation is in question before the courts, but if the state's right to order the reductions is finally established, the interstate rates on these bulk commodities, which constitute a large percentage of the carload tonnage of all western carriers, will come down with them.

The reductions which will result in rates on grain will illustrate. The short line distance rate between the Missouri and Mississippi rivers will be reduced from 13 cents per 100 lbs., on wheat, and 12 cents per 100 lbs. on corn and other grain, to 8½ cents per

Competition and market conditions require that the rates on grain from the states of Kansas and Nebraska shall be so adjusted that the grain raised in those states can move eastward freely through either of the primary markets at the Missouri river Kansas City or Omaha. When these markets are reached, not alone the grain markets of the United States, but the foreign markets as well must be open to the producer, so that the Nebraska or Kansas producer may have the benefit of the best prevailing market price of the world to-day; and the adjustment must be maintained from day to day so that the large grain buyers may take the surplus grain into elevator storage, not only at the Missouri river, but at the large storage points at the Mississippi river, the Ohio river, the Lake ports, the milling centers, and the Atlantic and Gulf seaboard, with the full assurance that when the demand makes eastern or southern shipment desirable he will have a parity of rates in either direction through any market. If the reduced rates are finally enforced the material reductions within the state will be insignificant compared with the automatic reductions in the interstate adjustment which must follow. The same reduction must be made from Omaha, not only to St. Louis but to the other Mississippi river crossings; to Peoria and Chicago, the gateways to the Central states; to Louisville, Evansville, Cairo and Memphis, the market points for all the Southeastern states; to Little Rock, Texarkana, Fort Worth, Dallas and Shreveport, the principal market gateways for the states of Arkansas, Louisiana and Texas; and to Minneapolis, the largest of the milling centers. Any reduction in the rate to the Mississippi river and Chicago means just that much reduction in the revenue on grain moving to Boston, New York, Philadelphia, Baltimore and Newport News for export, as these rates are all made on the Mississippi river combination. And when these rates go down, a similar reduction is forced in the rate to Pensacola, Fla., Mobile, Ala., New Orleans, La., and Port Arthur and Galveston, Tex., for export.

It has never been found feasible to carry local and proportional rates on the same basis, and there is therefore the probability of further reduction in the proportional basis. To what figure the proportional rate on wheat across Missouri might fall as the result of carrying a local rate of 8½ cents, is, of course, problematical. The rates up to this time have always been maintained about 4 cents lower than the local rates. The accompanying chart only illustrates the direct reductions in the existing proportional rates:

KANSAS AND NEBRASKA

During the year 1907 the Railroad Commission of Kansas forced a reduction of 15 per cent. in the existing rates on grain within the state. A reduction in grain rates always applies as well on flour, meal and other grain products. The Nebraska Commission forced a 15 per cent. reduction in state rates, not only on grain and grain products, but on live stock, coal, lumber and fruits and vegetables.

Kansas and Nebraska do not consume a hundredth part of what they produce, and the great bulk of the commodities consumed within these states is produced outside of them. The freight destined from points of origin within either state and moving under the state's mileage rates to points of consumption within the state, is as nothing to that which moves to points beyond the state. That is to say, nearly all the traffic of both the states is interstate, and subject to the influence of the competitive interstate rate adjustments.

Fig. 8.

This chart shows the reduction in interstate rates which would follow a reduction of 5 cents, in the Texas railroad commission's first-class rate from Galveston to Waco. (The rates shown apply only from the basing points.) All other towns group around these and the reduction from all is the same as from the basing point. Upper figures: Rates at present in effect. Lower figures: Rates which would apply following the above-mentioned reduction.

The products of Kansas and Nebraska find their primary markets (Kansas City, Kan., and Omaha, Neb.,) on the Missouri river at the extreme eastern boundary of the state, and the state regulation fixes the rate at which the product is hauled from points of production to these primary markets, no matter what the ultimate destination of the product may be. As a result, the 15 per cent. reductions in the grain rates required by both state commissions have called for a flat reduction of just that amount in all interstate rates, and a corresponding shrinkage in railroad revenues on practically all of the grain raised in both the states.

A contingent result is a horizontal reduction in the rates on Oklahoma grain. The Choctaw line of the Rock Island operates in Oklahoma under a charter which provides that its rates in that state must not be higher than they are in the states from which it enters Oklahoma. The line enters Oklahoma from Kansas, as well as from Arkansas, and the charter provision required an immediate adjustment of the Oklahoma rates on the Kansas scale. With the Oklahoma rates on the Kansas basis it was found impossible to maintain the adjustment formerly prevailing from points in southern Oklahoma to points in Texas, and a readjustment there was necessary. Similar reductions of the rates to Arkansas points will be required.

This situation clearly illustrates the interdependence of state and interstate rates. The accompanying chart will give a partial illustration of the situation. It can, of course, picture the effect only at a few points. The reductions are general, affecting every point:

TEXAS.

In Texas, state regulation of rates is deliberately designed to control the rates on interstate business both into and out of the state. There is, from the standpoint of the state, excellent reason for this policy; for, aside from its timber and a portion of its grain, little which Texas produces is consumed within the state, and the bulk

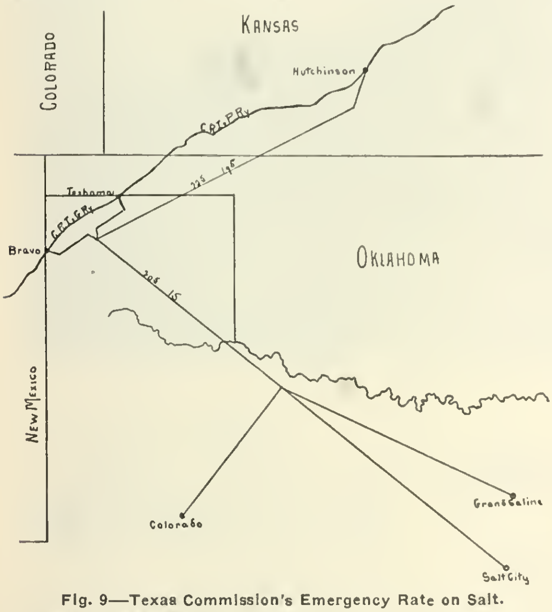


Fig. 9—Texas Commission's Emergency Rate on Salt.
Average mileage—From Hutchinson, 300; *from Colorado,* 660; *from Grand Saline,* 525; *from Salt City,* 690.

of the food stuffs, wearing apparel and manufactured articles which its citizens consume or use are imported from other states.

The state commission has always conceived it to be to the state's interest to link its fortunes with the coastwise steamship lines rather than with the all-rail carriers reaching the state through its northern gateways. Consequently the commission has made the port of Galveston the radiating point in its adjustment. The class rates from the eastern seaboard have always been made the exact combination of the steamship rates from New York, Boston, Philadelphia and Baltimore to the port of Galveston, plus the commission's local rates thence to every point in the state. This has forced the rail carriers to group all the producing territory west of seaboard territory, and to maintain a relative adjustment calculated to permit these territories to market their products in Texas in competition with the rates from the seaboard fixed for the rail carriers both in and outside the state by the Texas commission and the steamship lines.

It necessarily follows that whenever the Texas commission reduces a rate from Galveston the revenue of the state carrier on all Texas business originating at the Atlantic seaboard is lowered and the interstate carriers are compelled to make corresponding reductions from every other basing point. The immediate effect of a reduction of 5 cents in the commission's first class rate from Galveston to Waco is outlined in the accompanying chart:

Texas is above all a cotton-growing state. The wealth of its farming communities and the business of its cities is founded on the production and marketing of this staple. The revenues of the carriers within the state are largely dependent upon the movement of the cotton crop. Texas produces one-quarter of all the cotton grown within the United States. It has, however, no cotton-spinning industry worthy the name. Probably 99 per cent. of the cotton grown in the state is sent to New England and southeastern spinning points and to foreign countries. The revenues of the carriers on all this interstate and foreign cotton freight are absolutely dependent upon the rates fixed by the railroad commission of Texas to the port of Galveston.

Three years since, the commission ordered a reduction in cotton rates of 5 cents per 100 lbs., or $1 per ton. The movement from Texas to interstate and foreign destinations in the fiscal year ending June 30, 1906, was a million and a half tons. The direct result to interstate carriers from this one act of the Commission has been an annual shrinkage in their revenues of something like a million and a half of dollars.

A cardinal principle in the three principal classification territories is that valuable commodities such as dry goods, notions, boots and shoes, hats, etc., shall take first class rates, whether the goods are shipped in carloads or in less than carload quantities. There is no voluntary variation from this in any interstate adjustment. The principle has frequently been reviewed without disapproval by the Interstate Commerce Commission. The Texas commission, however, has taken the opposite view, and in its state classification has fixed class "A" basis on these commodities when shipped in carload quantities. This action on their part has no force or effect so far as concerns state traffic. None of these commodities are manufactured within the state and no house in the state jobs them in carload quantities. The state commission's action does, however, reduce the interstate rate on these commodities from New York to interior Texas towns 37 cents per 100 lbs. in carload lots.

That the Texas commission exercises its rate-making powers with deliberate intent to control the interstate rates for the benefit of its industries appears from the following illustration.

The Rock Island has a line running southwest from the state of Kansas, passing diagonally across the Panhandle of Texas into New Mexico and on to El Paso. There are large salt industries on this line at Hutchinson, Kan., and in the year 1905 the Rock Island, being asked to establish a reasonable rate from Hutchinson into its Panhandle towns, published an average rate of 19½ cents. The average distance is about 300 miles. There are salt plants of considerable importance at Grand Saline, Salt City and Colorado, Texas, and under the state commission's orders, the Rock Island, in connection with other lines, had in effect an average rate of 20½ cents per 100 lbs. from these state salt plants to the Panhandle towns. The average haul to these points is from Grand Saline, 525 miles; from Colorado, 660, and Salt City, Texas, 690 miles. When the Rock Island's interstate rate came to the attention of the Texas commission, it ordered the Rock Island's Texas line to non-concur in the reduction, threatening that if the interstate rate were allowed to stay in, they would compel the state carriers to haul salt from these state plants to the Panhandle points for 15 cents per 100 lbs. Needless to say, the interstate rate was withdrawn, and it remains today at the Texas maximum rate of 22½ cents. The map illustrates the situation.

ILLINOIS.

Recent reductions in class rates in Illinois have forced reductions of the interstate rates between St. Louis, Hannibal, Quincy, Keokuk, Davenport and Dubuque, and will eventually force similar reductions in rates between intermediate local points either wholly interstate or wholly within other states than Illinois.

ARKANSAS.

The Arkansas commission has prescribed a full line of class and commodity rates which produce an effect on all the rates on merchandise brought into the state from points beyond, similar to the results of the Texas commission's regulation of the rates in that state.

MINNESOTA.

The Minnesota commission has fixed a scale of class rates within the state which recently required the leveling down of all rates from Minneapolis, St. Paul and Duluth to Iowa and Dakota points. It was with respect to this situation that Judge Lochren said in the case before him involving the validity of these rates:

"It would seem to be very difficult to avoid . . . the conclusion that these rates fixed in respect to Minnesota do necessarily and directly affect interstate commerce. . . . I have no doubt that Congress might very properly, under the constitutional provision giving it the entire power of control over interstate commerce, assume control of the avenues of interstate commerce of the railroads which are engaged in interstate commerce, and of all rates which are collected by those railroads, whether within the states or without the states, because the matter of those rates would affect these avenues of interstate commerce, and might affect their ability to continue as avenues of interstate commerce."

And as to this argument, urged before the Supreme Court in the Minnesota rate case, recently decided, the opinion of Mr. Justice Peckham says:

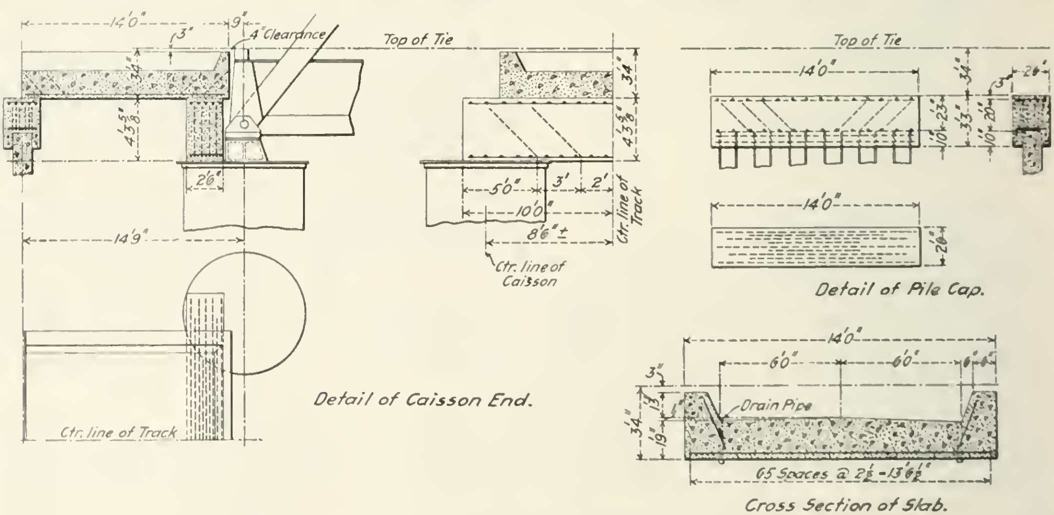
"Still another Federal question is urged growing out of the assertion that the laws are, by their necessary effect, an interference with and a regulation of interstate commerce, the grounds for which assertion it is not now necessary to enlarge upon. The question is not, at any rate, frivolous."

Reinforced Concrete Trestle on the Burlington.

The reinforced concrete trestle illustrated herewith was recently completed on the St. Louis-Hannibal line of the Burlington. The crossing of Salt river, about 100 miles north of St. Louis, is a three-span through truss bridge, with a trestle approach on the north nearly 500 ft. long. When it became necessary to renew this trestle, which was built of timber, it was decided to substitute reinforced concrete.

The structure had to be put up under traffic. A temporary trestle was built by driving piling on each side of the old bridge and capping it longitudinally. The stringers of the old bridge, together with some new material, were then placed across this and the rails spiked directly thereto. The old bridge was removed from underneath this structure and the new one built in its place without interference with traffic. This method is more expensive than is the case where the floor slabs are cast in a yard nearby and set in the bridge by a derrick, and its use is justified only where trains are frequent.

Reinforced Concrete Trestle Approach to Salt River Bridge.



Details of Reinforced Concrete Trestle; Chicago, Burlington & Quincy.

The north approach is 477 ft. 6 in. long. The bents are spaced 14 ft. centers and there are six piles to the bent; these piles, which are 22 ft. long, were molded on their sides. They are reinforced with eight ½-in. corrugated steel bars, wound spirally with No. 12 steel wire. They are 16 in. square at the top, are chamfered 3 in. on the corners and taper 8 in. in 30 ft. They were driven, for the most part, with an ordinary road pile-driver having a 3,000-lb. hammer. In driving the piles were capped with an 8-in. rubber cushion, and although, sometimes, several hundred blows were required, and in some cases the full 24-ft. drop of the hammer was used, none of the piles was injured. They were driven in gravelly sand and the penetration was from 14 to 16 ft.

After the piles were driven, molds were put around the tops and the caps cast in place. When these had set sufficiently, the forms for the slabs were put up and these likewise built in place. Building paper was put in the joints between slabs. There is no other provision for expansion. A pier, resting on wooden piling, is placed at every fifth span to take the longitudinal thrust. The end of the steel span adjoining the trestle rests on caissons. The floor slab of the trestle rests on a reinforced concrete beam, 4 ft. 3⅝ in. deep, on top of the caissons. The south approach has only three spans and is 42 ft. 9 in. long.

In the West and South there are many miles of wooden trestle bridges carrying tracks over overflow water only. They are a constant expense for maintenance and renewal, many of them being in swampy land, affording poor foundations. The advantages of concrete construction in such situations are obvious. Its low first cost—from $25 to $30 per foot of single track—the complete immunity from fire, the permanent character of the structure and the freedom from maintenance cost should commend it to maintenance engineers.

The Salt river trestle was designed by C. H. Cartlidge, Bridge Engineer of the Burlington, and was built by company forces.

The Pennsylvania's New Rail Sections and Specifications.

The accompanying rail sections and the following specifications are the results of the work of the rail committee of the Pennsylvania Railroad. The members of the committee are: Theo. N. Ely, Chief of Motive Power, Lines East and West, Chairman; A. C. Shand, Chief Engineer, Lines East; L. R. Zollinger, Engineer Maintenance of Way, Lines East; A. W. Gibbs, General Superintendent Motive Power, Lines East; C. B. Dudley, Chemist, Lines East; T. H. Johnson, Consulting Engineer, Lines East; Robt. Trimble, Chief Engineer Maintenance of Way, Lines West; W. C. Cushing, Chief Engineer Maintenance of Way, Lines West; J. C. Bland, Engineer of Bridges, Lines West; D. F. Crawford, General Superintendent Motive Power, Lines West.

Chemical Composition.

1. The steel of which the rails are rolled shall conform to the following limits in chemical composition:

Bessemer.

	Per cent. Lower limit.	Desired composition.	Upper limit
Carbon	0.45	0.50	0.55
Manganese	0.80	1.00	1.20
Silicon	0.05	0.12	0.20
Phosphorus	....	....	0.10

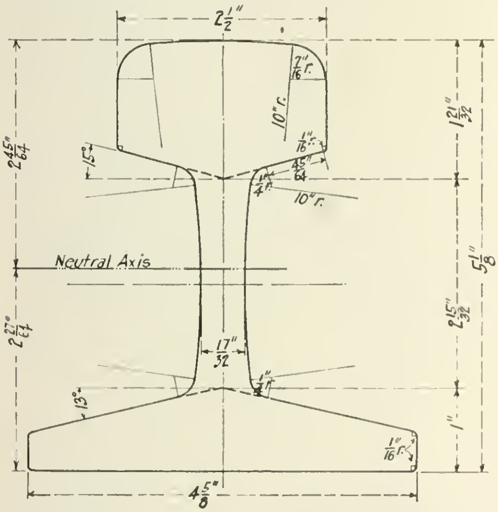
Open hearth.

	Lower limit.	Desired composition.	Upper limit
Carbon	0.70	0.75	0.80
Silicon	0.05	0.12	0.20
Manganese	....	....	0.80
Phosphorus	....	....	0.03

Process of Manufacture.

2. Ingots shall be kept in a vertical position until ready to be rolled, or until the metal in the interior has had time to solidify.

3. No "bled" ingots shall be used. ("Bled ingot"—one from the center of which the liquid steel has been permitted to escape.)



Area of head	3.57 sq. in.	42.2 per cent.
" web	1.51 "	17.8 "
" base	3.39 "	40.0 "
Total	8.47 sq. in.	100.0 per cent
Moment of inertia		29.1
Section modulus, head		10.77
Section modulus, base		12.02
Ratio periphery, head to area, head		1.73
" " web " " web		3.81
" " base " " base		2.69
" total periphery to total area		2.18

85-lb. Rail; Pennsylvania Railroad.

4. There shall be sheared from the end of the bloom formed from the top of the ingot sufficient discard to insure sound rails. (All metal from the top of the ingot, whether cut from bloom or rail, is the top discard.)

5. In reheating, care shall be taken to avoid burning the steel, and under no circumstances shall a "cinder heat" be used. ("Cinder heat"—one in which the scale on the sides of the ingot becomes fluid.)

6. The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws, for a rail 33 ft. in length, of $6\frac{1}{4}$ in. for 85-lb. section, and $6\frac{1}{2}$ in. for 100-lb. section. These allowances to be decreased at the rate of $\frac{1}{100}$ in. for each second of time elapsed between the rail leaving the finishing rolls and being sawed. The bars shall not be held for the purpose of reducing their temperature, nor shall any artificial means of cooling them be used between the leading and finishing passes, nor after they leave the finishing pass.

Mechanical Requirements.

7. The name of the maker, the weight and type of the rail, and the month and year of manufacture shall be rolled in raised letters and figures on the side of the web, and the number of the heat shall be plainly stamped on each rail where it will not subsequently be covered by the splice bars. A letter shall be stamped on the web to indicate the portion of the ingot from which the rail was rolled.

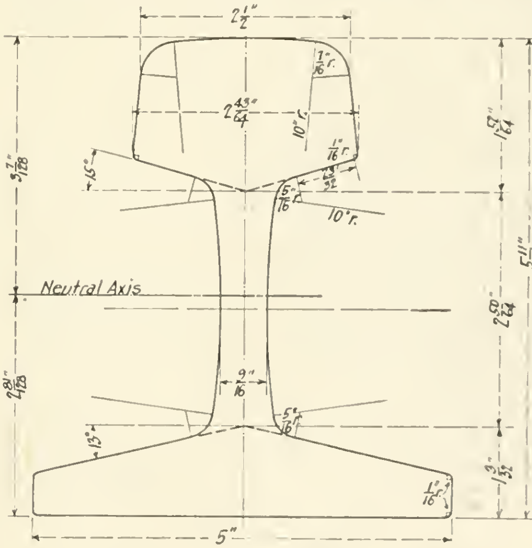
8. The section of rail shall conform as accurately as possible to the templet furnished by the railroad company. A variation in height of $\frac{1}{64}$ in. less or [illegible] in. greater than the specified height, and $\frac{1}{16}$ in. in width of flange, will be permitted; but no variations shall be allowed in the dimensions affecting the fit of the splice bars.

9. The weight of the rails specified in the order shall be maintained as nearly as possible, after complying with the preceding paragraph. A variation of one-half of 1 per cent. from the calculated weight of section, as applied to an entire order, will be allowed.

10. The standard length of rails, at a temperature of 60 deg. F., shall be 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying as follows: 30 ft., $27\frac{1}{2}$ ft. and 25 ft., and all No. 1 rails less than 33 ft. long shall be painted green on ends. A variation of ¼ in. in length from that specified will be allowed.

11. The rails must be free from injurious mechanical defects and flaws; shall be sawed square at the ends, a variation of not more than $\frac{1}{32}$ in. being allowed; and burrs shall be carefully removed.

12. The rails shall be smooth on the heads, straight in line and surface, and without any twists, waves or kinks; particular attention being given to having the ends without kinks or drop. The



Area of head	4.09 sq. in.	41.0 per cent
" web	1.85 "	18.6 "
" base	4.03 "	40.4 "
Total	9.97 sq. in.	100.0 per cent
Moment of inertia		41.9
Section modulus, head		13.71
Section modulus, base		15.91
Ratio periphery, head to area, head		1.59
" " web " " web		3.58
" " base " " base		2.43
" total periphery to total area		2.30

100-lb. Rail; Pennsylvania Railroad.

hot straightening shall be carefully done, so that gagging at the cold presses will be reduced to a minimum. Any rail coming to the straightening presses showing any sharp kinks or greater camber than that indicated by a middle ordinate of 4 in. in 33 ft. will be at once marked as a No. 2 rail, and only accepted as such. The distance between the supports of rails in the straightening presses shall not be less than 42 in.

13. Circular holes for splice bars shall be drilled to conform accurately in every respect to the drawing and dimensions furnished by the railroad company, and must be free from burrs.

Tests and Inspection.

14. One drop test shall be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected by the inspector from each heat of steel, from any position in the ingot. The test piece shall be placed head upwards on solid supports, 5 in. radius, 3 ft.

between centers, and both 85-lb. and 100-lb. sections shall be subjected to an impact test from a weight of 2,000 lbs., falling 15 ft. The deflection for No. 1 classification rails must not exceed that indicated by a middle ordinate of 2 in. in 3 ft. for 100-lb. section and 2¼ in. for 85-lb. section. Test pieces shall be tested to destruction. The temperature of the test pieces shall be between 60 and 120 deg. F.

(*a*) If a test piece breaks without showing physical defect, all rails made from that heat shall be rejected absolutely.

(*b*) If, however, the test piece broken under test "*a*" shows physical defect, the top rail from each ingot of that heat shall be rejected; and

(*c*) A second test shall then be made of a test piece selected by the inspector. If this second test piece breaks, the remainder of the rails of the heat shall also be rejected. If this second piece does not break, the remainder of the rails of the heat will be accepted as either No. 1 or No. 2 classification, according as the deflection is less or more, respectively, than the prescribed limit.

(*d*) If the test piece, test "*a*," does not break, but when tested to destruction shows pipe, the top rail from each ingot shall be rejected. The remainder of the rails of the heat will be accepted as either No. 1 or No. 2 classification, according as the deflection is less or more, respectively, than the prescribed limit.

(*e*) If the test piece, test "*a*," does not break, and when tested to destruction does not show pipe, the rails of the heat will be accepted as either No. 1 or No. 2 classification, according as the deflection under test "*a*" is less or more, respectively, than the prescribed limit. Note—The drop test and the deflection requirements may be modified if considered advisable by the railroad company.

15. The drop-testing machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than 5 in. The anvil block of the drop testing machine shall weigh at least 20,000 lbs., and the supports shall be part of, or firmly secured to, the anvil. The foundations for the anvil block shall be such as will meet the approval of the railroad company.

16. No rails shall be accepted which contain any physical defects that impair their strength.

17. Rails improperly drilled or straightened, or from which the burrs have not been properly removed, shall be rejected, but may be accepted after being properly finished.

18. No. 2 rails to the extent of 5 per cent. of the whole order will be received. All rails accepted as No. 2 rails must have the ends painted white, and must be kept separate from No. 1 rails, and be shipped in separate cars.

19. Rails will be accepted and billed according to actual weights.

20. All rails must be loaded in the presence of the inspector.

21. The makers shall furnish the inspectors with the carbon determination of each heat, and, also, two complete analyses which shall represent the average steel of each day's work, before the rails are shipped. These analyses will be checked from time to time by the railroad company's chemist, and, on request of the inspector, the makers shall furnish a portion of the test ingot for check analyses.

22. Inspectors representing the railroad company shall have free entry to the works of the makers at all times when the contract is being filled, and shall have reasonable facilities afforded them by the makers to satisfy them that the finished material is furnished in accordance with these specifications. All tests and inspection shall be made at the place of manufacture, prior to shipment.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XV.

Agreements Among Ocean Carriers to Control Rates.

As might be expected, the freedom of the sea conduces to variation in the forms of agreement among sea carriers. At least four kinds of agreements are clearly discernible: (1) division of territory; (2) freight pooling; (3) pooling of profits; (4) "conference" or agreement to maintain rates.

1. Division of territory, although not the most common, is probably the simplest form of agreement, as it is the easiest to operate. Each party is, within limits, free to do as it chooses within its own territory. The agreement between the German companies and the Morgan syndicate makes a precise division of territory, by limiting future new services and setting the number of sailings that might be made on some existing services. In the North Sea traffic, Wilson's of Hull, the great rivals of the United Danish Lines, agree with their rivals as to which ports each shall serve, and when they disagree the threat of either party to compete at all points is a strong argument for peace, as it was also in the recent (December, 1905) quarrel—or ostensible quarrel—between the Hamburg-American and North German Lloyd companies. There are many divisions of territory that are tacit rather than formal. A line performing a certain service desires to add to or extend its service, but fears to do so knowing that the move will be regarded as a practical declaration of war and treated accordingly. This is probably the commonest of all causes of rate wars. A new carrier enters a rich field for a share of the trade and a contest ensues.

One of the commonest ways of ending a rate war is for the contestants to divide up the territory. The following is an example: During 1902 and 1903 the trade from New York to Hayti and Cuba was competed for by the Hamburg-American Line and the Cameron Line. This was settled and competition ended by the Cameron Line withdrawing their ships from Hayti, but continuing their Mexico and Cuba services. The owners of the Cameron Line further acted as agents for the Hamburg company in Hayti, but the Hamburg company's ships did the carrying.

2. Freight pooling achieves a similar result by (a) the common method of alternate sailings or by (b) the more unusual method of actual division of the traffic on a basis of percentage or kinds of traffic.

(a) Alternate sailings is one of the most, if not the most, widespread of all forms of line agreements. It is simple in its development and really was the origin of line traffic on many routes. Two or three merchants who were in the habit of sending an occasional sailing vessel for themselves and others, naturally chose different times for the despatch of their ships, because there was then more freight offering. They almost inevitably worked out something as a schedule.* The same advantage holds true when two or more lines are running on the same route. As the advantages of this manifestly increase with the length of the route, it is natural that it should be prevalent in the trade to South America, Africa and the Orient.

To the Argentine Republic, one French and two English lines give a uniform rate with alternate sailings and exchange of passenger tickets. To the west coast of South America the Hamburg-American and the Hamburg-South American companies alternate the schedule and increase their ships together. But these lines have even a closer pooling alliance. In the Oriental trade two French lines operate together, taking turns, and the two great German companies have tried about all forms of combinations. This service has been double, consisting of the Imperial Mail line and a cargo line, the two companies joining in furnishing the vessels for these. This was followed by a period during which the Hamburg company managed the freight line and the Bremen company the mail line, each contributing ships to both. This was satisfactory to neither party, and by a Hamburg conference in November, 1903, it was agreed that the Bremen company should furnish as well as manage the mail line, and the Hamburg company the cargo line. The companies then exchanged vessels and agreed not to antagonize each other in this trade. A half-dozen companies along the Dalmatian coast recently made a similar arrangement by which passenger and express business was taken by one line and freight by the others. The contract between the German lines and the Morgan syndicate made provision for the sharing by the two interests of new trade or of extension when the enlargement amounted to doubling the number of sailings.

3. Pooling of profits seems to be quite common, if one may infer from the known number of these ordinarily secret arrangements. The two great German companies appear to have a money pool, and it is announced from time to time in the press that they have pools with some of the smaller German companies. There is a pool of passenger earnings between the two German companies, the Holland-American and the Red Star Line, which belongs to the International Mercantile Marine Company, and runs to Antwerp. The German East-Africa Company and the Austrian Lloyd got into competition because the Austrian line entered the East Africa trade, but after various negotiations† they announced a reported agreement by which "receipts from the passenger branches of the two services shall be divided at fixed intervals between the two companies, and that a mutual understanding shall also be arranged as regards the goods traffic."

The pooling of profits in ocean-carrying is comparatively simple if office expenses are left out, as is usually the case. The ships are often chartered, the owner furnishing the crew, so that the expense account, as well as income, can be calculated to a nicety. Even where ships are not chartered, it is common to have them surveyed when they enter pool service and the owner credited with the same amount of money that he would have received if he had chartered the vessel to outside parties at current rates.

There is a profit pool among the carriers from the United Kingdom to Australia. Within the past decade there have been profit pools in the line trade from New York to Australia and from New York to Brazil, and there was every outward sign that there was also one from New York to South Africa. Its existence was finally revealed in May, 1905, by a suit in the court of King's Bench, London.‡ Three British firms in the United Kingdom-South African

*The Hamburg-American and North German Lloyd companies were formed by such groups of merchants who desired a better service than their occasional independent ships gave, and, uniting, formed the now famous companies.

†*Fairplay*, January 28, 1904, p. 145.

‡See New York *Journal of Commerce*, June 7, 1905.

trade also had vessels in New York service. They were entitled to 21 per cent. in the pool; the German Hansa line had 16 per cent., and was sued because of the failure to maintain the agreement which was entered into October 23, 1901. During most of this period there was a rate war in progress, and the difficulty of operating a pool under these circumstances is shown by the fact that in 1902 there were 87 meetings and in 1903, 61.

Pools of both sorts are apt to be short-lived, as were most of those referred to above, because of their tendency to become non-progressive arrangements. They heal the difficulty of the hour, but they must be well arranged, indeed, if they can provide for the satisfactory division of increased trade among the participants. This is the rock upon which they all alike go to pieces. It matters little whether they be divisions of traffic or divisions of money. One line feels that its position, expenditures, or activity merit a large share of the increase in the trade. The line that has done less wants, of course, an equal share. An example will illustrate: In February, 1893, the British-India, Peninsular & Oriental, and Hansa steamship companies came to a clear-cut agreement about the trade between Middlesboro', London, Hamburg and Antwerp with India. In September, 1898, it was modified, apparently in favor of the stronger parties, so that if Antwerp freight exceeded the capacity of the Hansa steamers, each of the other lines could have six sailings a year from Antwerp, the amount of freight in each of these additional sailings being prescribed and limited. This lasted until January, 1905, when the P. & O. Company, again dissatisfied, threw the agreement to the winds, announced more frequent sailings from Antwerp, and a long rate war between the two British companies and the German company followed. Announcement of its end in the spring of 1907 did not give the terms of the agreement.

4. Shipping conferences. These are usually agreements to maintain rates upon a certain route. Once the carriers have agreed, they usually arrange a schedule of sailings, rendering the best possible service, and keep off competitors by a system of deferred rebates. This is usually 10 per cent. of the freight. It is calculated at the end of a long period, usually six months, and paid six months or a year later, *provided* the shipper has remained "loyal" to the members of the conference. Shipping by a rival line is, of course, "disloyalty," so that the conference carriers, by means of these deferred rebates, practically keep all regular shippers under bonds to let all rivals severely alone. Thus is the shipper bound. The starting of rival shipping lines is deterred by the certainty of fierce competition, and by the restraining tendency which the rebates will have on the people who would otherwise ship by the new line.

Despite this inner stay and outer prop, the way of the shipping conference is far from smooth. The prosperity that attends their success attracts the hungry outside shipowner who sets up competition, creates chaos and general loss in the hope of being admitted to the conference.

Owing to the oft and widely repeated fact that the United States has had few and poor shipping connections other than trans-Atlantic, the best place to see the shipping conference in full operation is in European trade, where the steamship lines are older and well established. The best single example is the South African Shipping Conference, which has successfully regulated the trade of a region that stood for some years in the glare of the world's attention. It is also an unprosperous region where discontent is rife and where there is diligent search for the causes of this lack of prosperity which leads to discontent. The fact that the conference has had long success and consequent freedom from rivals has produced a feeling of independence and made it less anxious to please the shipper in matters of detail. All these influences have combined to throw much light on the South African Shipping Conference.

A New York freight broker, well acquainted with European conditions, recently declared: "The steamship people in England ride the shippers; they *ride* them; they say "you can have so much space in such and such a ship." The British shippers seem to be of the same opinion. After the close of the Boer War the press was full of complaining letters. Such grave bodies as the Liverpool and Leeds Chambers of Commerce took the matter up and condemned it vigorously; the colonial premiers entered into correspondence with the head of the conference; and South African commercial bodies were quite as active as those of England.

The Leeds Chamber of Commerce showed that when a rival line had arisen and the rebates had failed to hold the shipper, the conference had quoted double (prohibitive) rates when the shipper persisted in patronizing the new company for that part of the freight which the new carrier could place. The British public was also enraged because the rates to Africa were from 21s. to 80s. per ton, and the same firms had steamers in the New York-South African service and were giving rates from New York at 10s. to 20s.*

American trade was naturally booming at the expense of the English. To this criticism the carriers replied that the New York rate was a heavy loss owing to competition, and that the rates from all continental points were the same as from British ports, a point that had been carefully stipulated in all arrangements with German and other lines.

From South Africa also came the charge of excessive rates, but the carriers declared their rates were reasonable, and that the African importers were suffering from the exactions of the colonial railroads. In this connection a paper before the Institute of Civil Engineers shows that on the basis of 1.54d. per ton per geographical mile for mineral trains in England, the total sea-borne rate was about one thirty-fifth of that figure. At the time of the African complaint against the shipping "ring," the rate on iron from the United Kingdom to Kimberley was as follows:

	Via Cape Town.		Via Port Elizabeth		Via Durban	
	Rail.	Ocean.	Rail.	Ocean.	Rail	Ocean
Distance	647	6,181	485	6,609	483	Circ 7,000
Rate per ton	218/5	22/6	166/2	22/6	110/-	25

Various persons and chambers of commerce were appealing to the British government to give them relief of some sort and one proposal was to give the mail and government contracts to an independent line that should be formed. An editorial in *Lloyd's Gazette* in August, 1904, stated that while monopoly had made the conference carriers a little autocratic in their manners, any government scheme to start another line "would just make it strong enough to join the conference." Occasionally, Sir Donald Currie, head of the largest British interests in the conference, would reply to the numerous attacks. One such long letter* made the challenging statement that "the South African trade is quite open." But owing to the rebate control and boycott rates it was practically open only to a line or combination that could offer as good a service, and that, as experience proved, was a heroic task. It is common for steamers to South Africa to skirt the coast, stopping at three or more ports. When competition did spring up, the conference lines eclipsed it by despatching a vessel directly to each of the three main ports, and it is currently reported that one of the lines in the conference got in only after losing a million dollars in a rate war which finally brought the conference to terms. So the statement that the trade "is quite open" may have needed a little interpretation.

In a letter to Mr. Chamberlain, Sir Donald Currie said (see *New York Journal of Commerce*, June 18, 1903): "This so-called rebate system prevails in every ocean steam trade, and while providing the necessary support which steamers, to be regularly employed, regularly require, it secures under suitable arrangements with the merchants regularity of rates, as well as the supply of sufficient steam tonnage."† *Fairplay* quoted Mr. Birchenough (who had been sent to South Africa by the government to investigate the matter) as saying: "The rebate system prevents the cutting of rates, and it is to that extent as much a protection to the shippers as to the 'ring' "; and the journal then stated editorially that, "as a simple matter of fact, the present very efficient service to the Cape could not possibly be worked otherwise than by a conference agreement."

The discussion of this rebate problem steadily continued, rose almost to the degree of ferment, and would not down. Finally, after special reports had been made to the British government upon it, a royal commission was appointed, in November, 1906, to inquire "into the operations of shipping rings or conferences generally, and more especially into the system of deferred rebates, and report whether such operations have ceased or are likely to cause injury to British or Colonial trade, and if so, what remedial action, if any, should be taken by legislation or otherwise."

The rather full accounts of hearings which were reported from time to time in *Lloyd's Gazette* and other maritime journals furnished much detailed information concerning the actual situation.

The disadvantages of the rebate system have been clearly pointed out. The Secretary of the Birmingham Chamber of Commerce testified that merchants have been so penalized that they were afraid to testify. The penalties have been doubled rates or no service. A representative of the London Chamber of Commerce testified that the heavier shippers got special secret rebates. But the most galling piece of testimony seems to have been the fact that the shipping ring lines charged higher rates from British ports than they did upon the same ships for continental or American goods going out to the British colonies and foreign lands. For example, the China Conference was inveighed against because the American rate was 25 shillings, and the London rate 45 shillings to China, and an offer of a 20 shilling rate from London, the British shipper dare not take, and kept on paying his 45 shillings, because he was tied with a heavy rebate shackle. Complaint was made that the British glassware paid 37 shillings and a half to New Zealand, while the same steamer took Continental glassware from Antwerp and Hamburg on a through rate at 22 shillings and a half. The defense of this by the part of the shipping company was that only by this means could they meet the competition of Continental steamers.

In answer to the direct question by the Commissioners, "Do you recommend the abolition of rebates by statute?" there was a surprising temperance of answer on the part of the aggrieved merchants; almost none of them favored such action. In the first place it was pointed out that the attempted prohibition by the United States

*This type of grievance still remains and is embodied in a strong resolution of the Associated Chambers of Commerce of Great Britain which met in London, March 7, 8, 1906.

**Syren and Shipping*, June 24, 1904.
†*Fairplay*, September 22, 1904, p. 444.

government while it had caused a temporary cessation of rebates, was really ineffective; because the rebate could be worked by a foreign corporation through its foreign offices.

The suggestion of the legal prohibition of rebates brought out a rather surprising statement of their advantages. It was shown that they permitted regularity and uniformity of rates, which enabled the merchant to make quotations for long times in the future, and, lastly, the shipping companies usually bound themselves to stop competing with the merchants by so-called "filling lines." This common practice has long been resorted to by shipping lines. When freight was dull, they would fill their ships with goods on their own account, to be sold in competition with merchants who were their patrons. Escape from this the merchants deemed a great gain.

A representative of the Ceylon Association of London testified that he thought the one year deferred rebate was too long a time for the money to be held by the carrier, and was therefore not liked by the shippers; but they didn't wish anything to interfere with the splendid, almost daily, service which the Ceylon shippers enjoyed by the 120 first class steamers which were returning from that island to European markets. Therefore, on the whole, they were against any legislation on rebates, for fear that the shipping lines might make something that bore more heavily upon them, since "a reasonable and regular rate seems to us more beneficial to the shipper and trader than one subject to violent fluctuations."

The consensus of opinion of the witnesses was similar to that of the Ceylon tea shippers; but great insistence was placed on the fact that something should be done to prevent lines carrying foreign goods more cheaply than British goods to the detriment of British trade. In this respect the conference of West Africa was held up as a shining example. The two British lines controlled by Elder-Dempster & Company had an agreement with the one rival German line, which they dominated, and as its result they had built up a splendid service, and to prevent the founding of a line directly with America, a rate was given to America, via Liverpool, which was identical with the rate to Liverpool only.

The China Conference is one of long standing, and, like numerous others from Europe outward, it has succeeded in keeping less before the public. One of the largest of these combinations is the reported agreement between two groups of west coast South American carriers—the Panama group, comprising eight companies, and the Magellan group of four companies. In the Panama group were companies representing America, England, Germany, France and Italy.

The founding of lines of steamers from New York to other than European and West Indian ports has had its largest and almost its entire development since 1890, and while these lines have not been long established, they have compassed practically all of the experiences in the catalogue of agreements among carriers. To South America, Africa, Australia and the east there were sailing-vessel lines that had grown up gradually from the operations of exporting merchants. This commerce has grown great enough to tempt the old-established firms of British shipowners to establish employment for some of their vessels by putting them into steam services from New York to the various coasts above mentioned. This was a direct blow at the trade of the American firms that had handled the trade from its inception, and strong rivalries have ensued. This has been further complicated by the coming of the German steamers upon the scene. Peculiar incidents have occurred in these contests. Firms agreeing in European conferences have competed here; at least one New York firm has been in both the east South American trade and the South African trade, but in one it fiercely competed with firms with which it had agreements in the other trade. The New York carrying combinations are well typified in all important respects by the happenings in the Australian trade.

The first of line service was in 1853, when two firms began taking turns in sending out their sailing vessels. In 1878 a Boston firm began, and in 1884 added a New York service, taking turns with the other two companies, and each got what rates it could at the agreed-upon time of sailing. In 1889 a fourth company essayed to enter this service and it was admitted, after a year of rate cutting, during which rates fell from 27½ cents per cubic foot to 7 cents.

The four companies now agreed and conducted their business without serious disturbances until 1896 and 1897, when some outside merchants chartered, loaded and despatched some ships to an Australian firm. This promised easily to become the origin of another line. Shortly thereafter the four carriers made rebate contracts, promising a 10 per cent. rebate if shipments were not sent by any outside line. The agreement was made with many firms, some for five years and others for shorter periods, down to one year and less. The shorter periods were apparently accepted because of the probability of opposition. At this time the charge was freely made that the four firms, by combining the functions of commission merchants and carriers, used their carrying functions to benefit their business as merchants to the detriment of other merchants. This very natural desire could be effected, as was then charged, by quoting rival commission houses higher rates, and by so-called "filling-orders"—filling up a ship, when cargo was scarce, with "bulk lines" to be sold in Australia in competition with their patrons who had paid full rates of freight.

In the spring of 1898 two London shipping firms, desiring return cargoes for ships carrying Australasian frozen meat to the United Kingdom, sent their steamers to New York to load outward. The four New York firms, which had been sending sailing vessels only, united in organizing the United States and Australasian Steamship Company, and placed at its head a man from one of their offices. This was done the very day that the advertisement of the British steamship service appeared, and the Americans succeeded in despatching the first steamer. The war was carried into the enemy's country by sending steamers to South Africa where the competing English firms had important services. This was a new venture for the Australasian shippers and was purely an incident of the lively war that raged from May until December, 1898. Rates were put down to 10s. a ton, about the cost of stevedoring and dunnage wood, and in December there was an agreement between the New York firms and the two London firms, but a third London line which had entered during the competition did not enter as a part of the agreement that formed the so-called Associated Line.

Before the beginning of the competition each of the four firms had taken its turn on the berth and had made what profits it could from its ship. The Associated Line worked on a profit pool said to have been divided equally between the New York and London interests. It, of course, had the rebate arrangement and the carriers' promised to do away with the obnoxious "filling lines." This Anglo-American agreement seems never to have run smoothly. Even the public press frequently mentioned the fact. Old-established American firms, accustomed to making their decisions on the spot, were dealing with the agents of British shipowners who are notorious for deciding in London everything for their agents in New York, whether they know the conditions in New York or not. That they do not know the New York situation is the consensus of American-New York opinion. In addition to internal troubles, the Associated Line had the strong competition of the one outside firm which was not well controlled by the rebates. Stronger measures were tried. In May, 1899, an Associated Line circular stated that if, after the first day of July, any commission house should consent to fill a buying order for any Australian or New Zealand merchant who insisted upon shipping by any line but the Associated Line, that commission house will not only lose its 10 per cent. deferred rebate for that client, but will in addition have to pay an additional rate of 5s. per ton upon all freight shipped to Australia, and 7s. 6d. per ton extra to New Zealand. This embraced all business done by the New York *commission firm* for clients "loyal" and "disloyal" to the Associated Line. The rival line continued to prosper, and in April, 1900, the penalties were increased to 12s. 6d. per ton, "on condition that they buy their goods from a loyal supplier, the consignee's name being subject to approval of one of the members of the Associated Line."

The attempts at coercion failed, and within a month the Associated Line had ceased to exist. It was resolved into its original elements, and rebates and penalties were declared off. During the exigencies of the fight it appears by the protests of merchants in both New York and Australia, that the rebates were withheld when due, and certainly were not paid for some months thereafter.* This was merely one more effort to hold trade away from the rival. The end of the combination was brought about quite as much by internal trouble as by competition, as is evidenced by the fact that the breakup of the combination caused no immediate break in rates.

Since the end of the pool in May, 1900, there has been a continuation of the ups and downs in the trade until the mere mention of the Australian trade makes a New York shipping man refer to primeval chaos. The steamship company owned by the four united New York companies is sending out both steamships and sailing vessels, and the three British firms are still in the business. In September, 1901, rate cutting apparently took the form of seeing who had the most money to lose. Weight cargo was carried for 5s. to 7s. 6d. per ton, and measurement cargo for 10s. The American company seems to have outgeneraled its opponent in this contest of loss. The shipping journals show that they advertised the same steamer from December 2 until March 27, when she finally sailed. In the interval she was making short voyages in nearby waters. The earlier cargoes that she should have taken to Australia got sent on the rivals' ship at the rivals' heavy loss. In May, 1902, there appears to have been an oral agreement that lasted till October, 1904, when one of the British lines started in to get a better share of the freight. This war lasted until August, 1905, after which time the carriers lived along for some months on day-to-day rate understandings, and efforts to pool the traffic or proceeds came to naught because the different parties could not see alike with regard to respective proportions that each should have. In February, 1906, one of the London companies suddenly made a great increase in the tonnage of its service. To secure freight for it, concessions in rates were made to some shippers on some classes of goods, but this had not resulted in a general disturbance of rates on April 8. This situation, like many another in the commercial world, is materially affected by bitter personal animosities existing

*New York *Journal of Commerce*, April 21, 1901.

between some of the principals, and rendering them oblivious to the ordinary economic impulses.

This detailed account of the recent developments in the New York-Australian trade, with its freight and money pools, its competitions, rebates and virtual boycotts, differs but little from the history of the trade to South Africa or East South America. In all of them the old American exporting firms have had to meet the competition of European shipowners who have competed by setting up new steamship lines. In the struggles that have followed, the pool, the rebate, and the boycott have been freely used. The boycott has not frankly borne that name, but the same practical result has been attained by indirect means. One method is the prohibitive rate described in the account of the Australian trade. A common device of the agent for the foreign-owned ship is the "inability" to name a rate. "I'll have to cable to headquarters," replies the agent. Upon application the next day or the next, the cable "hasn't come yet." Another method of achieving this result is for the ship's agent to tell the applicant that he has no space, although the next applicant, if friendly, may contract for 500 tons. In a recent conversation a New York freight broker said that he was boycotted by the carriers to four different parts of the world. It should be noted that it is the broker who is usually boycotted, not the actual consignor of the freight. He can get another broker and have his bargain made.

There is one broad difference between the recent American and British shipping conferences. Those in Europe are made by lines owning ships that they use. The American conferences have been upon the basis of hired ships or European ships being managed at long range by non-resident owners. The members of European conferences have therefore had more at stake, and in the freight depression prevailing since the Boer War most of the American conferences have gone to pieces from time to time, and most of the European conferences have survived.

One of the most successful of the American conferences is that of the four lines from New York to the Orient. Since the last peace in 1904 it seems to be getting stronger and displaying its strength day by day, until in July, 1907, it was declared by one shipper to exceed even the Hamburg-American in its independence. This appears to be strong language, as a later article will show.

The rebate system is comparatively new in the New York trades and seems to have had its chief growth since the coming of the British steamers to compete with the American sailing vessel merchant-carrier firms. The recent strenuous competition between carriers from New York to South Africa led to the withholding of rebates because of "disloyalty." The dissatisfaction of some of the penalized firms over the definitions of loyalty led to a suit being brought against the carriers in New York in 1904, and it is currently stated that a letter from the United States Attorney General's office so alarmed the foreign owners that they feared to risk trial under the Sherman law, and stopped all rebates for a time. The foreign shipping representatives are reported to have said that they would carry our freight for us, but they did not care to go to prison for us. There was shortly afterward a change in the head of the United States Department of Justice, and the rebates began again in some quarters. The suit did not come to trial.

(To be continued.)

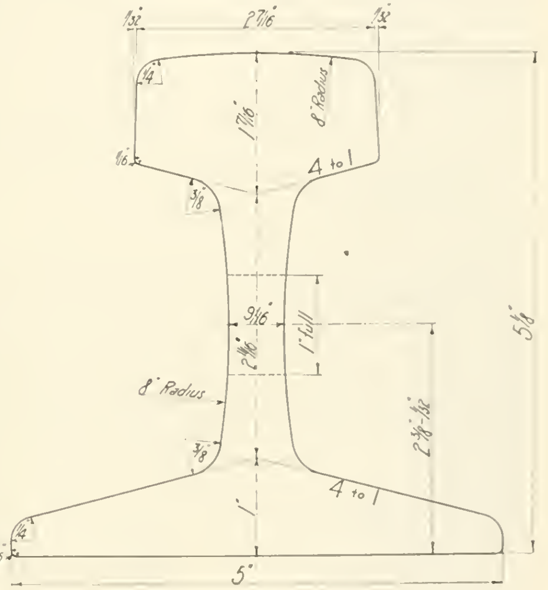
New Rails for the Canadian Pacific.

The Canadian Pacific recently ordered 40,000 tons of 85-lb. Bessemer and open hearth rails from the Dominion Iron & Steel Co., and the Algoma Steel Co. A new section has been adopted for these rails, in place of the A. S. C. E. section which the road has heretofore used. As may be seen from the accompanying drawing, this section is in general similar to the series A section recommended in the October, 1907, report of the American Railway Association's Committee on Standard Rail and Wheel Sections. Still more metal, however, has been taken from the head and added to the base, while the web has been reinforced. The head, though smaller, is shaped much like that of series A, except that the sides are more nearly vertical. The radius of the upper corners is ¼ in. instead of ⅜ in., and the radius of the top of the head is 8 in. instead of 14 in. The minimum thickness of the web is about the same, but it is reinforced at the top and bottom, the radius of the sides of the web being 8 in instead of 14 in. The base is somewhat deeper and is distinctly wider, being only ⅛ in. narrower than the rail is high, as it is believed that, although the road uses tie plates on all curves, it cannot sacrifice the added safety which the wider base gives. The base is, however, $\frac{3}{16}$ in. narrower than the A. S. C. E. section. The vertical moment of inertia is 29.492, and the horizontal, 7.139. Other figures are as follows:

	Area, per centages.	Cooling per centages.	—Section modulus— Vertical.	Horizontal.
Head	36.77	1.965	10.425	...
Web	22.21	3.081	...	...
Base	41.02	2.875	12.81	2.875
Total	100.00	2.586		...

The specifications for the manufacture of these rails follow the general principles laid down in the proposed and standard specifications of the American Railway Association, the Maintenance of Way Association, and the American Society for Testing Materials. There are several interesting differences. The carbon content in the Bessemer rail is the same as the A. S. C. E. and M. of W. specifications so far as the limiting percentage, but it is further required that it average between 0.57 and 0.59. The percentages of phosphorus and sulphur are the same as the A. S. C. E. and M. of W., but the limits of manganese are 0.80 and 1.00 instead of 0.80 and 1.05. The percentage of silicon is not to exceed 0.18 per cent.; the A. S. C. E. and M. of W. limit is 0.20. For the open hearth rail, the limits for carbon are 0.56 and 0.66 with an average of not less than 0.60. The A. S. C. E. limits are 0.58 and 0.68, and the M. of W. 0.68 and 0.78. The limit of phosphorus is 0.06, the A. S. C. E. limit being 0.05 and the M. of W., 0.03. Sulphur is not to exceed 0.055; the two societies make this 0.06. The limits for silicon are 0.075 and 0.018. The M. of W. limits are 0.075 and 0.020, while the A. S. C. E. gives only a maximum of 0.20. The manganese limits are 0.80 and 1.00; the A. S. C. E. are 0.80 and 1.05, and the M. of W. maximum is 0.90. An addition to the usual list of percentages is the requirement that the sum of sulphur plus copper plus other injurious elements be not more than 0.075.

In the branding specifications, aside from the requirements made by the three societies as to weight, name of maker, date of manu-



85-lb. Rail; Canadian Pacific.

facture and heat number, it is specified that the part of the ingot from which the rail is rolled be also indicated.

After cutting off or allowing for the "sand" or top end of each ingot, at least 12 in. more of seemingly hot steel shall be cut off that end of the bloom; if the steel does not then appear solid, the cutting shall continue until it does. No bled ingots or ingots from chilled heats, or from badly poured heats shall be used.

The drop tests of Bessemer rails are not quite as severe as the A. S. C. E. and M. of W. requirements. A section of rail is to be tested from every third heat, and the weight is to fall 18 ft. instead of 20 ft. It is, however, provided that should a heat be rejected, similar tests shall be made of rails from the preceding and succeeding heats. For open hearth rails, three sections of rail taken from the top of the first, middle and last ingots of each 50 ton heat are to be tested. The heat is to be rejected unless two of the tests stand.

From reports made to the company by its inspectors, it seems that the new rail requires less cold straightening and less camber, also, as is to be expected, the temperature is more uniform throughout the rail after leaving the rolls than in the old A. S. C. E. section.

Block Signals on the Railroads of the United States, Jan. 1, 1908.

The tables which appear on the following pages have just been issued by the Interstate Commerce Commission. Table 1 is an exhibit showing for each reporting company the aggregate length of its lines or parts of lines on which the block system is in use; Table 2 shows the kinds of automatic signals used; Table 3 is an exhibit of the methods and apparatus used in the operation of the

TABLE I.—AGGREGATE LENGTH OF LINES OR PARTS OF LINES ON WHICH THE BLOCK SYSTEM IS IN USE JANUARY 1, 1908.

Names of railroads.	Automatic block signals.					Nonautomatic block signals.					Total, all kinds.	Total miles operated by company (passenger lines).	Per cent operated under block system.
	Single track.	Double track.	Three track.	Four track.	Total.	Single track.	Double track.	Three track.	Four track.	Total.			
Ann Arbor						1.0				1.0	1.0	292.0	
Atchison & Eastern Bridge						.4				.4	.4	.4	100.0
Atchison, Topeka & Santa Fe		20.2			20.2	1,144.3	327.5			1,471.8	1,492.0	7,480.3	19.9
Atlanta & West Point							6.0			6.0	6.0	[illegible]	14.5
Atlantic Coast Line						527.0	62.4			589.4	589.4	4,181.0	14.1
Baltimore & Ohio [a]	11.2	131.6			142.8	222.9	600.3	70.3	18.5	912.0	1,054.8	2,964.5	35.6
Baltimore & Ohio Southwestern						8.7	48.5		2.2	59.4	59.4	991.0	6.0
Baltimore & Sparrow's Point							3.0			3.0	3.0	4.7	63.5
Bessemer & Lake Erie [b]						101.2	84.9			186.1	186.1	216.0	86.2
Boston & Maine	3.1	172.8	0.5	2.1	178.5		123.6			123.6	302.1	2,238.6	13.0
Buffalo, Rochester & Pittsburg						308.6	113.3			421.9	421.9	421.9	100.0
Caldwell & Northern						2.4				2.4	2.4	23.5	10.2
Camden Interstate [c]						16.0				16.0	16.0	30.0	53.3
Central of Georgia						50.1	15.0			65.1	65.1	1,913.0	3.4
Central of New Jersey	13.0	169.0		30.4	212.4						212.4	475.8	44.6
Central Vermont						1.5				1.5	1.5	[illegible]	
Chesapeake & Ohio						1,194.8	288.2			1,483.0	1,483.0	1,670.7	88.8
Chicago & Alton	170.3	141.1			311.4	351.4	37.9			389.3	700.7	904.2	77.5
Chicago & Eastern Illinois	3.6	103.5			107.1	169.4	57.5			226.9	334.0	683.0	49.5
Chicago & Northwestern		591.2	12.5	2.4	606.1	2,354.9	228.5			2,583.4	3,189.5	7,697.7	41.4
Chicago & Western Indiana		7.5			7.5		19.8			19.8	27.3	27.3	100.0
Chicago, Burlington & Quincy		30.8		5.5	36.3	8,289.1	503.3	18.7	1.4	8,812.5	8,848.8	8,962.2	98.7
Chicago Great Western		7.9			7.9	264.2	26.8			291.0	298.9	735.0	40.7
Chicago, Milwaukee & St. Paul	5.9	38.0			43.9	4,167.6	385.4			4,553.0	4,596.9	6,550.2	70.2
Chicago, Rock Island & Pacific	1.0	152.1			153.1	752.0	118.6			870.6	1,023.7	6,679.8	15.3
Chicago, St. Paul, Minneapolis & Omaha		6.4			6.4	591.6	64.1			655.7	662.1	1,488.5	44.5
Chicago Terminal Transfer		5.4			5.4						5.4	46.1	11.7
Cincinnati & Muskingum Valley						11.4				11.4	11.4	148.4	7.7
Cincinnati, Hamilton & Dayton						73.0	27.9			100.9	100.9	907.0	11.0
Cleveland, Akron & Columbus						11.0	8.0			19.0	19.0	177.4	10.7
Cornwall & Lebanon						8.3	13.7			22.0	22.0	22.0	100.0
Cumberland & Pennsylvania						4.3		3.0		7.3	7.3	31.3	23.3
Cumberland Valley						18.8	10.1			28.9	28.9	163.2	17.7
Davenport, Rock Island & Northwestern						40.6	1.1			41.7	41.7	41.7	100.0
Delaware & Hudson	177.2	208.6	4.3	17.5	407.6	.6				.6	408.2	743.9	54.8
Delaware, Lackawanna & Western [d]	1.4	459.0	6.1		466.5						466.5	859.2	54.3
Erie		60.0		13.6	73.6	643.5	623.9			1,267.4	1,341.0	1,744.6	77.0
Chicago & Erie						240.4	8.4			248.8	248.8	248.8	100.0
New Jersey & New York		10.5			10.5	26.1				26.1	36.6	51.8	70.0
New York, Susquehanna & Western and Wilkesbarre & Eastern							20.7			20.7	20.7	236.1	8.0
Grand Rapids & Indiana							2.2			2.2	2.2	436.5	0.5
Grand Trunk Railway System:													
International boundary to Black Rock Jct.						0.7				0.7	0.7	0.7	100.0
Atlantic & St. Lawrence						165.1				165.1	165.1	165.1	100.0
Grand Trunk Western						7.0	323.9			330.9	330.9	330.9	100.0
Michigan Air Line						105.6				105.6	105.6	105.6	100.0
Detroit, Grand Haven & Milwaukee						185.5	3.5			189.0	189.0	189.0	100.0
Chicago, Detroit & Canada Grand Trunk Junction						54.7	2.7			57.4	57.4	57.4	100.0
St. Clair Tunnel	2.0				2.0						2.0	2.0	100.0
Grand Rapids Terminal						1.1	0.4			1.5	1.5	1.5	100.0
Great Northern	6.2	62.0			68.2	252.1				252.1	320.3	6,168.0	5.2
Hocking Valley						74.7				74.7	74.7	338.5	22.1
Illinois Central [e]	28.0	227.9		12.0	267.9	783.9				783.9	1,051.8	5,598.1	18.8
Iowa Central						27.8				27.8	27.8	394.4	7.0
Kentucky & Indiana Bridge & Railroad Co.						7.2	2.7	0.7		10.6	10.6	20.0	53.0
Lackawanna & Wyoming Valley						1.0	2.4			3.4	3.4	22.6	15.0
Lehigh Valley [f]	14.1	411.0	34.6	10.8	470.5	695.6	54.8			750.4	1,220.9	1,141.9	100.0
Long Island	4.0	65.2		3.7	72.9		22.7			22.7	95.6	392.0	24.4
Louisville & Nashville	7.0				7.0	445.5	38.8			484.3	491.3	3,775.0	13.0
Maine Central	62.3	29.2			91.5						91.5	910.6	10.1
Missouri Pacific	126.0	23.9			149.9	226.6	3.3			229.9	379.8	5,212.6	7.3
Mobile & Ohio		4.7			4.7	42.4				42.4	47.1	825.0	9.6
Monongahela	0.5				0.5						0.5	53.6	0.9
Monongahela Connecting							4.0			4.0	4.0	55.0	8.0
Nashville, Chattanooga & St. Louis						89.8	7.2			97.0	97.0	1,236.5	7.8
New York & Long Branch		38.0			38.0						38.0	38.0	100.0
New York Central Lines:													
New York Central & Hudson River		129.1		14.5	143.6	1,734.4	604.7	43.3	305.6	2,688.0	2,831.6	2,843.5	99.5
Boston & Albany		152.0		19.2	171.2		0.5		2.4	2.9	174.1	352.3	49.4
Michigan Central [g]		272.0			272.0	984.4	19.1			1,003.5	1,275.5	1,275.5	100.0
Lake Shore & Michigan Southern		311.8	67.8	120.0	499.6	950.3	43.6			993.9	1,493.5	1,493.5	100.0
Cleveland, Cincinnati, Chicago & St. Louis [h]						582.8	290.2			873.0	873.0	1,762.7	49.5
Lake Erie & Western [i]						9.7	8.9			18.6	18.6	827.0	2.3
Pittsburgh & Lake Erie		100.9	8.4	30.8	140.1	28.5	2.9			31.4	171.5	190.7	90.0
Chicago, Indiana & Southern		2.0			2.0	16.7				16.7	18.7	301.4	6.0
New York, New Haven & Hartford	23.3	228.3			251.6	395.0	219.3		61.6	675.9	927.5	2,029.2	46.4
New York, Ontario & Western	31.9	102.9			134.8						134.8	492.8	27.3
Norfolk & Western	1.1	29.3			30.4	1,506.7	205.5			1,712.2	1,742.6	1,829.3	95.3
Northern Pacific	3.9	15.0			18.9	886.6	224.9			1,111.5	1,130.4	4,975.5	22.7
Pennsylvania Railroad [x]		46.7	2.9	187.8	237.4	1,084.4	660.3	42.4	200.3	1,987.4	2,224.8	3,184.0	69.8
Pennsylvania Company	17.8	45.9	12.7	31.6	108.0	216.4	521.9	10.8	11.4	760.5	868.5	1,305.4	66.5
Pittsburgh, Cincinnati, Chicago & St. Louis		7.2			7.2	603.7	416.8	49.2	19.9	1,089.6	1,096.8	1,408.5	77.8
Philadelphia, Baltimore & Washington		12.0		21.0	33.0	20.2	155.3	20.4	11.3	207.2	240.2	646.7	37.1
Northern Central						287.2	125.6		17.7	430.5	430.5	440.0	97.8
West Jersey & Seashore		85.2	6.0		91.2	51.6	29.1			80.7	171.9	291.1	59.0
Peoria & Pekin Union						6.2	6.5			12.7	12.7	16.7	76.0
Pere Marquette	6.1				6.1	29.3				29.3	35.4	1,917.5	1.8
Philadelphia & Reading [y]	4.3	282.8	40.5	15.8	343.4	98.2	125.1			223.3	566.7	846.9	65.3
Atlantic City		86.7			86.7	23.5				23.5	110.2	152.9	72.1
Northeast Pennsylvania	2.9	1.9			4.8	1.7				1.7	6.5	25.9	25.1
Perkiomen						38.3				38.3	38.3	38.3	100.0
Philadelphia & Frankford	2.6				2.6						2.6	2.6	100.0
Philadelphia, Newton & New York	4.2	2.0	1.5		7.7						7.7	22.2	34.7
Reading & Columbia						35.7				35.7	35.7	53.3	67.0
Queen & Crescent Route:													
Alabama Great Southern	45.6				45.6		1.5			1.5	47.1	290.5	16.2
Cincinnati, New Orleans & Texas Pacific	272.1	56.3			328.4	5.5				5.5	333.9	335.9	99.4
Richmond, Fredericksburg & Potomac						9.8	77.9			87.7	87.7	87.7	100.0
St. Louis & San Francisco	25.0	16.2			41.2	331.3	16.5			347.8	389.0	4,767.2	8.1
St. Louis Merchants Bridge Terminal		5.7			5.7		1.1			1.1	6.8	9.9	69.0
San Pedro, Los Angeles & Salt Lake	1.1				1.1						1.1	1,066.4	
Seaboard Air Line						210.1				210.1	210.1	2,436.5	8.6
Southern						1,388.8	205.2			1,594.0	1,594.0	5,920.6	26.9
St. Louis-Louisville Lines						148.6	1.0			149.6	149.6	515.7	29.0
Southern Illinois & Missouri Bridge		4.6			4.6						4.6	4.6	100.0
Southern Pacific—Atlantic System:													
Texas & New Orleans	106.7				106.7						106.7	438.7	24.3
Louisiana Western	103.6				103.6						103.6	140.3	73.9
Morgan's Louisiana & Texas	94.4				94.4						94.4	282.0	33.5
Galveston, Harrisburg & San Antonio	39.5				39.5						39.5	1,275.5	3.1
Southern Pacific—Pacific System	1,621.0	131.0		1.0	1,753.0	102.3				102.3	1,855.3	5,766.3	32.2

Table 1.—Aggregate Length of Lines or Parts of Lines on Which the Block System is in Use January 1, 1908—Continued.

Names of railroads.	Automatic block signals. Single track.	Double track.	Three track.	Four track.	Total.	Nonautomatic block signals. Single track.	Double track.	Three track.	Four track.	Total.	Total, all kinds.	Total miles operated by company (passenger lines).	Per cent operated under block system.
Staten Island Rapid Transit	1.3	7.0			8.3	8.9	11.7			20.6	28.9	28.9	100.0
Terminal Railroad Association of St. Louis		6.0			6.0		1.1			1.1	7.1	12.6	56.3
Ulster & Delaware	25.0				25.0						25.0	126.3	19.8
Union		0.6			0.6	2.4				2.4	3.0	7.4	40.5
Union Pacific	819.5	356.8		2.2	1,178.5	11.1				11.1	1,189.6	2,917.0	40.8
Oregon Short Line	176.8				176.8						176.8	1,368.9	12.9
Oregon Railroad & Navigation Co	297.0				297.0						297.0	1,248.6	23.8
Vandalia						216.6	22.0			238.6	238.6	795.7	30.0
Wabash		19.6			19.6	1,726.7	113.8			1,840.5	1,860.1	1,987.1	93.6
Wabash Pittsburgh Terminal		4.8			4.8						4.8	63.5	7.4
Washington Southern							34.2			34.2	34.2	34.2	100.0
Wisconsin Central							4.4			4.4	4.4	783.2	0.5
Total	4,363.5	5,690.8	197.8	541.9	10,803.0	38,517.0	8,447.6	258.8	652.3	47,875.7	58,678.7	151,455.2	

[a] Includes Cleveland, Lorain & Wheeling.
[b] Manual block system on 8.9 miles used exclusively by freight trains not shown in this table.
[c] Electric road.
[d] Includes Syracuse, Binghamton & New York.
[e] Includes Yazoo & Mississippi Valley.
[f] Automatic signals in addition to telegraph block on 6.6 miles. Automatic signals on 167.2 miles and nonautomatic signals on 57 miles used in whole or in part exclusively by freight trains.
[g] The Michigan Central has 243.5 miles automatic block signals in Canada not shown in this table.
[h] Includes Peoria & Eastern.
[i] Includes Northern Ohio.
[x] Includes 19.6 miles of road of more than four tracks.
[y] Automatic block signals on 16.3 miles used exclusively by freight trains not shown in this table.

Table 2.—Kinds of Automatic Signals in Use.

Names of railroads.	Uninclosed disks ("clockwork"). Miles of road.	Uninclosed disks. Miles of track.	Inclosed disks. Miles of road.	Inclosed disks. Miles of track.	Semaphores: Electro-pneumatic. Miles of road.	Electro-pneumatic. Miles of track.	Electric motor. Miles of road.	Electric motor. Miles of track.	Electro-gas. Miles of road.	Electro-gas. Miles of track.	Normal clear, miles of track.	Normal danger, miles of track.	Total automatic signals. Miles of road.	Total automatic signals. Miles of track.
Alabama Great Southern	14.5	14.5					31.1	31.1			45.6		45.6	45.6
Atchison, Topeka & Santa Fe			4.6	9.2			15.6	31.2			40.4		20.2	40.4
Atlantic City			86.7	173.4							173.4		86.7	173.4
Baltimore & Ohio			9.5	9.5			39.1	76.2	94.2	188.4	12.6	261.5	142.8	274.1
Boston & Albany	120.2	247.0	10.0	40.0			28.0	67.8	13.0	26.0	314.8	66.0	171.2	380.8
Boston & Maine	20.6	41.2	1.3	3.1			147.7	270.0	8.9	17.8	312.7	19.4	178.5	332.1
Central of New Jersey					29.7	116.0	163.3	318.6	19.4	38.0	434.6	38.0	212.4	472.6
Chicago & Alton							311.4	452.5			135.8	316.7	311.4	452.5
Chicago & Eastern Illinois			8.7	13.8			98.4	196.8			[a] 210.6		107.1	210.6
Chicago & Northwestern			599.8	1,216.9	6.3	12.6					1,229.5		606.1	1,229.5
Chicago & Western Indiana							7.5	[a] 15.0			15.0		7.5	15.0
Chicago, Burlington & Quincy			26.9	53.8	5.5	22.0	3.9	3.9			75.8	3.9	36.3	79.7
Chicago Great Western							7.9	15.8			15.8		7.9	15.8
Chicago, Indiana & Southern							2.0	4.0				4.0	2.0	4.0
Chicago, Milwaukee & St. Paul			5.7	9.0			34.7	69.4	3.5	3.5	68.4	13.5	43.9	81.9
Chicago, Rock Island & Pacific			7.9	15.0			145.0	290.0	0.2	0.2	305.2		153.1	305.2
Chicago, St. Paul, Minneapolis & Omaha							6.4	12.8			12.8		6.4	12.8
Chicago Terminal Transfer			1.0	2.0	3.2	6.4	1.2	2.4			10.8		5.4	10.8
Cincinnati, New Orleans & Texas Pacific	39.0	39.0	56.1	56.1			228.3	281.6	5.0	8.0	382.9	1.8	328.4	384.7
Delaware & Hudson			37.8	75.6					369.8	601.6		677.2	407.6	677.2
Delaware, Lackawanna & Western			11.0	20.6			445.5	897.1			917.7		456.5	917.7
Erie							73.6	175.6				175.6	73.6	175.6
Galveston, Harrisburg & San Antonio			1.7	1.7			37.8	37.8			39.5		39.5	39.5
Great Northern			68.2	130.2							127.0	3.2	68.2	130.2
Illinois Central			25.9	63.6			78.0	146.8	157.4	314.7	373.6	151.5	261.3	525.1
Lake Shore & Michigan Southern			5.1	10.2			319.0	714.4	175.5	585.2	724.6	585.2	499.6	1,309.8
Lehigh Valley			262.8	550.2			193.6	404.7	14.1	28.2		983.1	470.5	983.1
Long Island							72.9	149.2			145.2	4.0	72.9	149.2
Louisiana & Western							103.6	103.6			103.6		103.6	103.6
Louisville & Nashville							7.0	7.0			7.0		7.0	7.0
Maine Central							91.5	120.7			120.7		91.5	120.7
Michigan Central			97.3	194.6			174.7	349.4			544.0		272.0	544.0
Missouri Pacific							149.9	173.8			173.8		149.9	173.8
Mobile & Ohio							4.7	9.5			9.5		4.7	9.5
Monongahela							0.5	0.5			0.5		0.5	0.5
Morgan's Louisiana & Texas							94.4	94.4			94.4		94.4	94.4
New Jersey & New York							10.5	21.0				21.0	10.5	21.0
New York & Long Branch							38.0	76.0			76.0		38.0	76.0
New York Central & Hudson River			11.2	22.4			124.3	277.6	8.1	16.2	316.2		143.6	316.2
New York, New Haven & Hartford	168.5	315.0	64.2	128.4			18.9	36.5			479.9		251.0	479.9
New York, Ontario & Western	134.8	237.7									237.7		134.8	237.7
Norfolk & Western					11.9	22.7	18.5	37.0				59.7	30.4	59.7
Northeast Pennsylvania			4.8	6.7								6.7	4.8	6.7
Northern Pacific			3.0	4.5			11.4	22.8	4.5	6.6	25.5	8.4	18.9	33.9
Oregon Railroad & Navigation Co			2.0	2.0			295.0	295.0			297.0		297.0	297.0
Oregon Short Line			22.3	22.3			154.5	154.5			176.8		176.8	176.8
Pennsylvania			4.5	9.0	227.2	834.6	5.7	11.4			855.0		237.4	855.0
Pennsylvania Company							108.0	274.1			274.1		108.0	274.1
Pere Marquette			3.2	3.2			2.9	2.9			6.1		6.1	6.1
Philadelphia & Frankford			2.6	2.6								2.6	2.6	2.6
Philadelphia & Reading			344.8	757.7	0.7	1.4			14.2	20.5	0.6	779.0	[b] 359.7	779.6
Philadelphia, Baltimore & Washington					33.0	108.0					108.0		33.0	108.0
Philadelphia, Newton & New York			7.7	16.7								16.7	7.7	16.7
Pittsburg & Lake Erie							140.1	350.2			350.2		140.1	350.2
Pittsburg, Cincinnati, Chicago & St. Louis							7.2	14.4			14.4		7.2	14.4
St. Louis & San Francisco			8.0	11.0			33.2	46.4			56.4	1.0	41.2	57.4
St. Louis Merchants Bridge Terminal							5.7	11.4			11.4		5.7	11.4
St. Clair Tunnel					2.0	2.0						2.0	2.0	2.0
San Pedro, Los Angeles & Salt Lake							1.1	1.1			1.1		1.1	1.1
Southern Illinois & Missouri Bridge							4.6	9.3			9.3		4.6	9.3
Southern Pacific Co.: Pacific System			2.4	2.4	6.0	13.7	1,741.6	1,870.9			1,887.0		1,750.0	1,887.0
Staten Island Rapid Transit			8.3	15.3								15.3	8.3	15.3
Syracuse, Binghamton & New York			10.0	20.0							20.0		10.0	20.0
Terminal Railroad Association of St. Louis							6.0	12.0			12.0		6.0	12.0
Texas & New Orleans							106.7	106.7			106.7		106.7	106.7
Ulster & Delaware							25.0	25.0			25.0		25.0	25.0
Union			0.6	1.2							1.2		0.6	1.2
Union Pacific			10.4	20.8			1,132.8	1,450.5	35.3	70.6	1,541.9		1,178.5	1,541.9
Wabash							19.6	39.2			39.2		19.6	39.2
Wabash Pittsburgh Terminal							4.8	9.6			9.6		4.8	9.6
West Jersey & Seashore					91.2	194.4					194.4		91.2	194.4
Yazoo & Mississippi Valley							6.6	6.6			6.6		6.6	6.6
Total	497.6	894.4	1,838.0	3,694.7	416.7	1,333.8	7,143.9	10,685.7	923.1	1,925.5	14,317.1	4,217.0	[illegible]	18,534.1

[a] Three-position signals.
[b] Includes 7.9 miles single track and 8.4 miles double track protected by automatic signals used exclusively for freight trains not shown in mileage table.

TABLE 3.—METHODS AND APPARATUS USED WITH MANUAL BLOCK SYSTEM

Names of railroads.	Morse telegraph.		Telephone.		Electric bells.		"Controlled." No track circuit.		"Controlled." Track circuit at stations.		"Controlled." Continuous track circuit		Electric train staff.		Block signal stations.	
	Miles of road.	Miles of track.	Miles of road.	Miles of track.	Miles of road.	Miles of track	Miles of road	Miles of track.	Miles of road.	Miles of track.	Miles of road.	Miles of track	Miles of road.	Miles of track	Total number.	Number closed part time.
Alabama Great Southern	1.5	3.0													2	
Ann Arbor	1.0	1.0													2	
Atchison & Eastern Bridge			0.4	0.4											2	
Atchison, Topeka & Santa Fe			1,437.5	1,765.0									34.3	34.3	301	20
Atlanta & West Point	6.0	12.0													3	
Atlantic & St. Lawrence	165.1	165.1													34	6
Atlantic City	23.5	23.5													7	7
Atlantic Coast Line	587.0	649.4	2.4	2.4											128	a 29
Baltimore & Ohio b	903.6	1,700.0									8.4	8.4			281	8
Baltimore & Ohio Southwestern	59.4	114.5													26	4
Baltimore & Sparrow's Point	3.0	6.0													3	3
Bessemer & Lake Erie	195.0	279.9													63	10
Boston & Albany			1.2	3.8							1.7	6.8			11	
Boston & Maine	118.8	211.1							4.8	9.6					35	10
Buffalo, Rochester & Pittsburgh	421.9	535.2													105	38
Caldwell & Northern	2.4	2.4													2	
Camden Interstate c							16.0	16.0							17	
Central of Georgia	65.1	80.1													21	2
Central Vermont											1.5	1.5			2	
Chesapeake & Ohio	1,206.9	1,391.1					147.4	147.4	92.1	188.2	28.9	36.8	7.7	7.7	224	83
Chicago & Alton	352.1	390.0							19.2	19.2			18.0	18.0	71	14
Chicago & Eastern Illinois	226.9	284.4					69.4	77.5							54	10
Chicago & Erie	248.8	257.6													60	8
Chicago & Northwestern	2,583.4	2,811.9													450	261
Chicago & Western Indiana					19.8	39.6									28	
Chicago, Burlington & Quincy	6,745.1	6,927.2	752.9	1,110.0			1,251.9	1,251.9			61.3	67.0	1.3	1.3	1,164	615
Chicago, Detroit & Canada Grand Trunk Junction	57.6	60.1													14	5
Chicago Great Western	288.9	315.7									0.5	0.5	1.6	1.6	66	6
Chicago, Indiana & Southern	16.7	16.7													5	3
Chicago, Milwaukee & St. Paul	4,543.5	4,929.9									1.0	1.0	8.5	8.5	615	267
Chicago, Rock Island & Pacific	861.6	980.2											9.0	9.0	170	37
Chicago, St. Paul, Minneapolis & Omaha	655.7	719.8													126	d 36
Cincinnati & Muskingum Valley	11.4	11.4													3	
Cincinnati, Hamilton & Dayton	100.9	128.8													31	
Cincinnati, New Orleans & Texas Pacific	2.5	2.5									2.1	2.1	0.9	0.9	6	
Cleveland, Akron & Columbus	19.0	27.0													17	
Cleveland, Cincinnati, Chicago & St. Louis	873.0	1,163.2													221	21
Cornwall & Lebanon	22.0	35.7													7	7
Cumberland & Pennsylvania	7.3	13.3													9	3
Cumberland Valley	28.9	39.0													12	
Davenport, Rock Island & Northwestern							41.7	42.8							7	6
Delaware & Hudson			.6	.6											2	
Detroit, Grand Haven & Milwaukee	189.5	192.5													39	25
Erie	545.3	712.9			722.1	1,178.4									371	75
Grand Rapids & Indiana	2.2	4.4													3	e 3
Grand Rapids Terminal	1.6	2.0													2	
Grand Trunk Railway System: International boundary to Black Rock Junction					.7	.7									2	
Grand Trunk Western	330.9	654.8													74	34
Great Northern	237.5	237.5											14.6	14.6	48	
Hocking Valley	74.7	74.7													24	
Illinois Central			769.1	769.1			769.1	769.1							188	
Iowa Central	27.8	27.8													7	2
Kentucky & Indiana Bridge & Railroad Co.	10.6	14.7													10	
Lackawanna & Wyoming Valley			1.2	2.4									2.2	3.4	2	1
Lake Erie & Western	18.6	27.5													13	
Lake Shore & Michigan Southern	993.9	1,037.5													190	104
Lehigh Valley	744.2	802.6											6.2	6.2	130	95
Long Island					14.1	28.2			8.6	17.2					37	f 10
Louisville & Nashville	484.3	523.1													115	5
Michigan Air Line	105.6	105.6													19	16
Michigan Central	935.5	954.6	68.0	68.0											180	87
Missouri Pacific	226.3	229.6			0.5	0.5	1.9	1.9			1.2	1.2			43	10
Mobile & Ohio	42.4	42.4													15	
Monongahela Connecting	4.0	8.0													6	
Nashville, Chattanooga & St. Louis	97.0	104.2													37	
New Jersey & New York					26.1	26.1									11	5
New York Central & Hudson River	2,235.5	2,743.8	2.9	11.6	5.3	16.6	1.4	2.8	372.9	1,302.4	70.2	234.0			342	254
New York, New Haven & Hartford	443.8	492.6							229.1	581.4	3.0	6.0			103	
New York, Susquehanna & Western and Wilkesbarre & Eastern					20.7	41.4									17	2
Norfolk & Western	1,060.5	1,192.8					651.7	724.9							313	98
Northeast Pennsylvania													g 1.7	1.7	2	2
Northern Central	429.6	607.4									0.9	1.6			115	17
Northern Pacific	1,111.5	1,336.4													199	10
Pennsylvania	1,761.2	2,925.9	202.6	370.2	9.4	18.8					14.1	18.4			566	34
Pennsylvania Company	758.0	1,333.2	2.5	5.0											213	5
Perkiomen	38.3	38.3													13	7
Peoria & Pekin Union											12.7	19.2			7	
Pere Marquette							29.3	29.3							10	2
Philadelphia & Reading	219.9	317.0	1.3	1.3							1.1	1.1	1.2	1.2	92	9
Philadelphia, Baltimore & Washington	205.6	434.0									1.6	3.2			66	1
Pittsburgh & Lake Erie							31.4	34.3							18	10
Pittsburgh, Cincinnati, Chicago & St. Louis	1,081.9	1,656.8					7.7	7.7							285	
Reading & Columbia	35.7	35.7													12	12
Richmond, Fredericksburg & Potomac	87.0	164.0											0.7	0.7	10	
St. Louis & San Francisco							344.8	361.3					3.0	3.0	71	2
St. Louis—Louisville Lines	143.7	144.7											5.9	5.9	27	6
St. Louis Merchants Bridge Terminal	1.1	2.2													3	
Seaboard Air Line	206.6	206.6											3.5	3.5	44	6
Southern	1,591.4	1,796.6	0.5	0.5									1.7	1.7	387	19
Southern Pacific Company—Pacific System											1.0	1.0	101.3	101.3	37	
Staten Island Rapid Transit							20.7	32.4							39	
Terminal Railroad Association of St. Louis	1.1	2.2													2	
Union	1.0	1.0					0.6	0.6			0.8	0.8			2	
Union Pacific													11.1	11.1		
Vandalia	238.6	260.6													62	
Wabash	1,820.7	1,914.7			19.8	39.6	1,840.5	1,954.3							360	91
Washington Southern	34.2	68.4													22	3
West Jersey & Seashore	51.6	51.6	29.1	58.2											25	16
Wisconsin Central	4.4	8.8													6	
Yazoo & Mississippi Valley			14.8	14.8			14.8	14.8							5	
Total	40,040.3	47,781.3	3,286.8	4,183.3	838.5	1,383.9	5,240.3	5,469.0	726.7	2,118.0	212.0	410.8	234.4	235.6	9,438	2,600

a 23 stations closed 7 months, 6 stations closed part of each day.
b Includes Cleveland, Lorain & Wheeling.
c Electric interurban road, using electric, manually operated signals under control of trainmen. Signals furnish both front and rear protection for space of one block.
d 8 stations closed a number of months; 28 closed part of each day.
e 3 stations closed 9 months.
f 6 stations closed six months; 4 closed part of each day.
g In use four months of the year.

Table 4.— **Practices in the Operation of Manual Block System.**

Names of railroads.	Permissive signaling not allowed.		Permissive signaling allowed. By three-position signals.		By two-position signal or flag.		By caution card		Rear-end protection only.		Signals opposite office.	
	Miles of road.	Miles of track.	Miles of road.	Miles of track.	Miles of road.	Miles of track.	Miles of road.	Miles of track.	Miles of road.	Miles of track.	Miles of road.	Miles of track.
Alabama Great Southern	1.5	3.0										
Ann Arbor	1.0	1.0										
Atchison & Eastern Bridge	0.4	0.4										
Atchison, Topeka & Santa Fe	34.3	34.3	1,437.5	1,765.0								
Atlanta & West Point	6.0	12.0										
Atlantic & St. Lawrence					a 165.1	a 165.1						
Atlantic City	23.5	23.5										
Atlantic Coast Line	5.3	10.6					584.1	641.2				
Baltimore & Ohio	253.4	433.7	ab 658.6	ab 1,274.7								
Baltimore & Ohio Southwestern	c 15.4	c 30.8	a 44.0	a 74.9								
Baltimore & Sparrow's Point			d 3.0	d 6.0								
Bessemer & Lake Erie							a 195.0	a 279.9			193.0	276.9
Boston & Albany	2.9	10.6										
Boston & Maine	123.6	220.7										
Buffalo, Rochester & Pittsburgh	396.0	509.3			a 25.9	a 25.9						
Caldwell & Northern							2.4	2.4				
Central of Georgia	65.1	65.1										
Central Vermont	1.5	1.5										
Chesapeake & Ohio							d 1,483.0	d 1,771.2			1,039.2	1,081.6
Chicago & Alton							389.3	427.2				
Chicago & Eastern Illinois			b 226.9	b 284.4							226.9	284.4
Chicago & Erie			a 248.8	a 257.6							248.8	257.6
Chicago & Northwestern							ad 2,583.4	ad 2,811.9			2,354.9	2,354.9
Chicago & Western Indiana							19.8	39.6				
Chicago, Burlington & Quincy	82.7	130.6	7,477.9	7,975.5			a 1,251.9	a 1,251.9	5,165.4	5,171.4	8,746.9	9,793.6
Chicago, Detroit & Canada Grand Trunk Junction					a 57.4	a 60.1						
Chicago Great Western	291.0	317.8										
Chicago, Indiana & Southern							16.7	16.7				
Chicago, Milwaukee & St. Paul	647.0	669.7					ad 3,906.0	ad 4,268.7			4,263.4	4,648.8
Chicago, Rock Island & Pacific			870.6	989.2							861.0	980.2
Chicago, St. Paul, Minneapolis & Omaha	655.7	719.8										
Cincinnati & Muskingum Valley			d 11.4	d 11.4							11.4	11.4
Cincinnati, Hamilton & Dayton			ae 59.1	ae 97.0	ab 41.8	ab 41.8						
Cincinnati, New Orleans & Texas Pacific	2.1	2.1			b 3.4	b 3.4						
Cleveland, Akron & Columbus			d 19.0	d 27.0								
Cleveland, Cincinnati, Chicago & St Louis	856.6	1,146.8			16.4	16.4					f 873.0	f 1,163.2
Cornwall & Lebanon					a 22.0	a 35.7			22.0	35.7		
Cumberland & Pennsylvania			e 7.3	e 13.3								
Cumberland Valley							28.9	39.0				
Davenport, Rock Island & Northwestern					a 41.7	a 42.8						
Delaware & Hudson					0.6	0.6						
Detroit, Grand Haven & Milwaukee					a 189.0	a 192.5						
Erie			a 1,267.4	a 1,891.3							837.9	1,178.1
Grand Rapids & Indiana	2.2	4.4										
Grand Rapids Terminal					a 1.5	a 1.9						
Grand Trunk Western					a 330.9	a 654.8						
Great Northern	14.6	14.6			ad 237.5	ad 237.5					237.5	237.5
Hocking Valley					a 74.7	a 74.7						
Illinois Central							d 769.1	d 769.1				
Iowa Central					a 27.8	a 27.8						
Kentucky & Indiana Bridge & Railroad Co.			a 10.6	a 14.7								
Lackawanna & Wyoming Valley	2.2	3.2			1.2	2.4						
Lake Erie & Western	18.6	27.5										
Lake Shore & Michigan Southern							a 993.9	a 1,037.5				
Lehigh Valley	750.4	805.2										
Long Island							22.7	45.4				
Louisville & Nashville			d 484.3	d 523.1								
Michigan Air Line					a 105.6	a 105.6						
Michigan Central	h 1,003.5	h 1,022.6							1,003.5	1,022.6	1,003.5	1,022.6
Missouri Pacific	7.7	7.7			222.2	225.5			226.8	230.1	226.6	229.9
Mobile & Ohio	17.6	17.6			a 24.8	a 24.8			24.8	24.8	42.4	42.4
Monongahela Connecting					a 4.0	a 8.0						
Nashville, Chattanooga & St. Louis	48.1	53.1					48.9	51.1				
New Jersey & New York					26.1	26.1					26.1	26.1
New York Central & Hudson River	2,260.8	3,241.8					g 427.2	g 1,054.4				
New York, New Haven & Hartford	675.9	1,080.0										
New York, Susquehanna & Western and Wilkes-barre & Eastern					a 20.7	a 41.4					20.7	41.4
Norfolk & Western			1,712.2	1,917.7					727.2	774.0		
Northeast Pennsylvania	1.7	1.7										
Northern Central	3.4	6.8	bd 427.0	bd 602.3					d 187.2	d 188.3	132.5	197.2
Northern Pacific							1,111.5	1,336.4				
Pennsylvania	6.7	7.3	dg 1,980.6	dg 3,326.0								
Pennsylvania Company			bd 760.5	bd 1,338.2							760.5	1,338.2
Perkiomen							bd 38.3	bd 38.3				
Peoria & Pekin Union							a 12.7	a 19.2				
Pere Marquette							29.3	29.3				
Philadelphia & Reading							g 223.3	g 348.4				
Philadelphia, Baltimore & Washington	58.6	126.4	d 148.6	d 310.8								
Pittsburgh & Lake Erie	31.4	34.3										
Pittsburgh, Cincinnati, Chicago & St. Louis			bd 1,089.6	bd 1,664.5							1,089.6	1,664.5
Reading & Columbia							b 35.7	b 35.7				
Richmond, Fredericksburg & Potomac	.7	.7					87.0	164.9				
St. Louis & San Francisco			a 347.8	a 364.3								
St. Louis-Louisville Lines	5.9	5.9					a 143.7	a 144.7				
St. Louis Merchants Bridge Terminal	1.1	2.2										
Seaboard Air Line							a 210.1	a 210.1				
Southern	1,560.4	1,755.1			a 33.6	a 44.1						
Southern Pacific Company—Pacific System	102.3	102.3										
Staten Island Rapid Transit					b 20.7	b 32.4						
Terminal Railroad Association of St. Louis	1.1	2.2										
Union					b 2.4	b 2.4						
Union Pacific					11.1	11.1						
Vandalia			b 238.6	b 260.6								
Wabash							a 1,840.5	a 1,954.3	773.4	773.4		
Washington Southern							34.2	34.2				
West Jersey & Seashore					ae 80.7	ae 109.8						
Wisconsin Central							4.4	8.8				
Yazoo & Mississippi Valley							d 14.8	d 14.8				
Total	x 10,039.9	12,665.9	19,531.3	24,989.5	1,788.8	2,214.6	16,507.8	18,846.3	8,130.3	8,220.3	23,196.4	[illegible]

a By dispatcher.
b Allowed by rule.
c Permissive movements allowed for westbound trains by dispatcher and three-position signal.
d For everything but passenger trains.
e By train order.
f In this mileage there are 58 signals opposite offices.
g Allowed in some cases.
h For passenger trains only. This company uses no block for freight trains on lines protected by manual block system.

x Camden Interstate, 16 miles electric road not shown in this table manual block system, and Table 4 shows the practice in vogue in the operation of the manual system. It appears that since September 30, 1906,* there has been an increase of 9,935.5 miles in block-signal mileage in the United States, the mileage now shown being 58,678.7, while in the earlier report it was 48,743.2. This increase represents 5,959.4 miles of manual and 3,976.1 miles of automatic. The increase in automatics on single-track lines is 2,331.1 miles. On the Lehigh Valley 79 miles of block-signal mileage is used exclusively for freight trains.

It appears from Table 4 that on 8,130.3 miles of road the block system is used for rear-end protection only.

China's Plans for New Railroads.

It is a fact worth noting that China now has a ministry of transportation, and that this ministry has reported in favor of a national railroad system, with its center at Pekin, the several lines to be built as means can be provided, those promising immediate profit first. The great north-and-south line will be that now open from Pekin south to the Yang-tze river at Hankow, with its extension south to Canton, together with the line now in operation from Pekin northeast to Hsin-min-tun (near Mukden), to be extended thence northward to the Amoor and the Russian border at Argun, crossing the Chinese Eastern at Tsitsikar. The road now under construction from Pekin northwest to the Great Wall at Kalgan should eventually be extended substantially over the caravan route through Urga to the Siberian border at Kiachta, which is not far from the Russian trans-Baikal railroad. The western line, beginning from a branch of the Pekin-Hankow railroad at a considerable distance south of Pekin, now under construction from Scheng-ting to Tai-juen, is planned for an indefinite western extension, largely through mountains and desert, towards Turkestan. With these main lines a number of branches would connect. The important thing in this report is that China at last desires to have railroads, and a whole system of railroads, and plans for a long time ahead, and for its own national needs.

Rail Committee of the Maintenance of Way Association.

The personnel of the American Railway Engineering and Maintenance of Way Association's committee on rail for this year is a notable one, both because of the rank and experience of the railroad officers composing it, and of the great mileage of the lines represented, the total miles being only a little under 100,000. The work which has been assigned to this committee by the Board of Directors of the association, which is given below, is subject to such change as action by the American Railway Association may dictate.

(1) Continue the investigation of the breakage and failure of rails and present summary of conclusions drawn from reports received.

(2) Report on the results obtained from the use of open-hearth steel rails and the chemical composition of such rails.

(3) Report on any recommended changes in specifications for Bessemer steel rails as heretofore adopted by this association.

(4) Present recommendation as to standard rail sections.

(5) Present report showing diagrams or photographs of typical characteristic rail failures corresponding to the classification as given in form M. W. 1,200, Report of Rail Failures in Main Tracks.

The committee is as follows: D. D. Carothers, Chief Engineer, Baltimore & Ohio, Chairman; R. Montfort, Consulting Engineer, Louisville & Nashville, Vice-Chairman; E. B. Ashby, Engineer Maintenance of Way, Lehigh Valley; J. A. Atwood, Chief Engineer, Pittsburg & Lake Erie; A. S. Baldwin, Chief Engineer, Illinois Central; J. B. Berry, Chief Engineer, Chicago, Rock Island & Pacific; Chas. S. Churchill, Chief Engineer, Norfolk & Western; W. C. Cushing, Chief Engineer Maintenance of Way Southwest System, Pennsylvania Lines West; F. A. Delano, President, Wabash Railroad; Dr. H. Dudley, Rail Expert, New York Central Lines; C. H. Ewing, ...ineer Maintenance of Way, Philadelphia & Reading; J. F. Hinck-... Chief Engineer, Frisco Railway System; John D. Isaacs, Con...g Engineer, Harriman Lines; Thos. H. Johnson, Consulting ...eer, Pennsylvania Lines West; Howard G. Kelley, Chief Engi... Grand Trunk Railway System; J. W. Kendrick, Second Vice-...ent, Atchison, Topeka & Santa Fe System; George W. Kitt-... Chief Engineer, New York Central & Hudson River; D. W. ...hief Engineer Maintenance of Way and Structures, Southern ...; Jos. T. Richards, Chief Engineer Maintenance of Way, ...ania Railroad; J. P. Snow, Bridge Engineer, Boston & ... Robert Trimble, Chief Engineer Maintenance of Way, North-...tem, Pennsylvania Lines.

...s. Kittredge and Kelley are past-presidents of the asso-...nd Messrs. Carothers, Churchill, Cushing and Snow are

...is the date of the last table issued by the Commission. It was ...he *Railroad Gazette*, March 1, 1907.

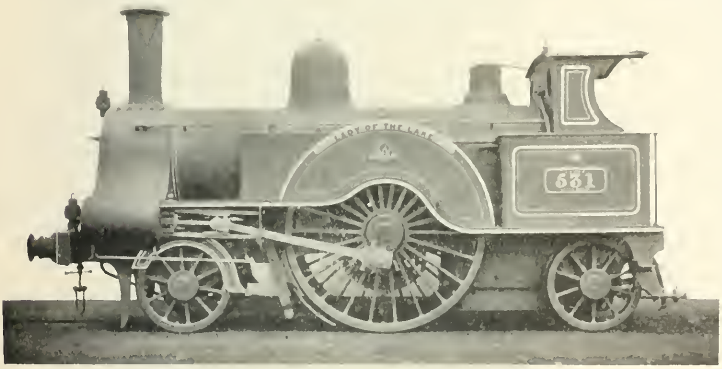
The Last of a Famous Class.

BY W. B. PALEY.

Historians of the locomotive engine all over the world will deplore the disappearance of the famous "Lady of the Lake" class of express engines on the London & North Western. After a career extending over no less than 48 years they have had to succumb to the inevitable, the class of work for which they were suited no longer existing. They had played many parts in their time; in fact, it was long since they had been able to run express trains single-handed, but work within their capacity had been found for them over and over again. This was largely due to the regard felt for them by the late Mr. F. W. Webb, so long the Chief Mechanical Engineer at Crewe, who assisted at preparing the working drawings for them under his predecessor, Mr. John Ramsbottom. In view of the projected acceleration of the Irish mail service between London and Holyhead, designs for an express engine capable of making longer runs than had hitherto been customary were prepared at Crewe in 1859, the first engine of the new type, No. 184, named "Problem," coming out in November of that year. To some extent Mr. Ramsbottom seems to have reproduced the principal features of a successful type of 7-ft. "single" express engines, designed by his predecessor, Mr. F. Trevithick, in 1847, but all the dimensions were enlarged and the important difference made that inside bearings only were used for all the wheels. In the 7-ft. class they had been outside for both pairs of carrying wheels. The cylinders were made 16 x 24, instead of 15 x 20, an additional 6 in. being added to the diameter of the driving wheels. The weight, full, was augmented from about 20 to 27 tons 6 cwts., of which 9 tons 8 cwts. were on the leading, 6 tons 8 cwt. on the trailing and $11\frac{1}{2}$ tons on the driving wheels. The boiler barrel was 10 ft. 5 in. long by 3 ft. 11 in., made of three rings ... iron plates, single riveted, the center line being $6\frac{1}{2}$ ft. above the rails. The firebox shell was flush at the crown with the barrel, 4 ft. 9 in. long by 4 ft., also of ... plates. The firebox itself was 4 ft. 2 in. long, 3 ft. 6 in. wide by 5 ft. 7 in deep, with sides of copper plates $\frac{1}{2}$ in. thick, the tube plate being of $\frac{3}{4}$-in. copper. These dimensions gave 85 sq. ft. of heating surface, and as the 192 brass tubes, $1\frac{7}{8}$ in. in diameter by 10 ft. 9 in. long, gave 1,013 ft. more on the outside, the total heating surface was 1,098 sq. ft. The grate area was 14.7 sq. ft., the firebar frame consisting of two round bars of iron 3 in. in diameter, resting at each end in a V-seat bolted against the ashpan side, with $\frac{3}{4}$-in. iron pegs screwed into them, at such distances as to provide an inch clear space for the bars. It was found that this spacing cured the troublesome tendency of the bars to run together. The smokebox was 2 ft. 8 in. long, provided with a door opening upward from the bottom, and also with a funnel-shaped chute to relieve it of ashes, an arrangement specially devised with a view to long runs. The stack was 16 in. in diameter and reached to 13 ft. 1 in. above the rails, an elaborate cap always used by Mr. Ramsbottom surrounding the top. Screw reversing gear was fitted on the left hand, which is the driver's side on the L. & N. W., the length of the links in the motion being 16 in. and the throw of the eccentrics $5\frac{1}{4}$ in. A large plain dome, of the type still used at Crewe, contained a double-beat regulator valve; the main steam pipe was $5\frac{1}{2}$ in. in diameter. The connecting rods were 6 ft. 3 in. long, with a short fork at the cylinder end, and had cross-head pins $2\frac{1}{4}$ in. x $2\frac{1}{4}$ in., the crank-pin bearing being 4 in. in diameter by $4\frac{1}{4}$ in. long. Single inside plate frames were used of iron 1 in. thick, 4 ft. 1 in. apart and 13 in. deep over the driving fork. Volute springs $5\frac{1}{2}$ in. in diameter, butting against the foot-plate, were used for the trailing wheels, laminated springs 2 ft. 8 in. span, of 11 plates, and 3-ft. span, of 18 plates, for the leading and driving wheels. These, with a wheel base of 7 ft. 7 in. in front of the drivers and of 7 ft. 10 in. behind, made a very steady riding engine only 24 ft. long over all. The cylinders had an internal back cover and were fitted with Ramsbottom's patent pistons, a type then new but now generally used in Great Britain. Two cast-iron rings, cut through so as to be slightly compressible, are sprung into recesses turned in the rim of the piston and kept from turning round by pins screwed into the rim. The engine was fitted with Gifford's injector, then very recently invented; in fact, it was the first engine on the L. & N. W. built with one. There was also a pump capable of supplying the boiler by itself, in case the injector proved unreliable. As to other dimensions the steam pipes were $3\frac{3}{4}$ in. in diameter, the steam ports $13\frac{1}{2}$ in. x $1\frac{1}{2}$ in., the exhaust ports $3\frac{1}{4}$ in. wide, lap $\frac{7}{8}$ in.; diameter of blast pipe at top $4\frac{1}{4}$ in. Two safety valves, each $2\frac{3}{4}$ in. diameter, were fitted on a manhole cover over the firebox, the brass pillars containing them having a strong coiled spring between and a steel lever, connected with both valves, extended over the top of the low weather-board. The blow-off pressure was 120 lbs. A similar engine, No. 229, "Watt," was built at the same time as the "Problem."

Eight others followed within about six months, so that when the improved Irish mail service commenced, on Oct. 1, 1860, the L. & N. W. Company was ready with suitable engines for it. The service comprised a day and a night train in each direction, only the night trains running on Sundays. The speeds were not high, but the runs were unusually long, including Euston to Rugby, $82\frac{3}{4}$ miles, and Chester to Holyhead, $84\frac{3}{4}$. First and second class passengers were taken for Ireland only, and strict clauses as to punctuality were enforced by the terms of the contract with the post office. It had been foreseen, however, that the old 4-wheel tenders, carrying but 1,500 gals. of water, could not be relied upon for covering the exposed stretch of line in North Wales. This led Mr. Ramsbottom to devise an ingenious system of taking up water without stopping the train from a long trough laid between the rails. He patented this in June, 1860, and in the following November a series of experiments was made with a trough laid near Colwyn, about midway between Chester and Holyhead. It was found that 1,200 gals. could easily be picked up from a trough one-quarter mile long, 18 in. wide by 7 deep and containing 5 in. depth of water.

The new engines were provided with 6-wheel tenders to hold 1,800 gals., and with the aid of the water-troughs were able to conduct the mail service with the greatest regularity and satisfaction. They ran between Holyhead and Stafford, $130\frac{1}{2}$ miles, with one stop of 10 minutes at Chester. This was for post office purposes mainly, the place being an important railroad center. South of Stafford the mails were for a short time worked by engines of different type belonging to the Southern Division of the line, but when the separate working of the two divisions was given up, in 1862, a fresh engine of the "Problem" class took up the running from Stafford to London. This arrangement continued for the best part of 20 years, till the trains got altogether too heavy for such light machines. In fact, before long it was often found necessary to use two of them, or a coupled engine, on the Holyhead section, which has some steep bits and is extremely exposed to gales of wind blowing in off the sea. The big 7 ft. 6 in. drivers were considerably affected by the high winds at times.



Express Passenger Locomotive, Lady of the Lake, 1862.

The year 1862 brought these engines prominently into notice in two respects. On January 7 No. 229, the "Watt," ran from Holyhead to Trent Valley Junction, Stafford, 131 miles, in 141 minutes without stopping, bearing despatches from Lord Lyons, the British Minister at Washington, to the effect that Messrs. Mason and Slidell, who had been taken out of the English steamer "Trent" by the United States ship "San Jacinto," had been released. Opinions were being much agitated by the occurrence; the greatest importance was attached to the quick transit of the despatches. The load was only three vehicles, weighing in all but 20 tons, and the run would have been made considerably faster but for a high wind and the necessity for slowing through such places as Chester and Crewe.

At the Great Exhibition of 1862 the L. & N. W. Company showed one of the "Problem" class, No. 531, "Lady of the Lake." It comprised some additional improvements, such as the tender with water lifter, and two openings through the front of the firebox, just under the ends of the brick arch and controllable from the foot plate, in order that air might be admitted to aid in consuming the smoke due to coal fuel. At that time the use of coal for passenger traffic was a new thing in this country, coke having been burned previously, and many devices were tried for securing its perfect combustion without making smoke. These openings were fitted to a large number of L. & N. W. engines at one time. They were about 7 in. square and permitted the fire to shine through them in a peculiar manner. They have long ago been entirely abandoned. The brick arch inclined downward somewhat toward the back of the firebox, instead of upward. Ramsbottom's pistons and his "gravity lubricators" were used, an invention patented in 1860. These were applied to the cylinders and slide-valves and consisted of round brass cups or vessels with narrow necks opening into or connected with the steam chest or cylinder, the vessel was filled with oil and the steam displacing a little from the neck or orifice became condensed. Water being heavier than oil it sank and displaced oil in the process, the action continuing so long as the engine was at work or there was any oil left. The lubricator was therefore always full of oil or water, or both, the latter under the oil. Two injectors fed the boiler, one on each side of the firebox. A bronze medal for excellence of design and workmanship, was awarded, and the engine carried it in a small glass case over the number-plate on the driver's side to the last day of her life.

One of this class, No. 291, "Prince of Wales," was working the down-day mail on Aug. 20, 1868, when near Abergele it was run into by some trucks loaded with casks of oil, which had broken loose from a goods train shunting at the top of an incline. The oil at once caught fire and a fearful holocaust resulted, no fewer than 33 persons being either burned to death or suffocated by the smoke and fumes of the blazing oil. Every scrap of paint was burned off the engine and the bearings melted out.

The average load with the Irish mails between Stafford and Holyhead in the sixties was 10 to 12 four-wheeled vehicles, weighing from 75 to 90 tons in all, taken at a speed of about 45 miles an hour on a consumption of $26\frac{1}{2}$ lbs. of good coal per mile.

In all 60 of the "Problem," or, as they were more often called, the "Lady of the Lake" class were built, the last 10 in 1865. No. 1,134, "Eunomia," the fifty-eighth, was the very last scrapped, just lately. About 1865, owing to increasing loads, Ramsbottom's 6 ft. 6 in. coupled engines, with inside cylinders, 16 x 24, began to replace them. When Mr. Webb's similar, but heavier, 17 x 24 coupled engines came out in 1874 the "Problems" soon got relegated to piloting and to light work off the main line. For some years, about 1890 to 1900, they worked the short fast three-quarter-hour expresses between Liverpool and Manchester with great success, and on the memorable occasion of the "race to Edinburgh," in 1888, No. 667, "Marmion" and 806, "Waverley," worked trains of four 8-wheeled coaches between London and Crewe at extraordinary speeds, $158\frac{1}{4}$ miles, without a stop.

Down to the time Mr. Webb resigned the whole of the 60 engines were running. They had, of course, all been rebuilt, most of them twice, and considerably modernized. As rebuilt, with larger fireboxes, boilers carrying 150 lbs. steam, their weight was increased about 4 tons to 31 tons 7 cwt., the original load on the drivers of $11\frac{1}{2}$ tons being raised to $14\frac{1}{4}$. Cabs were added in place of the miserable weather-boards which both Northern and Southern Division engines had so long carried in testimony to the old-fashioned ideas of the respective chiefs. The pattern of nine oval openings in the driving-splashers was done away with; Webb's plain funnel substituted, and the safety-valves enclosed in a neat iron case. Solemn black paint, instead of Ramsbottom's dark green, was used, but the engines remained about the prettiest little machines that ever ran in Great Britain, and their disappearance will make many a London & North Western man feel that in them he has lost some of his oldest friends.

Foreign Railroad Notes.

There died on February 3, 1908, a man who entered the railroad service in Austria in 1829. This man, Wagner von Wagensburg, reached the highest positions in the state railroad service, and was retired on a pension no less than 38 years ago. He was born in 1811.

The government of German Southwest Africa reports that among the difficulties accompanying the extension of its railroad towards Keetmanshoop is the necessity of importing water, which cost on the line just the same as beer in Munich—about 6 cents a quart. Laborers brought in from Upper Silesia wouldn't stay, and Croats were engaged in their place. Native prisoners of war could not stand the climate and the work, and more and more Cape "boys"—that is, natives reared among the Boers—must be depended on to do the earthwork.

Argentina has passed a general railroad law, which will form the uniform basis of all charters granted hereafter by the general government (there are a few state charters), and under which it is intended to bring the older companies as favorable provisions of their old special charters expire. By the new law the railroads will pay 3 per cent. of their net earnings, in lieu of all other taxes, and the proceeds of this tax will be used only for the construction and maintenance of roads and bridges, and particularly of roads leading to the railroad stations. Plans for work for which these expenditures are to be made are to be submitted to a commission consisting of the managers of the railroads.

The Kansas City Terminals of the Missouri, Kansas & Texas.

The Missouri, Kansas & Texas enters Kansas City, Mo., over the tracks of the St. Louis & San Francisco from Paola, Kan. For some years it used also the 'Frisco freight house and terminals at Kansas City, but on account of the growth of business the contract for joint use of these terminals when it expired was not renewed. Thereupon, the Missouri, Kansas & Texas Terminal Company of Kansas City, was organized and, after considerable difficulty, acquired 50 acres of ground in Rosedale, Kan., for a terminal yard and a tract of land, with a frontage of 1,600 ft., on Wyoming street between 14th and 17th streets, in Kansas City, Mo., for a freight house and house tracks.

This freight house location is near the freight houses of the Rock Island, the St. Paul, the Santa Fe, the Burlington, the Alton, the St. Louis & San Francisco and the Union Pacific, no two of these being more than a block or two apart. The Missouri, Kansas & Texas freight house was finished in the winter of 1906-1907. It consists of a one-story warehouse 34 ft. x 500 ft. and a two-story brick office building 44 ft. x 97 ft. It is used for both inbound and outbound freight and is served by five tracks, with a total length of about two miles. There is room for about the same amount of additional trackage in the future.

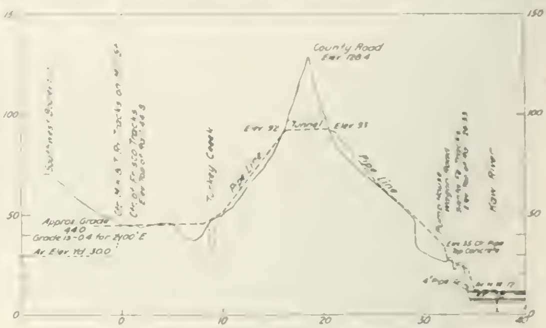
The improvements at Rosedale include a 10-story engine house, with an annex 45 ft. x 80 ft. for machine shop, a 70-ft. manually operated turntable, a 40-000-gal. steel water tank on a steel tower 100 ft. high, two cinder pits, a Robinson cinder conveyor, an ice station and six miles of yard tracks. The yard connects at each end with the main tracks of the St. Louis & San Francisco. Only about one-third of the space available for tracks is so occupied. A plan of the yard and other facilities at Rosedale is shown herewith.

The most interesting feature of the work at Rosedale was the filling of the site which, when acquired, was on an average about 12 ft. below the present grade of the yard. Furthermore, the east end of the track was badly cut up by Turkey creek. A new channel was excavated, involving removal by teams of about 35,000 cu. yds. of material which was deposited on the yard site. In addition 55,000 yds. of material were hauled by teams from neighboring high ground and put on the site. The filling done by teams, however, was less than one-sixth of the total embankment required.

A steam shovel pit was selected on the line of the St. Louis & San Francisco about three miles from the yard site, and it was at first planned to have work trains do most of the filling. This plan was abandoned because work teams would have had to pass over the main tracks of another railroad which might easily have led to frequent delays and perhaps serious accidents. Finally it was proposed to pump sand from the Kaw river. This is nearly one mile north of the new yard and nearly parallel to it, but separated from it by a bridge, which is about 120 ft. above low water in the river A contract was let for doing the filling in this way.

A tunnel 330 ft. long was cut through the ridge at an elevation 80 ft. above low water in the river and 48 ft. above the grade of the yard. A 12-in. wrought-iron spiral pipe of No. 14 B. W. G. was laid from the river to the tunnel and thence to the Rosedale yard. At way of Turkey creek. The cost of the contractor's plant was nearly the river end the pipe was carried on pontoons from the tank to a barge, where it was connected with a centrifugal pump driven by a 150-h.p. steam engine. A 250-h.p. engine and another centrifugal pump were put near the river bank. Natural gas was used for fuel. A dike was built along Turkey creek to retain the sand discharged by the pipe line the water finding its way back to the Kaw river by double and its capacity much less than had been estimated. The pump on the barge was able to deliver water and sand (about 90 per cent. of the water and 10 per cent. of sand) to the secondary pump on the bank of the river, faster than the latter could force it over the hill to the further end of the pipe line. After operating at a loss for two months, during which time about 20,000 cu. yds. of sand were deposited on the yard site, the contractor suspended work.

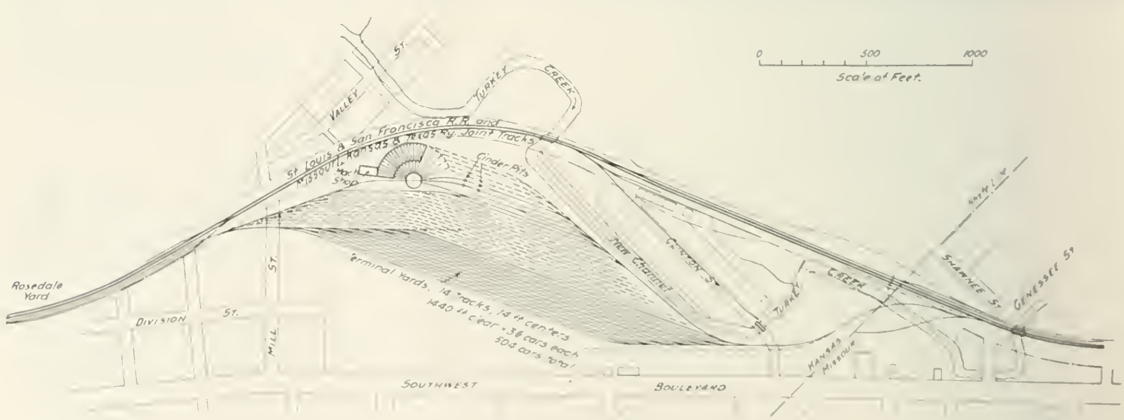
Because of these unfavorable results the man who had furnished the funds for the plant, lost faith in the venture. F. W. Fratt, the Chief Engineer of the terminal company, then offered to release the contractor, take charge of the equipment, operate it and pay the owners a certain amount per yard of filling for use of the plant. This proposal was accepted.



Profile Showing Location of Pipe Line Which Pumped Sand for Filling.

Soon after Mr. Fratt took charge he installed a centrifugal pump and a 175-h.p. gas engine on the south side of the hill at about the elevation of the grade of the yard and improved the other pumps. A plan of the pipe line is shown in the accompanying drawing. Work was resumed in April, 1906, and continued with little interruption, except during two winter months, until the filling was finished in October, 1907. There were short delays due to minor accidents to the pipe line and machinery, but on the whole the results of the operation of the plant by the terminal company were satisfactory to all concerned.

The total amount of sand deposited was approximately 480,000 yds., and the cost per yard of the work done by the terminal company, including royalty, but not including engineering, was slightly under the contract price. When filling was about half completed it was necessary to renew the pipe line throughout, and the second line was practically worthless at the close of the work. The average amount of filling per month was 30,000 cu. yds. The minimum amount per day of 24 hours was 800 yds. and the maximum 1,500 yds. The greatest distance sand was pumped was a little more than 6,000 ft.



New Kansas City Terminal Yard at Rosedale, Kan.; Missouri, Kansas & Texas.

The cost of the Missouri, Kansas & Texas terminals in Rosedale and Kansas City was about $1,250,000, more than half of which was for land. All of the work was in charge of F. W. Fratt, Chief Engineer, and N. M. Fitch, Assistant Engineer, of the Missouri, Kansas & Texas Terminal Company.

GENERAL NEWS SECTION

NOTES.

Soap and towels have been removed from the passenger cars of the Nashville, Chattanooga & St. Louis. This is the result of complaints of alleged discrimination against colored passengers.

The Cleveland, Cincinnati, Chicago & St. Louis has again put in service the "Knickerbocker Specials," running between New York and St. Louis in 27 hours, which were taken off last autumn.

In the Canadian Pacific shops at Montreal 800 men have been laid off, most of them being employees of the passenger car repair department. Work on new freight and passenger cars is active at the shops.

The Canadian Pacific Transfer Co. has just received from the builders the car ferry steamer "Charles Lyon," built at Toronto, for use in carrying cars between Prescott, Ont., and Ogdensburg, N. Y. The boat carries 14 cars.

The Nebraska State Supreme Court has granted a restraining order against the express companies doing business in the state, forbidding them to charge rates in excess of the tariffs prescribed by the Sibley act. The order goes into effect April 15. The Sibley act reduces express rates 25 per cent.

Indictments containing 58 counts against the Missouri Pacific and Iron Mountain roads, a former general freight traffic manager of the two companies, and a prominent grain dealer, were returned by the federal grand jury at Little Rock, April 11. They charge the granting and receiving of rebates.

The Canadian Pacific pension department has found that some of the pensions, calculated according to the regulations, were insufficient to protect the recipient against want during his declining years, and the company has modified the regulations so that henceforth the minimum pension shall be $20 a month.

The Long Island Railroad has filed with the New York State Public Service Commission new passenger tariffs for its Manhattan Beach and Rockaway divisions, increasing some of the fares to 3 cents a mile from 2½ cents. The fare from Long Island City to Manhattan Beach will be 33 cents each way instead of 23 cents as heretofore.

An officer of the Lake Shore & Michigan Southern says that the company will at once put up a telephone line between Buffalo and Erie; and, according to newspaper reports, the telephones are to be used in place of the telegraph for directing the movements of trains. This part of the road is all double-track or four-track and is equipped with automatic block signals.

Judge Calhoun, in a Texas state court, has enjoined the railroad commission of that state from enforcing the use of its new accounting system which it has proposed to require the railroads to use. The new system would be in conflict with that prescribed by the Interstate Commerce Commission, and it is held unreasonable in its requiring the use of averages deduced from theoretical bases.

The Ohio State Railroad Commission has made a rule governing the loading and unloading of cars, providing that when a consignee shall elect to work on a fixed standard of receipts his business shall be rated as to daily capacity and thereafter if the cars consigned to him exceed the rating, he shall be charged each day with 1½ times his rated daily capacity, 48 hours being allowed for unloading each day's placing, actual and constructive.

The Interstate Commerce Commission, ruling on a case where commercial travelers have been in the habit of borrowing tickets from fellow passengers and with them checking baggage on which otherwise excess would be charged, holds such practice to be illegal, as it creates a preference in favor of the passenger who is thus able to borrow, as compared with one who cannot do so. Borrowed tickets may not be used in any case to check baggage.

The State Tax Commission of Wisconsin has fixed the total taxes on railroad property for the present year at $3,083,720, an increase of $282,033 over last year. The property is taxed on an ad valorem basis, and the increase of taxes is due to an increase in the valuation from $255,850,000 to $267,861,500 and to an increase in the rate from $10.95 to $11.51 per $1,000 of valuation. The rate is the average paid by all other taxable property in the state.

A press despatch from Milwaukee says that Judge Tarrent has handed down a decision upholding the Wisconsin eight-hour law regulating the length of a day's labor by a railroad employee; and at the same time declaring unconstitutional the federal nine-hour law because it attempts to regulate commerce wholly within a state as well as interstate commerce within a state. The suit is one (begun as a test case) against the Chicago, Milwaukee & St. Paul, and it will be taken as soon as possible to the Supreme Court.

The competition between the transcontinental lines in the carriage of oranges and lemons from southern California to the East is now so sharp that the time to Chicago has been reduced, in the case of many shipments, to eight days, and in some cases to seven days, as against nine days a year ago. The line composed of the San Pedro, Los Angeles & Salt Lake, the Denver & Rio Grande and the Chicago, Burlington & Quincy is said to be making the best time.

The roads between Buffalo and New York have filed new tariffs on domestic grain, effective May 1, showing, on the principal grains, an increase of 8 and 10 per cent. The export grain rates have not been changed. The rates in cents per bushel are as follows:

	New rate.	Old rate.
Wheat	6½	6
Corn	5¼	4¾
Rye	6	5½
Barley	5¼	5
Oats	4	4
Flaxseed	5½	6

It is announced that the Pennsylvania Railroad in the year 1907 paid out $436,006 on claims for losses which were traced to thefts; and the number of arrests made on the company's premises for trespassing was 4,156. This record, which, though not a novel one, is indicative of a fact which receives far too little appreciation, may well justify the company in its renewed appeal to the public and to local magistrates to aid the road in ridding itself of trespassers. Over 800 men were killed or died from injuries received while trespassing on the Pennsylvania lines, east and west, during the year.

The Pennsylvania Railroad, which for several years has had its trains and freight yards well supplied with boxes of appliances for use in "First Aid to the Injured" is paying increased attention to that department this year, and at the lectures to be given to the employees on "first aid" the policemen and firemen of the cities where the lectures are given will be invited to attend. In promoting employees their records as regards attendance at the lectures will be considered. The stretcher which is used on the Pennsylvania Railroad can be taken apart and made into a bundle 3 ft. 6 in. long and 6 in. in diameter.

The New York State Public Service Commission, second district, announces that the complaint of the Watertown Chamber of Commerce against the freight rates charged by the New York Central on its Rome, Watertown and Ogdensburg division has been satisfied by the road, which has given notice of its intention to put in effect rates which will be satisfactory to residents in the northern part of the state. There is to be a new tariff which will reduce rates about 15½ per cent. from existing freight rates and it will be put in effect not later than July 1. In view of this notice the commission has adjourned the hearing indefinitely.

Railroad men in Chicago say that the uniform classification committee, which has been endeavoring since the first of the year to bring about a uniform classification for freight throughout the country, has disbanded. The task of formulating an acceptable uniform classification was found to be absolutely hopeless. No middle ground could be reached. The southern and western roads might possibly have agreed, but the central and eastern roads refused to raise their classification so as to make it conform to the southern and western. The Central Association roads said it would be impossible for them to increase rates, while the southern and western lines declared their inability to exist if they lowered their classification to conform to that of the official and eastern.

The Pennsylvania Railroad Employes' Relief Fund is now 22 years old, and about $18,000,000 has been paid out in benefits. As is well known the railroad company not only pays the operating expenses of the relief department, but also makes up deficiencies when, by reason of the small margin allowed in fixing the assessments, the income for any three-year period is insufficient to pay the benefits to which members are entitled under the rules. In the 22 years these deficiencies alone have amounted to $654,741. In addition to these payments, the company in the first 16 years of the life of the organization paid $33,919 to sick members whose sickness continued beyond the time (one year) to which they were entitled to benefits from the fund. The membership of the fund is now 95,089, nearly five times as many as in the first year of the organization.

The New York State Public Service Commission, second district has refused permission to abandon parts of the route of a line of railroad, even a line which parallels an established road and where the two are consolidated. Chairman Stevens says that if abandonment is assented to by the trustees of the mortgage covering the line, as well as the bondholders and all of the persons along the line of the route who would be affected injuriously, the application would be liable to receive favorable consideration, but the commission would not by any of its acts submit bondholders to possible litigation as to the value of securities. This ruling was given in denying an application of the Central New England for authority to abandon that portion of its line between West Pine Plains and Salt Point, 16 miles. The company by reason of a merger made last year has a line nearly paralleling the portion of road sought to be abandoned. Residents in the territory affected and trustees and holders of the company's income bonds contended that the proposed action would be detrimental to their interests.

Congress has passed an Employers' Liability Bill, but there was no adequate discussion of the measure, and the faults which the Supreme Court found in the former law do not appear to have been cured. Quite unexpectedly the Senate, on April 9, took up for discussion and finally passed without amendment, the bill which was sent over by the House two days before. This bill was quickly substituted for the La Follette measure, reported some time ago by the Senate Committee on Education and Labor. Democrats charged that the measure in the shape it left the House was unconstitutional and had been consciously left in this condition by the Judiciary Committee in order that it might be thrown out by the courts when it came to be put to the test later. This claim was sharply rebutted by Republicans. As passed, the bill is claimed to meet the objections of the Supreme Court to the law of 1896. The bill abolishes the strict common law liability which bars a recovery for personal injury or death of an employe occasioned by the negligence of a fellow servant. It also modifies the common law rule which makes contributory negligence a defense to claims for such injuries, and permits an employee to recover for an injury caused by the negligence of a co-employe. The bill does not bar recovery even though the injured one contributed by his own negligence to the injury, but the amount of the recovery is diminished in the same degree that the negligence of the injured one contributed to the injury.

Bethlehem Steel Company.

The third annual report of the Bethlehem Steel Co. shows the following results, with comparisons:

	1907.	1906.	1905.
Net manufacturing profit	$2,569,252	$1,859,353	$3,468,802
Total net income	2,638,957	1,364,175	3,372,475
Balance, after interest charges	$1,618,789	$762,749	$2,765,399
Depreciation	....	....	400,000
Net income for year	$1,618,789	$762,749	$2,365,399
Previous surplus	593,421	1,843,619	....
Total surp. before dividends	$2,212,210	$2,606,368	$2,365,399

Locomotive Exports.

Exports of locomotives in the first eight months of the current fiscal year were valued at 5,987,716, a decrease of $215,824, as shown in the following table:

	1908.	1907.
Europe	$134,552	$347,850
British North America	591,488	934,651
Central America	92,480	874,565
Mexico	571,442	988,696
Cuba	527,577	684,095
Other West Indies	48,696	12,900
Argentine	169,315	404,948
Brazil	525,885	135,580
Other South America	828,502	549,647
China	109,935	....
Japan	265,820	1,415,736
British Australasia	25,440	76,316
Philippines	63,882	48,437
Other Asia and Oceania	2,029,577	....
British Africa	3,425	....
Other Africa	....	30,119
Total	$5,987,716	$6,203,540

Steel Prices.

E. H. Gary, Chairman of the Board of the United States Steel Corporation, said last week that no reductions in the prevailing prices of steel are contemplated. Prices may be increased or decreased at any time if there is good reason. Prices should at all times be reasonable and fair. The mere fact that the demand is greater than the supply—that the necessities of the purchaser are great—does not justify an increase in price; nor does the fact that the demand is less than the supply furnish an argument for lowering the price. In neither case would the quantity bought and sold be more or less. What the manufacturers and purchasers both, as a rule, desire is stability of prices—the avoidance of violent and sudden fluctuations. If the question of reducing or increasing prices be raised at any time during the next few months, there will be deliberate and orderly consideration.

The Standard Storage Battery.

The storage battery shown in the accompanying illustrations is designed on the principle that buckling may be prevented by maintaining a firm contact between the active material and the lead while at the same time leaving the active material free to expand

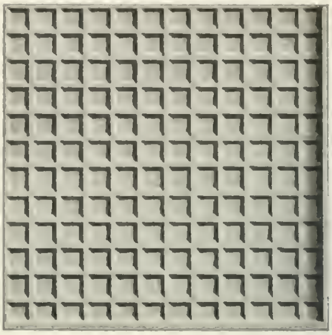


Fig. 1.

Each unit consists of a pair of plates of porous pottery. The inner surface of each has recesses molded in it as shown in Fig. 1, while the outer surface, as shown in Fig. 2, has vertical ribs, which strengthen the plate and also form passage ways for the free cir-

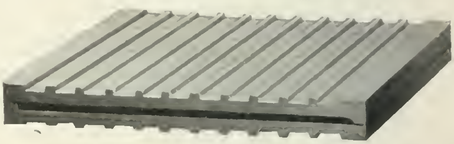


Fig. 2.

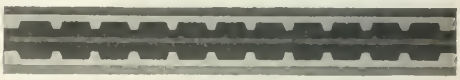


Fig. 3.

culation of the electrolyte. Each plate is filled with lead-oxide paste and between the two plates is a sheet of lead which is only thick enough to conduct the current and leave a margin of safety. A horizontal section of a complete unit is shown in Fig. 3. The walls of

Fig. 4.

the plate are only about $\frac{1}{32}$ in. thick and are so porous that the electrolyte passes through easily, although the pores are fine enough to retain the lead-oxide. Each unit, as described, is about 3½ in. square and ½ in. thick, having 2½ ampere hours capacity each. Large plates may be built up out of a number of the smaller plates, using a single sheet of lead as a conductor for all. In assembling the battery the separate units, or the larger built up plates, are connected in parallel, and hard lead bands are passed around them as shown in Fig. 4, tightly enough to hold the active material in close contact with the lead conductors. Rubber plugs are placed between the bands and the end plates, and the space at the ends of the plates is sealed with wax.

These batteries are made by the Standard Electric Accumulator Co., Jersey City, N. J. It is claimed that they show high efficiency and stand heavy, frequent overloads without noticeable damage.

Asbestos Protected Metal.

Annealed sheet steel, because of its lightness, ease of application and fire resisting qualities, has always been popular as a roofing material. Various means have been tried for protecting it from rust and the attack of acid fumes; many kinds of paint have been used, and the metal has been galvanized with zinc spelter or coated with tin, but none of these methods have been altogether satisfactory. Different light materials, such as prepared felt, saturated asbestos felt, etc., are also used as roofings. The desirable features of both these kinds of roofing are combined in asbestos protected metal. This is made as follows: Annealed sheet steel is immersed at a high temperature in a bath of cement compound, the expansion of the metal under heat allowing the preservative to penetrate it. The sheet is then passed through hot dripping rolls which take off the surplus compound and make the coating uniform. Asbestos felt is next applied to both sides, under heavy pressure, and the sheet is then cooled slowly. It is claimed that this protects the steel from all outside influences and that the bond between the asbestos and the cement coated steel is so strong that there is no danger of the materials becoming separated. The asbestos is not saturated, but has a clear white surface. It is also claimed that the material will resist fire, water, gas and sulphur fumes for an indefinite time, and that it has the strength, rigidity and lightness of sheet metal, as well as the convenience and ease of application of the best ready prepared roofing. It has been used for three or four years as roofing and siding on many kinds of railroad structures and other buildings, and has also been used for interior work. Because of the non-conductivity of the asbestos, the sheets will stand a great deal of heat without drawing or buckling. The accompanying illustration shows an installation in which the material is subjected to particularly severe treatment. This is the roof of a foundry building, wood planking being directly under the roofing. The cupola stack being short, live cinders and hot metal strike the roofing at its base before being in the air long enough to cool.

Foundry Roof Covered With Asbestos Protected Metal.

This roofing is made in flat or corrugated sheets, and also in the form of beaded siding, standing seam and other shapes. There are two qualities: Aspromet brand and Duckback brand. In the former, the texture of the asbestos is similar to the usual asbestos building felt and is absorbent. For outside work, this should be painted. In the other brand, the asbestos is waterproofed and has a glossy surface which does not require painting or other treatment. The Belen and Clovis coaling stations on the Belen cut-off of the Atchison, Topeka & Santa Fe (*Railroad Gazette*, March 13, 1908) are roofed and sheathed with Duckback brand, 24 gage corrugated steel being used for the roofing and 26 gage for the siding. The flooring of the conveyor at the Clovis plant is also of asbestos protected metal.

One use of asbestos protected metal is the Robertson car roof. This is an inside roof for box cars in which the joints between the sheets are made watertight. It is claimed that this roof is fireproof and rustproof, easy to apply, inexpensive and will minimize interior condensation.

These roofings are made by the Asbestos Protected Metal Co., Canton, Mass.

An English View of the Erie.

Robert Fleming, one of the best known English railroad experts, who is in this country representing the English security holders of the Chicago Great Western, has made the following statement in regard to the Erie Railroad:

"I don't know whether Erie is going into the hands of a receiver, but that would be the best thing that could happen to the security holders if it were followed by a sound reconstruction. Erie was, both bonds and stocks, mainly held in England thirty years ago, and my first experience in the reorganization of American railways was of the Erie in 1876. The committee were divided in opinion as to whether the then second mortgage bonds should be made a preferred stock. The majority unfortunately favored leaving it as a mortgage, but delaying its foreclosure powers. The result was that Erie never had credit and reconstruction after reconstruction followed.

"The reconstructions all had more or less the same fatal defect: no adequate provision for future capital requirements was made and the property was mortgaged almost up to its value. No big public service corporation in this go-ahead country is able to hold its place unless it has credit. Although the financial community is greatly indebted to Mr. Morgan for many things, his reorganizations have sometimes been dominated by too great an optimism.

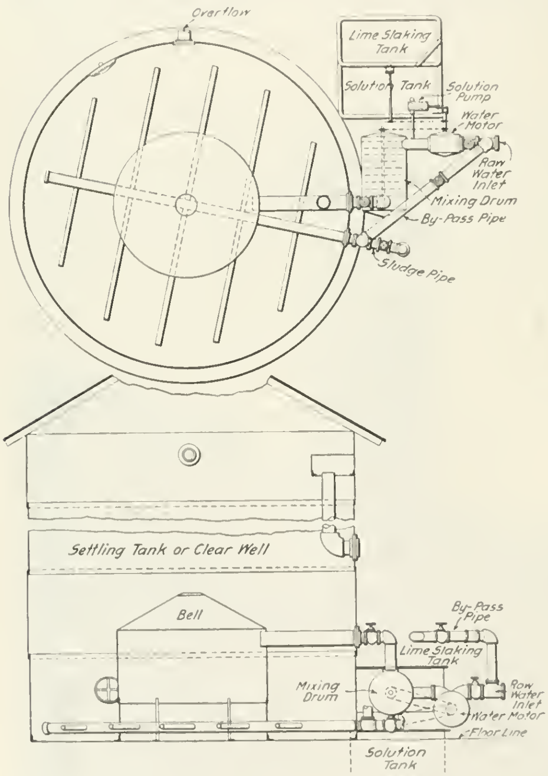
"If this time he will have courage enough to bring forth from present troubles a new Erie that will not want periodical reconstruction, he will have done a great thing for the security holders themselves and for the reputation abroad of American railroad securities.

"All that is wanted to enable Erie to hold a front place in the railroad system of the country is that its mandatory charge be reduced to an absolutely safe limit. With the exceptional standing of J. P. Morgan & Co., I believe a reconstruction can be carried out without an actual foreclosure, because new securities can be given that would have a greater market value than the existing ones.

"It is not for me to propose a scheme, but, beginning with the general lien bonds, should they be offered a 4½ per cent. first cumulative preferred stock instead of their present bonds, and so on according to the rank of the junior securities, complete solvency would be established and Erie would be able to borrow what money it wants on a security that would sell at a high price. I say nothing about assessment or reducing the stock. I think the investing public are beginning to realize that with able management it is better to have a good preference stock than a doubtful mortgage bond. Erie reorganized on a sound basis would be a distinct step towards improving the general situation."

The Holmen Water Softener.

The water softener illustrated herewith was built by the Southwest System of the Pennsylvania Lines West of Pittsburgh at the Indianapolis shops. It was designed by A. R. Holmen, chief draftsman of the motive power department. The capacity is 30,000 gals. an hour. It consists of a settling tank, mixing drum, solution tank with lime slaking tank above, an adjustable solution pump and a water motor, with the necessary piping. The motor drives stirring apparatus in the mixing drum and solution tank by chains and sprockets on its shaft, and drives the solution pump by an adjustable crank arm. Opening the raw water valve starts the motor and the apparatus which it drives. For each revolution of the motor the solution pump makes one stroke. The length of the stroke and



Plan and Section of Holmen Water Softening Plant.

the strength of the solution, which in this particular installation contains lime and soda ash, may be adjusted to inject the proper amount of chemicals into the raw water. The chemicals and water meet in the pipe between the motor and mixing drum, passing into the latter together. The mixture in the drum is agitated about a minute before passing into the bell in the settling tank. It passes out under the lower edge of the bell, and flows from the top of the settling tank to storage tanks through the overflow pipe.

It is claimed that the thorough mixing of the water and chemicals under pressure hastens the chemical action so that it is completed before the mixture leaves the bell; also that the precipitate is crowded together into more compact form, causing quick and complete clarification.

In the bottom of the tank there is a system of pipes connected to the waste pipe, for removing the sludge. The sludge pipe and raw water inlet are connected by a by-pass valve, so as to admit raw water directly to the settling tank for stirring the sludge or making repairs. No filter was installed, as it was thought the settling of the precipitate would be complete, but a pipe and the necessary floor space are provided so that sand filters may be put in if desired.

The softener has been in operation eight months with satisfactory results. The simplicity of the design, the few parts, and their accessibility, require little work for operation and maintenance.

Hanover Locomotive Works.

A consular report gives the following table of locomotives exported by the locomotive works at Hanover, Germany, to the year 1907.

Russia	251	Bulgaria	21	British Indies	74
Roumania	115	Holland	18	China	16
Spain	79	Greece	9	Siam	16
Denmark	55	Norway	5	Argentine Rep.	11
Turkey	54	France	5	Cochin China	5
Austria	48	Sweden	4	Chile	4
Portugal	40	Japan	93	Brazil	3
Italy	40	Dutch Indies	76		

The Pennsylvania in 1874 and in 1908.

The report of a committee of Pennsylvania Railroad stockholders which investigated the condition and prospects of the company in 1874 makes interesting reading in the light of the company's subsequent experiences. The year in which this committee performed its work offers some striking parallels with the present year, following as it did a year of severe panic and introducing an era of hard times the country over, and the fact that the committee, after probing into the fundamentals of the company's position with most surprising thoroughness and impartiality, reached some very cheerful conclusions, has its own lesson for railroad stockholders of to-day.

In retrospect, these conclusions are found to have been in many respects much too cheerful, even though the committee professed to have guarded itself sedulously against the natural human tendency toward exaggeration of future possibilities, and proved its professions by severely discounting the then book value of some of the company's assets. In the same way, the committee expressed the opinion that for many years no returns could be expected upon the stock of the Philadelphia & Erie, which has since become a highly important and profitable part of the system. Likewise, the committee said that the company's investments south of Baltimore were unfortunate and indefensible. So far as these investments represented ownership in what was afterward reorganized into the Southern Railway, the committee's judgment may have been well founded; yet it may be questioned whether the management of the Southern would have been just what it was if the Pennsylvania had retained an active interest in the property, while the Pennsylvania stockholders would regard it as unfortunate to-day if their road were without its entrance into Washington.

On the other hand, the committee declared that there was "no doubt of the ability of the company to earn not only its usual 10 per cent. dividend, but a surplus over and above expenses, liabilities and contingencies." The Pennsylvania was then paying 10 per cent. upon its stock, and had averaged 9.9 per cent. during all the twenty years since the main line was first opened to the public in 1853. The committee saw fit to warn the stockholders against the dangers of extension and expansion, a policy which it evidently thought the management had pursued to the point of recklessness. How much and how long circumstances allowed the management to take this warning to heart may be gathered from a comparison of mileage, capitalization and earnings of the Pennsylvania Railroad of 1873, with the same characteristics as they existed last year.

	1907	1873.
Miles of road	3,792	1,574
Bonded debt	$270,974,600	$43,145,700
Debt per mile	71,400	27,400
Capital stock	314,594,600	68,141,500
Stock per mile	83,000	43,300
All capitalization, per miles	154,400	70,700
Net capitalization of road	365,579,600*	61,579,200*
Net capitalization, per mile	96,400	39,100
Net capitalization per mile, all tr'ks	63,500†	30,700.
Gross earnings	164,812,800	39,983,100
Gross, per mile	43,400	25,400
Net earnings	45,205,500	13,745,300
Net, per mile	11,900	8,700

*Less book value of securities owned, carried at cost.
†On mileage of first, second, third and fourth tracks, excluding sidings and yardage.

In 1873 the Pennsylvania earned about 12 per cent. on its capital stock and paid 10 per cent. Its earnings last year were practically the same, yet the dividends were only 7 per cent. Back of these two dry facts lies the history of American railroading for a generation. The increase in net earnings shown above is surprisingly small in comparison with the increase in capital invested as represented by stocks and bonds, and the gain would probably look smaller still in comparison with the actual increase in capital value of the plant employed. Taking this period as a whole and the experience of the Pennsylvania as typical within certain territorial limitations, the trend of financial adjustment between railroad stockholders on one side and labor and the users of railroads on the other has been in favor of the latter.

But the stockholders has undoubtedly been favored by an influence which does not appear in the figures. Railroads are a much safer form of business undertaking now than they were then, and it would probably not be going too far to say that the increasing safety of railroad investment is directly related to capital's relinquishment of profits.—*Wall Street Journal.*

INTERSTATE COMMERCE COMMISSION RULINGS.

Classification of Multigraphs Lowered.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of the Forest City Freight Bureau v. Atchison, Topeka & Santa Fe. It was held that inclusion by carriers operating under the Western Classification of multigraphs in cases in less than carloads, in double first class, is unreasonable. Defendants were ordered to classify such multigraphs as 1½ times first class.

Reparation on Shipment of Fruit Jars.

The Commission, opinion by Commissioner Cockrell, has announced decision in the case of the American Grocer Co. v. Pittsburg, Cincinnati, Chicago & St. Louis et al. The Commission granted reparation in this case against only the St. Louis, Iron Mountain & Southern for an excessive charge on one carload of glass fruit jars transported from Cairo, Ill., to Calico Rock, Ark. The rate charged was 37 cents per 100 lbs., but pending suit before the Commission it was reduced to 29 cents. The Commission also ordered that the 29-cent rate be maintained for one year from the date of the order.

No Authority Over Steamship Line to Cuba.

In Lykes Steamship Line v. Commercial Union and 13 railroads, opinion by Commissioner Cockrell, it was held that an ocean carrier established under the laws of Cuba and transporting traffic between Havana, Cuba, and Galveston, Tex., is not subject to the Rate Law. The rule laid down in the recent Cosmopolitan Shipping Company case was followed.

The Commission further declared that the word "adjacent" as used in the act to modify the words "foreign country," would seem to mean adjacent in the sense of the possibility of substantial continuity of rails.

Coal Rate Upheld.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of Laning-Harris Coal & Grain Co. v. St. Joseph & Grand Island. In January, 1907, the complainant shipped a carload of coal weighing 50,000 lbs. from Springfield, Ill., to Leona, Kan., a station on the line of the St. Joseph & Grand Island. Defendant assessed on this shipment a rate of 10.0013 cents per 100 lbs. Complainant insists that the rate should have been 9.0013 cents per 100 lbs. This was the only question presented. The Commission held that the charge collected was correct and dismissed the complaint.

No Authority to Require Special Passenger Rates.

In A. G. Field v. Southern Railway et al., opinion by Commissioner Harlan, it was held that the Commission has no authority to require carriers to establish special fares, based on less than the normal passenger-mile revenue, for the use of passengers on particular occasions or for special purposes. On that ground, and also on the ground that the legal right of carriers to issue party rate tickets and confine their use to theatrical companies has been fully considered by the Commission, this complaint for an order requiring the defendants to re-establish such party rates is dismissed on motion of the Commission.

Reparation on Shipments of Iron Pyrites.

In Detroit Chemical Works v. Northern Central et al, opinion by Chairman Knapp, the rate of $2.32 per ton on imported iron pyrites from Baltimore to Detroit was held to be now and during the time it was in effect, unreasonable and unjust; it should not have exceeded $2.21 per ton. Reparation awarded.

In the similar case of Detroit Chemical Works v. Erie et al, opinion by Chairman Knapp, it was held that the rate of $3.32 per ton on imported iron pyrites in carloads from New York to Detroit is now and was during the time it was in effect unreasonable and unjust; it should not have exceeded $2.81 per ton. Reparation awarded.

Shippers' Instructions Govern Lower Rate by Another Route.

The Commission (opinion by Commissioner Lane) has announced decision in the case of the Larsen Canning Co. v. Chicago & North Western et al. It appeared that the complainant directed that its shipments of two carloads of canned vegetables from Green Bay, Wis., to Washington, Ohio, move via a certain route over which there was no joint through rate, and the sum of the locals was applied. The goods might have been shipped by complainant between these points over a route having a joint rate less than the sum of the locals. The Commission held the initial carrier was bound to observe the instructions of the consignor in this case. It was also bound to collect the published rate applicable to the designated route and entails no liability under the law for so doing. No evidence was introduced tending to show that the rate charged and collected was unreasonable and unjust in itself. The complaint was dismissed.

Coal Rates from Wyoming to Nebraska Reduced.

In Nebraska State Railway Commission v. Union Pacific, opinion by Commissioner Clements, the complaint alleged that rates on coal from Rock Springs and Hanna, Wyo., to points in Nebraska, are unreasonable. The Commission held that the fact that there is competition for the purchase of this coal between Nebraska communities and communities in Wyoming and Utah affords no justification to the carrier for charging more than a reasonable rate for the transportation of such coal as the Nebraska people may succeed in buying. No justification exists for the maintenance of a blanket rate on coal to all points on defendant's lines in Nebraska. The Commission held that the rates of $1.50 per ton applying on lump coal from Rock Springs, and $3.50 per ton from Hanna to points in Nebraska on the line of the Union Pacific between the Nebraska-Wyoming boundary and Grand Island Neb., including the latter point and points on the branch line from Kearney to Callaway Neb., are unjust and unreasonable, and prescribed just and reasonable rates therefor

Intra-State Rate Covering Part of Interstate Movement.

In Baer Bros. Mercantile Co. v. Missouri Pacific and Denver & Rio Grande, opinion by Commissioner Prouty, it was held that a railroad which lies entirely within the limits of a single state becomes subject to the act to regulate commerce by participating in a through movement of traffic from a point in another state to a point in the state within which it is located, although its own service is performed entirely within the latter state. To maintain a petition before the Commission for recovery of excessive freight charges it is not necessary that payment of the freight charges should have been made under protest. A rate of 45 cents on beer from Pueblo, Colo., to Leadville, which is part of a through transportation from St. Louis to Leadville is excessive; such rate should not exceed 30 cents per 100 lbs. Reparation awarded

The bringing of a suit in the United States Circuit Court for the recovery of excessive railroad charges is not a bar to a subsequent proceeding before the Commission where that suit was dismissed without prejudice, and for the reason that the Commission had never passed on the reasonableness of the rate involved

No Authority Whatever Inside Oklahoma.

The Commission, opinion by Commissioner Clements, has announced its decision in the case of D. B. Hussey v. Chicago Rock Island & Pacific. The complaint in this case asked for reparation on account of alleged unreasonable rates on shipments of cross ties moving between April 25 and August 12, 1907, from Barnett, Ind. Ter. to McAlester. Subsequent to movement of these shipments and filing of the petition this territory was admitted as a state into the Union and the points of origin and destination are now in the state of Oklahoma. By the act of Congress admitting Oklahoma to statehood the intraterritorial jurisdiction of the Commission ceased to apply to territory now embraced in that state. The Commission held that it can make no lawful order in any case of which it has no jurisdiction and dismissed the complaint for want of jurisdiction.

The Commission in coming to this conclusion declared that if the subject-matter itself is not still within its jurisdiction, the fact that the complaint was filed and served prior to the transformation from territory to a state is wholly immaterial. The acquirement of jurisdiction of the parties by the filing and service of the complaint in no way helps the Commission to retain the case if the law under which the jurisdiction over the subject-matter must be exercised has ceased to operate. If the Commission has jurisdiction now to award reparation in this case, it would seem that it would also have jurisdiction in all similar cases now or hereafter brought on causes of action which accrued in the territories from which the state was formed and which are not barred. Such a conclusion would create a situation in Oklahoma whereunder the Commission could be acting on one standard of rates as a basis for reparation on past shipments without power to alter the rates whereas the state authority, which alone has power to alter them might be acting on an entirely different basis for that purpose—a condition incompatible with the principles and purposes of the

Rate Law which is intended to secure uniformity of rates and equality of treatment to all shippers.

Commissioner Harlin rendered an elaborate dissenting opinion.

Storage on Inland Shipments at Lake Ports.

The Commission, opinion by Commissioner Lane, has decided the case of the Commercial Club of Duluth v. Northern Pacific et al. The privilege of free storage was involved. The carriers offer free storage in transit at Duluth, Minn., or Superior, Wis., on both eastbound and westbound lake freight during the closed season of navigation. The practice is for inland shippers to bring their traffic to the warehouses at such ports before the close of navigation, where they are held in free storage by defendants until ordered forward by rail at the balance of the through rate from eastern points of origin. The Duluth merchants, having their business houses at the point where the storage is given, are compelled to pay storage and also dockage and switching charges. Complainant alleges that this business deprives Duluth of its advantage of location at the head of the lakes and operates to transfer such advantage to inland points. It appears that the privilege is open to all shippers alike and that the practice is not confined to defendants, but is forced by competition of other lines operating through other lake ports. The Commission held that the facts do not at this time justify condemnation of a practice in which so many carriers and shippers not parties to this action are interested. The fact that the privilege of free storage is more valuable to inland merchants than to merchants at lake ports does not necessarily make the privilege unlawful. The position of complainant is that the privilege takes away from the lake ports an advantage of their location; but the better position seems to be that the inland jobbing centers, by reason of their location at points where the competition of several lake ports operates, also have advantage of location, one result of which is seen in the effect of this privilege of free storage.

Obscure Rates Condemned.

In Hydraulic Press Brick Co. v. St. Louis & San Francisco et al., opinion by Commissioner Clements, it was held that defendants' rate of 48 cents per 100 lbs. for transportation of enameled brick from Cheltenham, Mo., to New Iberia, La., is unjust and unreasonable and should not exceed 30 cents per 100 lbs. for the future. Reparation awarded.

The practice of inserting obscure and general clauses in voluminous tariff publications, to the effect that where a combination of locals, either general or in specific instances, will make a lower aggregate through rate than the specific joint through rate therein stated, the former will be used, has been found by long experience to result in gross misapplication of the tariffs and in unjust discriminations. Under this practice the individual or concern whose business is large enough to warrant the employment of a traffic or rate expert will be able to secure combinations resulting in lower aggregate charges than can be secured by the smaller or occasional shipper who is unable to employ such an expert and who is required to pay the joint through rate appearing on the face of the tariff. It is self-evident that if such discriminations are to be broken up there can be but one lawful rate in effect at a given point on any commodity in the one direction between two points.

The carrier may, in its own interest if it so desires, carry for a longer distance over its own line than would be necessary if carried between the same points over the line of its competitor, in order to obtain part of the competitive business, on terms that will afford some profit. It does not necessarily follow, however, that a carrier in competing for traffic in this way thereby subjects itself to an order compelling it to do so.

No Permanent Lien on Jobbing Territory.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of the Lincoln Commercial Club v. Chicago, Rock Island & Pacific et al. The complaint alleged that the defendants exact unreasonably higher rates on coal, paving brick, cement, lumber, glass and glassware, salt, rice, egg-case fillers and sugar, to Lincoln than to Omaha, from the same points of origin in Kansas and territory south, and west of the Mississippi river, for substantially the same distances. The Commission held that it is apparent that the cost of handling traffic from Kansas City to Omaha and Lincoln is practically the same and that difference in expense does not justify the maintenance of a higher rate to Lincoln than to Omaha. Justification for these higher rates must be found, therefore, if at all, in commercial and competitive conditions rather than in added cost of service. The questions presented were considered by the Commission as to each of the above articles separately, and the conclusions of the Commission were that the rate on coal may properly be 15 cents per ton higher to Lincoln and on paving brick and cement 1½ cents per 100 lbs. higher to Lincoln than to Omaha, and that with respect to lumber, glass and glassware, salt, rice, egg-case fillers, and sugar, rates from said points of origin to Lincoln should not exceed those to Omaha. The Commission said:

"The defendants, with some earnestness, urged that the holding which we have made will require them to readjust their distributing rates from Lincoln and from Omaha, but we are unable to appreciate the force of this suggestion. Cities have no indefeasible lien upon any given jobbing territory. Changes in conditions are always likely to affect the boundaries of that territory. Conditions are not the same when Lincoln draws its supplies from points of production in the west or south that they were when these supplies came through Omaha from the east. It is no part of the business of a railroad to so adjust its tariffs as to artificially define the territory into which particular jobbing localities may sell."

Competitive Rate Adjustment Upheld.

In the case of the Railroad Commission of Kentucky v. Louisville & Nashville et al., opinion by Commissioner Clements, the complaint questioned reasonableness of rates between Owensboro and Henderson, Ky., and points in Trunk Line and Central Freight Association territories. It also alleged that such rates result in unjust discrimination against Owensboro and Henderson and give undue preference to Evansville, Ind.

The carriers most directly interested in the Evansville rates for the most part serve the territory north of the Ohio river, while those most directly interested in the rates to Owensboro and Henderson serve the territory south of the river. There is greater density of population and of traffic in the territory north of the Ohio river known as Central Freight Association territory in which Evansville is situated, than in territory south of the river, in which Owensboro and Henderson are situated. The general adjustment of rates throughout Central Freight Association territory has a forceful effect on the Evansville rates. The larger volume of traffic and greater number of carriers operating in that territory create a greater degree of competition and the rates generally have been adjusted with a view to meeting the conditions resulting therefrom.

It was held that it is not incumbent on a road to measure the rates to all points on its line from and to which it handles the bulk of the traffic, by lower rates fixed by competitors operating over a more direct route to some other point also on its line but to which it handles an unappreciable volume of traffic. So to hold would be totally to disregard the effect of competitive conditions which the Supreme Court has held in numerous cases to justify the application of lower rates to farther distant points over the same line in the same direction. The long and short haul clause as construed by the courts prohibits charging a higher rate to a less distant point only where the carrier responsible for both rates occupies a like relation to the more distant point to which the lower rate applies.

The record fails to show that the rates in question are, under present conditions, unreasonable in and of themselves, or that the circumstances and conditions under which the traffic is handled to and from Evansville are so substantially similar to those under which traffic is handled to and from Owensboro and Henderson as to make the charging of higher rates to and from the last mentioned points unjustly discriminatory as compared with the rates applying between Evansville and the same points in Trunk Line and Central Freight Association territories. The complaint was dismissed.

TRADE CATALOGUES.

Roofing.—A pamphlet issued by the Cortright Metal Roofing Co., Philadelphia, Pa., is entitled Rightly Roofed Buildings. The Cortright metal shingles are designed to give the advantages of the tin roof without the buckling and rattling of the ordinary tin roof. The shingles are locked together on the side in such a way as to allow for expansion and contraction, but without allowing water to get through; at the top they are molded in steps to prevent water from entering at this point. The pamphlet includes testimonials, and is illustrated with a number of photographs of buildings covered with this roofing.

Vises and Ratchet Drills.—Illustrated price list No. 5 of the Charles Parker Co., Meriden, Conn., shows a number of styles of vises for use in locomotive and car building plants and by metal workers and machinists generally. A new vise is described, made with a patented reinforced sliding jaw, in which a solid steel bar is inserted in the slide throughout its length, being thoroughly welded into the casting. The vises are made of a mixture of cast-iron and Bessemer steel. Ratchet drills and parts are also described, with dimensions, weights and prices.

Water Softeners.—Bulletin No. 120, of the Buda Foundry & Manufacturing Co., Chicago, describes the Buda intermittent and continuous systems of water softening. The method used in each is outlined and illustrations are shown. The adaptability of water treating plants and the economies of using soft water are pointed out. The motor meter and chemical pump used are illustrated and described, and there are a number of illustrations of installations of both systems of both wood and steel construction.

Asbestos Wood.—Catalogue No. 107, of the H. W. Johns-Manville Co., New York, describes, with illustrations, the many uses of asbestos wood. These include roofing, sheathing and interior wood work. Its advantages in electrical work for taking the place of slate, marble, etc., are noted. This material is made in sizes from ¼ in. thick to 2 in. thick, the standard size of sheet being 36 in. x 48 in. Price lists of different thickness and styles are given.

Thermit.—The Goldschmidt Thermit Co., New York, has begun the publication of a quarterly periodical, *Reactions*, the object of which is to make public the improvements made from time to time in the use of thermit. The first issue consists of a number of articles of this description, clearly illustrated with half-tones and drawings. There are also a few notes and short articles on other subjects of interest.

Graphite.—The April issue of *Graphite*, published by the Joseph Dixon Crucible Co., Jersey City, N. J., has a short note calling attention to Dixon's yellow crayons for engineers and surveyors. They are particularly useful for making marks on rails; it is claimed that the mark is not easily washed off by rain, but can be distinctly seen for several months.

Derails.—A circular of the Hayes Track Appliance Co., Geneva, N. Y., gives a condensed list of Hayes derails, illustrated with photographs of the different types.

MANUFACTURING AND BUSINESS.

The New York offices of the Crocker-Wheeler Co., Ampere, N. J., will be moved on April 24 to the Hudson Terminal buildings, 32 Cortlandt street.

The New York office of the Federal Signal Co., Albany, N. Y., has been moved from 42 Broadway to the Terminal building, Forty-first street and Park avenue.

The New York office of the Railroad Supply Co., Chicago, will be moved to the Hudson Terminal buildings on May 1. The address will be room 540, 32 Cortlandt street.

Porter Bros. & Welch, Railroad Contractors, Vancouver, Wash., have ordered, for work on the Northern Pacific, a number of 5,000 candle-power Milburn lights, manufactured by the Alexander Milburn Co., Baltimore, Md.

Robert C. Pruyn, President of the Consolidated Car Heating Co., New York, and Francis C. Green, General Manager, have declined re-election to their offices in the company. Their successors will be elected at the annual meeting in June.

The thirteenth annual convention of the International Association of Municipal Electricians will be held at Detroit, Mich., this summer. The Secretary, Frank P. Foster, Corning, N. Y., is asking members to suggest subjects to be presented and discussed at this meeting. Suggestions should be sent not later than April 20.

E. E. Keller, for over 20 years connected with the Westinghouse interests, and for 11 years Vice-President of the Westinghouse Machine Company, Pittsburgh, Pa., has completed his duties as Receiver and General Manager and resigned from the company. He will take a vacation and then devote most of his time to personal interests.

Nathaniel S. Bouton, President of the Maryland Car Wheel Co., died in Dunedin, Fla., April 3, aged 80 years. Mr. Bouton had lived, since 1852, in Chicago, where he established the Union Foundry Works. This concern was sold to the Pullman Company in 1886. At the time of his death, besides being the head of the Maryland Car Wheel Co., he had foundries at Aurora and Naperville, Ill., and Birmingham and Decatur, Ala.

John E. Greiner, Assistant Chief Engineer of the Baltimore & Ohio, has resigned, effective May 1, to become a Consulting Engineer. He will open offices in Baltimore, Md., New York and Chicago. Mr. Greiner has been building bridges on the Baltimore & Ohio for the last 20 years. He has designed, or had charge of the designing of, every bridge erected on this road since 1885. Among these structures are the Arthur Kill bridge, which, with a 520-ft. span, was at the time the largest bridge in the world; the Ohio river bridge at Benwood, W. Va., a 345 ft. span without false work; the Ohio river bridge at Parkersburg, W. Va., and the double-track bridge now being built at Havre-de-Grace, Md. Since 1899 he has also supervised the design of all stations and buildings on the road. He was born at Wilmington, Del., in 1859, and was educated at the Wilmington High School and Delaware College, where he took B.S. and C.E. degrees. From 1880 to 1883 he was a draftsman at the Edgemoor Bridge Works; he then went to the Keystone Bridge Works, and in 1885 had charge of the Seventh Avenue suspension bridge at Pittsburgh, Pa. Later in that year he went to the Baltimore & Ohio, where he was, successively, draftsman, inspector of bridges, chief draftsman, Assistant Bridge Engineer, Engineer of Bridges and Building, and finally Assistant Chief Engineer. He is a member of the American Society of Civil Engineers, the American Railway Engineering and Maintenance of Way Association, and the Association of Railway Superintendents of Bridges and Buildings, and is serving on various committees of these societies.

Iron and Steel.

The Pittsburg & Lake Erie is said to be in the market for 14,000 tons of bridge material.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 26.)

American Society of Civil Engineers.

At a meeting of this society on April 15, a paper on "Recent Developments in Pneumatic Foundations for Buildings," by D. A. Usina was presented for discussion, illustrated with lantern slides. This paper was printed in "Proceedings" for March, 1908.

Freight Claim Association.

The seventeenth annual meeting of this association is to be held at Atlantic City, N. J., June 17, this date having been fixed in place of the date formerly announced (May 20). The President of this association is R. C. Richards, of the Chicago & North-Western, and the Secretary is W. P. Taylor (R. F. & P.), Richmond, Va.

Western Railway Club.

At the April meeting, to be held in the Auditorium Hotel at 8 o'clock p.m., Tuesday, the 21st inst., the paper of Prof. Dewsnup, of the University of Illinois, on "Freight Car Efficiency," which was read at the March meeting, will be discussed. Also the committee on Recommended Changes in the Rules of Interchange will report.

Association Railway Telegraph Superintendents.

At the meeting of this association to be held in Montreal, Que., June 24-27, the papers to be read include the following: "Dry Batteries on Telegraph Wires," by U. J. Fry, of Milwaukee, "Reduction of Telegraphing by Use of Printed Forms," by O. C. Greene, of St. Paul; "Commercial Reports," by G. C. Kinsman, of Decatur, Ill.; "Wiring of Station Buildings from the Contractor's Standpoint," by J. H. Jacoby; "Adverse Railroad Legislation," by E. A. Chenery, of St. Louis; "Telegraph Work on the Isthmus," by C. F. Annett, of New Haven, Conn.; "Qualifying Operators for Train Despatching," by C. S. Rhoads, of Indianapolis, "Selecting Operators for Railroad Use," by L. H. Korty, of Omaha, "Moving Trains by Visible Signals," by L. B. Foley, of New York, "Block Signals," by H. C. Hope, of St. Paul, "Use of Telephones in Connection with Train Movements," by W. W. Ryder, of Chicago, "The Interstate Commerce Commission," by Charles Selden, of Baltimore, "The Association," by W. F. Williams, of Portsmouth, Va., "The Telephone," by F. F. Fowle, of Chicago.

International Master Boiler Makers' Association.

The second annual convention of this association is to be held in the Hotel Pontchartrain, Detroit, Mich., May 26-28. At this meeting there will be committee reports to be followed by topical discussions on the following subjects.

Best Method of Applying Flues. Best Method for Caring for Flues. E. J. Hennessy, Chairman.

Boiler Explosions. J. T. Goodwin, Chairman.

Best Method of Applying Flexible Staybolts. J. H. Smythe, Chairman.

Use of Oil in Boiler Shops, Its Use in Stationary and Locomotive Boilers.

Topical discussions will also take place on the following subjects:

"Standardizing of Shop Tools." T. C. Best.

"Standardizing Boiler Blue Prints." W. H. Laughridge.

"Modern Improvements and Physical Tests in Boiler Design and Materials." H. S. Jeffery.

Members of the convention on May 26 will visit the plants of the Chicago Pneumatic Tool Company and the Detroit Seamless Tube Company.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Grand Trunk.—M. M. Reynolds, heretofore Comptroller of the National lines of Mexico, has been appointed Fifth Vice-President of the Grand Trunk. He will have special supervision of the treasury and accounting departments of the Grand Trunk and general supervision of the finances of allied companies.

Houston & Texas Central.—S. F. Carter, Jesse H. Jones and E. B. Parker, all of Houston, have been elected directors, succeeding J. D. Bowne, T. W. House and A. P. Root.

C. C. Barry has been appointed Secretary, succeeding William H. Field, who remains Treasurer.

Isthmian Canal Commission.—Gen. Peter C. Hains has resigned as a member of the Commission.

National Railroad of Mexico.—W. L. Fritz, Assistant Auditor, has been appointed Auditor and his former position has been abolished.

New York, New Haven & Hartford.—Amory A. Lawrence, of Boston, Mass., has been elected a Director, succeeding Charles F. Choate, resigned.

New York Public Service Commission, Second District.—John B. Olmstead, of Buffalo, N. Y., President of the Municipal League, has been appointed Commissioner in the Second district to fill the vacancy caused by the resignation of Charles H. Keep to become President of the Knickerbocker Trust Co., New York City.

Philadelphia & Reading.—C. E. Henderson, Second Vice-President, has resigned on account of ill health.

Operating Officers.

Chicago & Eastern Illinois.—E. H. DeGroot, Superintendent of the Indiana division, has been appointed Superintendent of the St. Louis division, with office at St. Louis, Mo., in place of R. D. Miller, deceased. P. S. Sampson succeeds Mr. De Groot, with office at Brazil, Ind.

East Broad Top Railroad & Coal Co.—C. H. Ketcham, whose resignation as Superintendent of the Morris & Essex division of the Delaware, Lackawanna & Western was recently announced, has been appointed General Manager of the East Broad Top and of the Rockhill Iron & Coal Co., with office at Orbisonia, Pa. Mr. Ketcham was born in 1855, and began railroad work as a telegraph operator in 1872 on the Louisville, Cincinnati & Lexington Railway, now part of the Louisville & Nashville. He served as yardmaster, Trainmaster, local freight agent and Assistant Superintendent. In 1890 he went to the Dunkirk Allegheny Valley & Pittsburgh as Superintendent, where he served till 1896. In 1893 he was also made Superintendent of the Buffalo division of the West Shore, a position which he held till 1899. He then became terminal agent of the Delaware, Lackawanna & Western at New York, and a few months later was appointed Superintendent of the Morris & Essex division of that road, where he served until his present appointment.

C. H. Ketcham.

Missouri & North Arkansas.—A. V. Brown, formerly Superintendent of the Chicago, Burlington & Quincy at Ottumwa, Iowa, has been appointed to the new office of Manager of the M. & N. A., with office at Eureka Springs, Ark.

New York City Railway.—W. L. Derr, General Superintendent, has resigned to go into contracting work, and his former office has been abolished.

Tonopah & Goldfield.—H. R. Hanlin, who has resigned as Trainmaster of the Baltimore & Ohio at Connellsville, Pa., has been appointed General Superintendent of the T. & G., with office at Tonopah, Nev.

Traffic Officers.

Nevada Northern.—H. B. Tooker has been appointed General Freight and Passenger Agent, in place of H. G. Toll, resigned; office at Ely, Nev.

Tonopah & Goldfield.—W. D. Foster has been appointed General Freight and Passenger Agent in place of J. F. Hedden, resigned.

Engineering and Rolling Stock Officers.

Baltimore & Ohio.—John E. Greiner, Assistant Chief Engineer, has resigned, effective May 1. He will open offices in Baltimore, Md., New York and Chicago as a Consulting Engineer. The position of Assistant Chief Engineer will not be filled at present, but Mr. Greiner's duties will be performed by Walter S. Bouton, who will be promoted from Assistant Engineer of Bridges to Engineer of Bridges, and by M. A. Long, who will look after all work on buildings. Mr Bouton and Mr Long will both report directly to D. D. Carothers, Chief Engineer.

Gulf, Colorado & Santa Fe.—M. T. Pratt, Superintendent of the Texas & Gulf, has been appointed Division Engineer of the Gulf, Colorado & Santa Fe, with office at Beaumont, Tex.

Texas & Gulf.—See Gulf, Colorado & Santa Fe.

LOCOMOTIVE BUILDING.

Butler Brothers, Hibbing, Minn., have ordered two six-coupled switching locomotives from the Baldwin Locomotive Works instead of 30 as stated in the *Railroad Gazette* of March 27.

CAR BUILDING.

The Union R. R. is in the market for extensive passenger car repairing.

The Chicago, Milwaukee & St. Paul has ordered a number of cabooses from the Ralston Steel Car Co.

The Northern Pacific is again figuring on refrigerator cars, but has changed the number to 500 instead of the 200 noted in the *Railroad Gazette* of March 6.

The National Car Line Co., Chicago, has ordered five 31-ft. steel tank car underframes, mounted on Bettendorf cast-steel trucks, of 80,000 lbs. capacity, from the Bettendorf Axle Co.

The Milwaukee Refrigerator Transit Co. has ordered 100 36-ft. refrigerator cars of 60,000 lbs. capacity from the Milwaukee Car Manufacturing Co., for May 20 delivery, to weigh 40,000 lbs.

The Forest City Railway, Cleveland, Ohio, it is said, is in the market for 100 pay-as-you-enter cars, and will remodel 50 ordinary cars into the pay-as-you-enter type. This item is not yet confirmed.

The Pennsylvania's order for 200 gondolas, noted in the *Railroad Gazette* of April 10, is an old order. The Middletown Car Works is just now starting work on these cars, the carrying out of the order having been held up for some time.

The Panama Railroad has rejected all bids on the 300 thirty-ton box cars and the 100 forty-ton Rodger convertible ballast cars, for which specifications were given in the *Railroad Gazette* of February 21. New bids have not yet been asked, but it is expected that they will be.

The Ardmore Traction Co., Ardmore, Okla., has ordered four single-truck closed electric cars from the St. Louis Car Co. instead of the McGuire-Cummings Manufacturing Co., as stated in the *Railroad Gazette* of March 20. These cars will be 20 ft. ¾ in. long, 7 ft. 4 in. wide and 8 ft. 1½ in. high, inside measurements. The special equipment includes:

Brakes	St. Louis Car Co. vertical wheel hand brakes
Couplers	St. Louis Car Co. radial
Curtain fixtures	Burrows
Curtain material	Pantasote
Seats	St. Louis Car Co.
Trucks	St. Louis Car Co.

RAILROAD STRUCTURES.

BETHLEHEM, PA.—Contract has been given to Fine & Harris, of Philadelphia, at $27,000 for the steel superstructure of the Northampton Heights bridge. S. W. Childs, of Philadelphia, was given a contract for the sub-structure at $15,000. The proposed structure will be 378 ft. long and is to be built jointly by the Easton & South Bethlehem Transit Co., the Bethlehem Steel Co. and the Borough of Northampton Heights.

BOSTON, MASS.—The loss of the Boston Elevated in the recent Chelsea fire included a car barn, one car and seven snow-plows.

BROWNSVILLE, TEXAS.—President B. F. Yokum, speaking in behalf of the St. Louis, Brownsville & Mexico, confirms the report that this company has applied for permission to build a bridge over the Rio Grande river from Brownsville, Tex., to Matamoros, Mex.

Houston, Texas.—Contract, it is said, has been given to D. H. Barnes, of New Orleans, by the Houston Belt & Terminal Co., to build two freight sheds, each 400 ft. x 600 ft.; the work to be finished by September, and to cost about $200,000.

New Westminster, B. C.—A contract, it is said, has been given by the Canadian Pacific to W. W. Forrester to put up shops here, to cost $20,000.

Philadelphia, Pa.—Bids are wanted April 22 by the Department of Public Works for the construction of the following bridges: Over the Philadelphia, Newtown & New York Railroad, 60 ft. reinforced-concrete arch, 90 ft. wide; appropriation, $40,000. Over the North Pennsylvania Railroad 60 ft. reinforced-concrete arch, 80 ft. wide; appropriation, $10,000. Under Chestnut Hill branch of the Philadelphia & Reading Railway, double-track railroad bridge, plate girder through, 67 ft. span on concrete abutments; appropriation, $35,000. Under Richmond branch of the Philadelphia & Reading, three-track railroad bridge, plate girder through, 54 ft. span on concrete abutments; appropriation, $40,000. Over Schuylkill river, substructure work only, seven concrete piers; appropriation, $200,000. George R. Stearns is Director.

Vera Cruz, Mex.—The Vera Cruz Terminals Board recently held a meeting to dispose of the necessary preliminary arrangement so that bids can be asked for the proposed improvements. (March 20, p. 429.)

Winnipeg, Man.—Local reports state that the Canadian Northern is planning to build a double-track steel bridge over the Assiniboine river here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Burrs Ferry, Browndell & Chester.—This company, it is said, has resumed work on the line from Chester, Tex., east to the Louisiana state line at Burrs Ferry, on Sabine river, 85 miles. A length of about 25 miles is finished, and the grade is ready for the rails for an additional 20 miles. (Mar. 13, p. 390.)

Canadian Northern.—This company is planning to finish the work on the Brandon-Regina branch, also to ballast the line from Rossburn to Russell this year. Ballasting is also expected to be done on the line to Pas Mission, and similar work is expected to be carried out on the extension towards Hudson Bay. On the line from Saskatoon to Goose Lake a large amount of track-laying will be done and it may be further extended. Track is to be laid on 25 miles of the line from Delmeny, on the main line, to Carelton, and grading and track-laying on 15 miles of the Oak Point line is to be finished. On the Oakland extension, along the western side of Lake Manitoba there will be ballasting and track-laying.

Canadian Pacific.—The plans of work to be carried out this year by the Canadian Pacific, it is said, include. Completion of double track between Winnipeg and Fort William, 418 miles, of which 222 miles is already finished. Extension of the Stonewall branch to Icelandic river, 36 miles. Track laying on the grade built last year between Weyburn and Stoughton. Completion of the line from Wolsley to Reston, in Manitoba, on which grading is finished, and about 39 miles of track remains to be laid. On the Sheho extension, 37 miles will be built (to Lanigan). On the Moosejaw extension work is to be continued from Tuxford northwest for 50 miles. From Swift Current, west to the Medicine Hat division, there is to be a large amount of grade revision work carried out. A new bridge will be built at Lethbridge, and a number of new steel bridges on the Pacific division in British Columbia.

Several large contracts are reported let to W. P. Tierney & Co., Nelson, B. C., for filling in trestles in eastern British Columbia.

Chicago, Lake Shore & South Bend (Electric).—Local reports state that this company recently put 300 additional men to work on the line it is building from South Bend, Ind., west to Chicago, Ill., 71 miles, to finish the work by the middle of May. (Mar. 13, p. 390.)

Chicago, South Bend & Northern Indiana.—This company, which is building a line from South Bend, Ind., west to Laporte, 28 miles, is said to be pushing the work so as to have the line in operation by July 1. (Mar. 13, p. 390.)

Colorado, Texas & Mexico.—This company is building from Mangum, Okla., south to Abilene, Tex., and also has projected a large number of branches. According to President Morris R. Locke of Mangum, about 76 miles of grading is finished, including that on a branch from Llano, Tex., to Fredericksburg, 18 miles; also at the yards in Abilene, Tex., and Merkel and Mangum, Okla.

El Paso & Southwestern.—See San Diego & Arizona.

Franklin & Clearfield.—See Lake Shore & Michigan Southern

Grand Trunk Pacific.—Work to be carried out by this company this year is as follows. Completion of the line from Portage la Prairie, Man., east to Winnipeg, 55 miles, closing the gap on the line between Winnipeg and Saskatoon, grading and track-laying from Saskatoon to Edmonton, grading 100 miles west of Edmonton, Foley, Welch & Stewart, contractors; grading 100 miles of line east from Prince Rupert, the Pacific terminus, on the contract of Foley, Welch & Stewart, completion of the line from Port Arthur to the junction with the main line at Superior Junction. Work is to be pushed on the section from Winnipeg east to the Lake Superior branch, J. D. MacArthur, Winnipeg contractor. About eight thousand men are expected to be at work on this section this summer. Extensive work is also to be carried out on the terminals in and around Winnipeg.

Vice-President F. W. Morse is quoted as saying that bids are being asked for grading 180 miles of line for this company west of Wolf Creek, from a point 120 miles west of Edmonton Alb., to a point 50 miles west of Yellowhead Pass.

Harrisville & Cornwallis.—Bids, it is said, are to be asked for in May by this company to build a line from Harrisville, W. Va., northwest to Cornwallis, six miles. Right-of way secured and surveys being made. W. S. Stout, President, and A. Wolverton, Chief Engineer, Harrisville.

Kansas City, Mexico & Orient.—President A. E. Stilwell is quoted as saying that all of the money has been subscribed to finish building the railroad between Wichita, Kan., and Sweetwater, Texas, a distance of 132 miles. This section of the road is now built except a 67-mile gap between Benjamin, Texas, and the Red river and the bridge across the Red river. It is expected to finish this work and begin operation by August. (Mar. 13, p. 391.)

Lake Shore & Michigan Southern.—Work, it is said, has been resumed on the Franklin & Clearfield, which has been building through Pennsylvania during the past two years. As projected the line is to run from Franklin, Penn., southeast to Brockville, 62 miles, thence east to Clearfield, a total of 110 miles. The eastern end of the line, from two miles west of Brookville to Clearfield, has not been finally located. The western end is finished from Polk Junction to the Clarion river, 37 miles and work is well advanced on the 23 miles from the river to two miles west of Brookville. The line is being built to secure a low grade route through the mountainous country bordering the Allegheny river, thence to the summit of the Alleghenies. There is to be one tunnel of 2,100 ft. and another of 1,700 ft. The extension to Clearfield will necessitate piercing a tunnel 2,500 ft. long. It is thought that the line will be in operation within a year. This will be made possible by traffic arrangements between Brookville and Clearfield. It is understood that such negotiations are under way with the Pennsylvania and the Buffalo, Rochester & Pittsburgh. In the event of such agreements it would only be necessary to build from Dubois to Clearfield. (Mar. 13, p. 392.)

Mexican Roads.—The Mexican Congress has under consideration the question of granting concessions to build a line from Matamoros south to Izucar and Acatlan, via Calacun, Tehuitzingo, Chinantla and San Pablo, thence to the boundary of Oaxaca and Guerrero. The names of the promoters are not given.

New Orleans Great Northern.—It is reported that this company has resumed work on the section from Monticello, Miss., north to Jackson. (Mar. 13, p. 392.)

Ohio Roads.—A company is being organized by R. K. Paige, of Painesville, Ohio, to build a line from Fairport Harbor, Ohio, south to Phalanx, on the Lake Erie, Alliance & Wheeling, about 45 miles. It is said that surveys are made, and much of the right-of way secured.

Pennsylvania.—The south tunnel of the two which this company is building under Bergen Hill, Hoboken, N. J., as a part of its New York City improvement, was recently driven through, and the company now has a continuous tunnel from the western end at the Hackensack Meadows to Long Island City, over five miles. The piercing of the north tunnel is expected to be finished in May by which time all the excavation work on the New York extension will be practically completed. Only a small part remains to be done. Altogether a total of about 3,000,000 cubic yards of earth, stone and sand will have been removed from the interior of tunnels having an aggregate length of 16.5 miles and from the space to be occupied by the terminal building.

Pittsburgh, Shawmut & Northern.—Surveys are reported being made by this company from the western terminus of its Kersey branch, at Weedville, Elk county Pa., for a proposed line from that place southeast about 20 miles to the headwaters of Sandy Run in Clearfield county, where connection is to be made with the projected Pittsburgh, Binghamton & Eastern. The work will include a bridge 80 ft. high and several hundred feet long.

Port O'Connor, Rio Grande & Northern.—This company, it is said, has suspended work on its proposed line projected from Port O'Connor, Tex., on the Gulf of Mexico, north to San Antonio, 190 miles, with a number of branch lines including one to Gonzales. About 100 miles of grading has been finished, but no track has been laid. (Mar. 13, p. 391.)

PRINCE RUPERT & PORT SIMPSON.—Organized to build a line from Prince Rupert, B. C., to Port Simpson, about 50 miles. Barnard & Robertson, Vancouver, B. C., are the attorneys.

ROSCOE, SNYDER & PACIFIC.—This company, which was organized to build a line from Roscoe, Tex., northwest to the New Mexico line, 200 miles, has 19 miles of track laid, and 11 miles additional graded. Beyond this point it is undecided when the work will be carried out. Martin Duval, Roscoe, Chief Engineer.

SAN DIEGO & ARIZONA.—This company, which proposes to build a line from San Diego, Cal., east to Yuma, Ariz., about 200 miles, has recently been granted a concession by the Mexican Government to build about 50 miles of this line; that part which parallels the international border through the northern part of lower California. J. D. Spreckels, the principal promoter of the project, is quoted as saying that the El Paso & Southwestern has under consideration the question of building an extension from Benson, Ariz., west to a connection with the proposed line at Yuma. (April 3, p. 493.)

WASHINGTON, BALTIMORE & ANNAPOLIS (ELECTRIC).—This company on April 2 opened its high speed electric line from Washington, D. C., northeast to Baltimore, 40 miles. (Nov. 29, p. 669.)

WESTERN CENTRAL.—This company proposes to build from London, Ont., to Guelph. English capitalists have become interested in the project, and it is now intended to continue the line to Toronto. C. B. Smith, Toronto, Ont., is the Consulting Engineer.

WISCONSIN CENTRAL.—President W. A. Bradford is quoted as saying that construction work on the extension to Duluth is proceeding at a rapid rate. Regular train service is now in operation between Owen and Ladysmith, 45 miles, and the line is built to South Superior, leaving only eight or nine miles to the northern terminus at Duluth. It is expected that the entire line will be in operation by July 1. This does not include the terminal at Duluth, where 1,800 feet of tunneling is necessary, considerable of it through solid rock. Contract for the tunnel has been let, it is reported, to the Lantry Construction Co., of Kansas City. (Mar. 13, p. 395.)

RAILROAD CORPORATION NEWS.

BALTIMORE & OHIO.—See Reading Company.

BUFFALO, ROCHESTER & PITTSBURGH.—For the first week in April, gross earnings were $111,000, a decrease of $55,000 from those of the first week in April, 1907.

CHICAGO & MILWAUKEE ELECTRIC.—Judge Grosscup has authorized the issue of $1,000,000 6 per cent. 3-year receivers' certificates. Of these, $122,000 will go to the parent company for construction materials to be used on the Milwaukee extension.

CUBA RAILROAD.—The New York Stock Exchange has listed the $6,800,000 of this company's first mortgage 5 per cent. 50-year bonds, due 1952, and also its $10,000,000 preferred stock. The company operates 128 miles of standard gage road, the main line extending from Santa Clara to Santiago. Its gross earnings for the seven months ended January 31, 1908, were $1,000,000, and net earnings, $107,000.

COLUMBIA RIVER & NORTHERN.—See Spokane, Portland & Seattle.

DELAWARE & HUDSON.—A special meeting of the shareholders is called for May 12 to authorize a $50,000,000 first refunding mortgage, securing 35-year 4 per cent. bonds. Of this, $20,000,000 will be issued at once to pay off the company's floating debt. On December 31, 1907, this debt was $10,800,000, of which $6,000,000 is in the form of notes maturing August 6. The remaining $30,000,000 bonds will be issued when needed.

ERIE.—See views of Robert Fleming on earlier page of General News Section.

GREAT NORTHERN.—Gross earnings for March were $3,200,000 against $4,400,000 in 1907. For the nine months ended March 31, the gross earnings were $44,100,000, which is an increase of $3,900,000 over 1907. The earnings in March, 1907, were unusually large because in this month much traffic moved that had been held up during the winter.

ILLINOIS CENTRAL.—A special meeting of the stockholders is called for May 18, to increase by $28,512,000 the capital stock of the company. At present the Illinois Central has a capital stock of $95,040,000, and if the new issue is agreed to by shareholders it will bring the total amount up to $123,552,000. The proceeds from its sale will be used to buy the property of the Kensington & Eastern, and the Memphis State Line, and for additions and improvements on the Illinois Central. Shareholders as registered on May 28, 1908, are to have the privilege of subscribing at par for the new stock to the amount of 15 per cent. of their holdings. The half of the new stock not offered to shareholders will be held in the treasury. The directors are to be authorized to offer this stock to shareholders later or to issue bonds convertible into this stock.

INTERNATIONAL & GREAT NORTHERN.—Gross earnings for the week ending April 7 were $124,000; in 1907 they were $138,000.

KANSAS CITY, MEXICO & ORIENT.—This company is seeking to place $700,000 2-year $6\frac{1}{2}$ per cent. notes to provide for completion of 77 miles of line from Sweetwater, Tex., south to San Angelo. These notes are secured by $1,400,000 first mortgage bonds.

LAKE SHORE & MICHIGAN SOUTHERN.—See Lehigh Valley and also Reading Company.

LEHIGH VALLEY.—It is reported that the $5,700,000 Lehigh Valley common stock owned by the Lake Shore & Michigan Southern is to be sold to a syndicate which plans to make the road a more independent property than it has been. The following table shows the holdings up to recently of Lehigh Valley common stock by other railroads:

Lake Shore & Michigan Southern	$5,700,000
Erie	1,000,000
Central of New Jersey	1,600,000
Reading Company	1,000,000
Delaware, Lackawanna & Western	1,000,000

The Erie has already sold its $1,000,000 holding. See Reading Company.

NATIONAL RAILWAYS OF MEXICO.—In return for guaranteeing unconditionally the principle and interest of the new $160,000,000, general mortgage bonds of the National Railways of Mexico, the government has been given outright the following securities:

Prior lien, $4\frac{1}{2}$ per cent. bonds	$6,000,000
General mortgage, 4 per cent. bonds	2,450,000
Common stock	63,730,000
Total value	$72,180,000

The government will use these bonds, or the proceeds of their sale, toward acquiring $30,337,900 stock of the National of Mexico and $20,000,000 stock of the Mexican Central. The government will then exchange this stock for the following securities of the National Railways of Mexico:

First preferred	$10,000,000
Second preferred	30,278,300
Common	10,994,000
Total	$51,272,300

This total added to the $63,730,000 common stock already allotted to the government will give it $115,002,300, which is a majority of the total $230,000,000 stock of the National Railways.

NORTHERN PACIFIC.—Gross earnings for March were $4,800,000, a decrease of 12 per cent. from the earnings of March, 1907. The loss was in freight and express, the passenger earnings having increased slightly. For the nine months ended March 31, gross earnings were $53,800,000, against $49,600,000 in 1907. The passenger earnings show an increase of 14 per cent.

PENNSYLVANIA.—The New York Bay Railroad, all of whose stock is owned by the Pennsylvania, has made a mortgage covering $6,000,000 40-year 4 per cent. bonds, dated January 1, 1908. The road runs from a point near Waverley, N. J., to the Greenville freight terminals, 7 miles, with 7 miles of branch lines.

READING COMPANY.—It is reported that the share of the Lake Shore & Michigan Southern in the $60,000,000 Reading stock (mostly first and second preferred) held by it and the Baltimore & Ohio, is to be sold to interests associated with the Baltimore & Ohio. The Philadelphia & Reading, with the Central of New Jersey which it controls, gives the Baltimore & Ohio its entrance to New York. See Lehigh Valley.

SPOKANE, PORTLAND & SEATTLE.—This company has increased its authorized capital stock from $5,000,000 to $25,000,000. The 221 miles of road from Pasco, Wash., to Vancouver, is now in operation. The company has acquired the Columbia River & Northern, extending from Lyle, Wash., to Goldendale, 43 miles, and will operate it as a branch.

UNDERGROUND ELECTRIC OF LONDON.—Sir George Gibb, Deputy Chairman and Managing Director, was, on April 15, appointed receiver of the Underground Electric Railways Co. of London, Ltd., on application of Speyer Bros., of London. It is probable that a reorganization plan will shortly be announced. In December last Speyer Bros., in London, and Speyer & Co., in New York, offered to purchase the defaulted coupons on the (about) $34,500,000 5-year profit-sharing notes which mature June 1, 1908.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of The Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 17. FRIDAY, APRIL 24, 1908.

Some of the advantages of storing coal under water were referred to briefly in these columns on February 14. Since that time Bulletin No. 17 of the Engineering Experiment Station of the University of Illinois on "The Weathering of Coal" has been issued. According to the authors of this pamphlet, information concerning the behavior of coal in any sort of storage is very meager and there is much disagreement between recorded facts. These studies were made therefore to get a better understanding of all of the conditions attending the storage of coal in large quantities, such as weathering, spontaneous combustion, etc. Reference is made to the growing prominence of the under-water plan, and the studies of deterioration included samples maintained in a submerged condition, as well as in the open air, under cover at varying temperatures and in air-tight containers. The period covered by the experiments was nine months. The experiments were considered as being only preliminary in character, which would furnish information for more comprehensive and elaborate tests. They appeared, however, to justify certain conclusions. With reference to the submerged coal, it is stated that there is evidence of a distinct difference between this and the air-exposed. The values found for it during the nine months did not vary, with possibly one or two exceptions, by greater amounts than would occur in tests made on succeeding days by the same person. The coal was submerged in ordinary water at a temperature approximately 70 deg. F. The results showed that the processes which are active in air cease under water, these processes being the decomposition of the pyrites and the loss of volatile matter. This phenomenon suggested to the experimenters the idea of a displacement of hydrocarbon gases by oxygen, by some process akin to osmosis or catalysis, whereby a certain amount of oxidation of the carbon or hydrogen occurs. The results of the various experiments were considered of value both for what they revealed and for the suggestions for further studies which would yield fuller information on this important subject.

Stockholders of the Illinois Central living at Hartford, Conn., representing, it is said, some 10,000 shares, last week appointed a local committee to handle their proxies at future annual meetings of that corporation. The incident projects into sharper light the familiar infirmity of stockholders in great corporations. They are a host of disorganized units scattered far and wide through the land. They cannot attend meetings and, if they could and did, there wouldn't be a National convention hall large enough to hold them all. They do not and most of them cannot keep in touch with their own investments. Hence their proxies are duly signed and sent on or dropped in the waste-basket and the annual meeting of the big corporation usually resolves itself into a half dozen accidental stockholders at one end of the room and a president and secretary intrenched behind a huge pile of proxies at the other. This is the case when net earnings are good, dividends regular and the skies clear; and the stockholder only wakes up when calamity strikes in. Now and then there has been an exception. The late President C. P. Clark, of the New Haven company, used fitly to dub its annual gatherings "Town meetings"; but they ceased to be such when the annual free ride of his stockholders to the meeting was cancelled. The Hartford idea has perhaps a certain note of suggestion. It outlines as a kind of ideal ultimate the federating of stockholders into groups each with its representative committee and accents Aesop's fable of the collective strength of the bundle of sticks weak when single. But the idealism vanishes in the average temper and habit of the average shareholder. In his corporate relation he repeats the imbedded trait of the citizen whose civic ardor is a flash and not a flame. True, his investment touches directly the stockholder's pocket nerve. But does it more so than taxation? His treatment of his proxy is thus of much the same breed as his neglect of his party primary, and "committees of protection" in their various shapes will probably continue to be the fruit only of corporative disaster actual or feared—and a fruit not seldom harvested too late.

The record of the traffic and earnings of the whole Pennsylvania Railroad system for the last ten years presents some notable facts. This system, more than any other, benefits by the traffic of the primary iron industries, which in these ten years have had a phenomenal growth. These industries produce more weight per man employed than almost any other; and in fact the increase in freight traffic (ton-miles) of the Pennsylvania Railroad system was 130 per cent. from 1898 to 1907. But it is somewhat surprising to find that the increase in passenger traffic meanwhile was even greater—133 per cent. In the aggregate there was a considerable increase in the extent of the system, from 9,036 to 11,176 miles; yet, even so, the traffic per mile of road increased 86½ per cent. in freight and 88¼ per cent. in passengers in the ten years. It may be said, however, that there was (and is) more room for the passenger traffic to grow. For every 100 passenger-miles there were 991 ton-miles in 1898, and 985 ton miles in 1907, very nearly 10 ton-miles to every passenger-mile. For the whole railroad system of the United States in 1906 there were 857 ton-miles per 100 passenger-miles; on the New York Central in 1907, 594 ton-miles to 100 passenger miles. That proportionally to freight the passenger traffic on the Pennsylvania is less than the average is not because the passenger traffic is light, but because the freight traffic is overwhelmingly heavy. The average for the whole country per mile of road was 982,401 ton-miles; on the New York Central (3,782 miles of road), 2,855,610; on the Pennsylvania system, 3,371,019 ton-miles. This helps to account for the fact that with slightly less than 5 per cent. of the total mileage of United States railroads, the Pennsylvania system had more than 14 per cent. of its gross earnings—$29,240 per mile, against an average of $10,460 for the country. Though, as we have seen, both passenger and freight traffic have grown greatly in the last ten years on this great system, and on the whole, one about as fast as the other, they have not grown evenly, by any means, and the passenger much more evenly than the freight. In the latter we have such yearly gains as 20 per cent. from 1898 to 1899, followed by 3.8 per cent. from 1899 to 1900 and a decrease of 2¼ per cent. from 1903 to 1904, followed by successive yearly increases of 17, 11.6 and 14.4 per cent., the latter from 1906 to 1907. In passenger traffic the increase did not vary greatly from 10 per cent. in 1899, 1900, 1902, 1906 and 1907; and in the year when there was a decrease of 2¼ per cent. in freight there was an increase of 3.6 per cent. in passenger traffic.

THE USE AND MISUSE OF COAL.

At a meeting of the American Society of Mechanical Engineers held on the evening of April 14, to discuss the subject of the conservation of our natural resources, Prof. W. F. M. Goss presented some rather startling figures regarding the utilization of the coal supply, figures that we all are more or less familiar with, but which need to be presented occasionally in order to drive home a realization of what is being done and what we must face if the present wastefulness continues. After reviewing the methods of mining in which the thin upper veins are neglected in order to first take out the better paying material from the thicker veins below, allowing the cover to become dislocated and rendering subsequent mining operations impossible in the upper strata, Dr. Goss showed how coal that has slate seams or is high in sulphur is left below, and how much otherwise valuable fuel is destroyed by heavy and injudicious blasting. He directed attention especially to the enormous quantity of coal used in modern locomotive service. Starting with an annual production in 1850 of between 50,000,000 and 60,000,000 tons, the output has more than doubled every decade since that time, until, in 1906, it reached an astounding total of something more than 400 million tons. Of this, nearly 120 million tons are burned in locomotives—more than the total annual output 25 years ago. That this consumption is carried on wastefully, and that there is a marked distinction between the practices of the United States and of Europe, was clearly shown. In Europe every possible effort is made to effect economies by the use of compounding or of superheaters, standing out in strong contrast with the practices of this country, where these means of saving are almost wholly disregarded, and emphasizing the distinction so often drawn, that Americans are prodigal of material and saving of labor, while the foreign engineer reverses this, clearly indicating where the source of greatest saving exists on the two continents, respectively. It is estimated that, by the use of superheaters and of a more rational system of burning the coal, a total saving of from 25 to 30 per cent. could be effected. This, with coal at $1.50 per ton, would mean an annual saving to the railroads of about $45,000,000. The figures are startling and it is useless to raise the cry, more or less sneering, that we have plenty of coal, and so what's the use of troubling ourselves. That there is a limit, no one can deny, although exhaustion does not stare us in the face this year or next, or in the next decade. But no matter how rich we may be, reckless extravagance is not the course of wisdom. Twenty-five years ago, when the Michigan lumber industry was at the height of its prosperity and when its pine controlled the markets of the world, there were a few conservative old fogies who protested against the rampant wastefulness, and predicted an early destruction of the forests and the extinction of the industry. But they were laughed at for their pains, and it was proven very conclusively by the mill men, to their own satisfaction, that the pine would last for a hundred years. So they continued to waste more than 25 per cent. of the log in sawdust and slabs, and to burn or leave behind all the tops and branches. Then, fifteen years later, they closed their mills, or burned them for their insurance, and Michigan pine was a thing of the past. The great, primeval forests had been obliterated, and in their place we have wide expanses of denuded sand flats, barren and useless.

Lest we should forget this warning, so recently given, the movement now on foot to conserve our natural resources in timber, coal and ore, was originated. Surely no industry has a more vital interest in the matter than have the railroads, despite the apparently reckless manner in which they consider the subject of coal economies or refuse to consider it, unless it can be demonstrated to them by an incontrovertible Q. E. D. that they can save a dollar to-morrow by taking action to-day, on the principle of a quick return and big profits. There is such a thing as making provision for the more remote future, and one of the oldest and most familiar of the means to this end lies in the preservation of the things we have now in hand.

WRITTEN EXAMINATIONS ON TRAIN RULES.

The Aurora, Elgin & Chicago, an electric interurban road, recently adopted a plan for written examinations of trainmen on its rules and regulations. We understand that this is the first interurban road to follow this plan, and the suggestion has been made that the idea is one the steam roads might do well to adopt. While oral examinations are almost universal with the steam roads, the idea of written examinations is far from novel. The Chicago & North-Western has been requiring written examinations for six years—ever since the present book of rules has been in effect. The system of questions is most complete, there being a separate set of questions for each class of employees who must be familiar with the rules in part or in whole. Each set of questions is bound in pamphlet form, 8 in. x 10½ in. For conductors there are 384 questions; for enginemen, 347; train despatchers, 175; agents and operators, 170; brakemen and baggagemen, 143; yardmasters and switchmen, 74; track, bridge and building foremen, 61; signalmen at interlocking plants, 53; firemen, 48. Agents also have an additional list of 228 questions on accounting rules. Space is provided at the end of each set of questions for any additional questions the examiner may care to ask.

Before the present rules became effective, an examining board was appointed and all employees were given a written examination thereon. There are no periodic re-examinations, but the rules are now being revised to conform to recent changes in the Standard Code, and all employees will again be examined. The examination papers are numbered and filed in the superintendent's office. Once a month the list is checked over to see that all changes have been properly entered. At the end of each quarter the papers of men who have left the division are removed from the file and stored away. Occasionally a man from the general superintendent's office goes over the road and checks up the superintendents. Men taking the examination must answer all questions. If the examiner, in looking over the papers, finds answers to questions which give the impression that the man has not understood the matter clearly, he is called in and questioned, and either allowed to revise his answer or is required to study up on these points and answer the questions again later, as the examiner may decide. If a man fails on the first examination he is allowed to try again within 60 days. In the event of a second failure a final chance is given him within six months.

A good many advantages are claimed by the North-Western for this system as compared with oral examinations. First of all, it is systematic and thorough. The questions are formulated to cover all the rules. In oral examinations no one person in a class will be questioned on all the rules even should the class as a whole be asked regarding every rule. The fact that the written answers are a record for reference at any time is equally important. If a man violates a rule he is unable to plead that he was not asked about it in the examination and did not understand it properly. Furthermore, many men are nervous in oral examinations and may make an unfavorable showing, when in reality they may be sound on the rules. In the written examinations they have all the time they want. If a man is in doubt about the meaning of a question, the examiner is there to explain it and give such help as is permissible. At the same time, the opportunity for displaying partiality is minimized. A further important advantage of the written method is that it assures a uniform understanding of the rules and eliminates variations in interpretation of the rules due to changes in examiners. Naturally an examiner interprets the rules as he personally understands them, and no two men may put exactly the same construction on them. An employee brought up on a certain division and instructed and examined by a certain officer, will interpret the rules accordingly. But examiners change, and employees are constantly changing from one division or district to another, and are thus coming in contact with examiners and employees whose education in the rules probably has been somewhat different. With the written examinations the viewpoint is the same for all.

A number of roads have considered written examinations, but the majority believe oral examinations much better and more satisfactory. We understand that the Rock Island is preparing to adopt the written plan. The Southern Pacific used written and oral examinations for a time; that is, the employee would first answer certain questions in writing and then would be questioned orally afterward to ascertain his understanding of the rules. At present the examinations are largely oral, for the reasons given at the beginning of this paragraph.

The Aurora, Elgin & Chicago has 234 questions on its list. They are printed on loose sheets about the size of the North-Western's pamphlet. All trainmen must be re-examined once each year. The passing grade is 95 per cent. In case of failure the first time, another trial is allowed within two weeks. A second failure in the case of men already employed results in suspension from the service. Of the 234 questions, 41 are on the air brake, and are therefore only for motormen, or candidates for that position.

THE RAILROAD SHORT TERM NOTE

Speaking in a very general and somewhat rough way, borrowers of money from banks and trust companies may be divided into three groups. There is the borrower of high standing and credit, either in business or out of it, who borrows on the strength of an individual name or names. There is the borrower—the "commercial" borrower—who obtains his loan on the commercial bill payable, as collateral security; and, finally, there is the borrower on stock, bonds, realty or other securities, usually solid, of the same general kind. In the borrowing of funds by railroad corporations one finds similar analogies. The short term note may be said to represent single name paper. It shifts to a kind of commercial paper when it becomes partly secured either by future potential mortgage power or more immediately by collateral which is apt to be of uncertain quality; and, finally, in the shape of the senior railroad mortgage or the junior mortgage of a prosperous railroad corporation we have the analogue of the bank loan well secured by first-class collateral in stocks or bonds.

The panic period which struck the nation six months ago had been preceded by a somewhat longer period of rising investment rates seriously affecting the borrowing power of corporations, especially the railroads. During that earlier period of a year or more it was not so much a case where credit was shaken as of actual exhaustion of investment funds owing to great loans of big railroad corporations. "Prosperity" then of uncertain endurance had overloaded them. There was shortage of cars, public outcry over detained freight, complaints of inadequate switching yards and terminals, steps toward and to reciprocal demurrage, saying nothing of more overt anti-railroad legislation actual or threatened. Not many railroad financiers or managers were prescient or saw the storm ahead just beginning to lift over the far railroad horizon, and investors were, with few exceptions, in the same mental condition. Railroad improvements seemed and were, for the time, imperative, and the high interest rate was deemed but a temporary strain. Hence the "short term note" policy adopted as a transitory expedient of bridging what looked like a narrow gap and hence also the sequel of that policy in a huge volume issued of that class of security. At first, in competition with an ordinary mortgage investment rate of 4 per cent., the short-term railroad note found a market on a 5 per cent. basis, which increasing money stringency ere long forced up to 6 per cent. Most of the better class of notes now outstanding are at the former rate; but out of 32 such issues 23 become due during the coming two years; and the experience of the Erie in its crisis just past suggests the problem ahead for some of the weaker lines.

Pessimists are now drawing somber horoscopes on the future of the railroad short note which, indeed, has become a very important element in the railroad situation on its fiscal side. They point out the great volume of those notes, their early maturity, their character as a note of hand of a railroad corporation, often unsecured, and the existing shadow on the net earnings which are the basic test of a railroad's borrowing strength, and they point to the Erie episode as the precedent and prophecy of trouble ahead when the short notes mature. The prognosis has its savor of reality, and if hard times lengthen and deepen overmuch may, in some cases, be fulfilled. But the reassuring argument is much the stronger. The railroad short notes are many in number, great in mass and diverse in terms. But in general they have been issued by strong corporations with large equities in dividends even if the dividends are reduced. A great proportion of them can be renewed even though a 6 per cent. note replaces a 5 per cent. one; and, when paid, they release just that amount of money for reinvestment—a trite fact, but one apt to be forgotten. Another point likely to be overlooked is the present-day saving power of capital when held in powerful hands of the individual. That massing of capital under single control has its palpable dangers when the individual is speculative and unscrupulous. But one of its good sides is its protective force in a corporation's crisis where a host of stockholders or even a body of directors cannot act with either effectiveness or promptitude. The Erie case itself is a vivid illustration. In 1873 and the few years following a road in the plight of the Erie would inevitably have gone through bankruptcy, and so late as 1895 the Erie practically did so under the form of stock assessments. It is now, for the time being at least, saved by individual action and resources which seem likely to be used hereafter in the case of other embarrassed big lines even should the hard railroad times protract into a "long drag."

Another feature of the interesting and important short note situation calls for attention. The holder of a short note of a perfectly solvent railroad corporation has, so long as the corporation is absolutely solvent, what amounts to a mortgage security. Using an outside illustration, A holds B's note of hand. A knows that B holds a profitable business block worth say $50,000, but carrying a first mortgage of $10,000, a second mortgage of the same amount, and thus with an equity of $30,000 which at forced sale would be but slightly reduced. The judgment against the equity, in case of default on the note, is in such a case ample security for A. His peril is in B's possible addition of a third mortgage or extension of liabilities in other directions, among which A must take his chance. Substitute for A the holder of the short term railroad note and for B the railroad corporation and the peril at once becomes obvious. The instant any railroad corporation begins to impair the equities that secure its note of hand that note becomes shady and a single grave instance of the kind affects that security as a class. The temptation to such a policy is plain enough. The weak railroad corporation is led to it as an ultimate resort to prevent a receivership, the solvent company is tempted by the prospect of securing a loan at a lower interest rate. As a broad and general policy, therefore, the policy of the railroad corporation should be the conservation of the equities which secure the short note. It may sometimes be difficult, but it is the price to be paid if the short note is to be renewed, if the whole structure of short note credit is not to be roughly shaken and if new crises of the Erie type are not to ensue without the Erie solution. In the short note matter, as well as in other railroad affairs during the present stress, wisdom points toward fore-thoughtful conservatism. That the notes happen to be "short" thus compelling, in a sense, that policy of conservatism as a condition of payment or renewal is perhaps a benign ultimate fact for the railroad companies as well as for the investing public. Had the notes been "long" though the fiscal strain would be relaxed, the inducement to immediate prudence would be relaxed also.

Train Accidents in March.

In March as in February the number of train accidents occurring in the United States which were of sufficient magnitude to come within the definition of "serious," as used in this column, was very small. But, though the number is small there need be no fear that the full record of the month will lack variety, nor is there any warrant for relaxation of effort to provide safer service. It is gratifying to be able to record diminishing lists of deaths and injuries, and we shall hope to see still further improvement, but the losses of property in collisions and derailments will continue to aggregate large sums, we may be sure. Three of the collisions shown in the present list appear from the newspaper accounts to have been due to mistakes in giving or understanding telegraphic orders, showing that the expense of maintaining the block system is still grudged by some roads. And these are roads which know the value of the system, too. The worst accident in March, the derailment at Bristow, Oklahoma, causing the death of a mail clerk, a fireman and a trespasser, was caused by a large iron nut which had been placed on the rail. The front part of the train fell through a high trestle. It was running fast, but the passenger car that was wrecked carried few passengers, which accounts in part for small number of injuries. How the nut came on the rail is not known, and we have classed the accident as due to "malicious obstruction."

TRAIN ACCIDENTS IN THE UNITED STATES IN MARCH, 1908

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd.
20.	Boston & Maine	Haverhill, N.H.	bc.	Ft & Ft.	4	1
24.	Chic., N. O. & T. P.	Burgin.	bc.	P. & Ft.	0	11
24.	Illinois Central	So. Memphis.	xc.	Ft & Ft.	1	5
*27.	Erie	Belvidere.	bc.	Ft. & Ft.	2	4
29	Lehigh & Hud. River	Eastchester.	bc.	Ft. & Ft.	1	2

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	No. persons reported Inj'd.
7.	Chic., Burl. & Q.	Kearney.	Pass.	dr.	0	4
†14.	St. L. & San Fran.	Bristow.	Pass.	malice.	3	7
19.	I. & G. N.	Pearsall.	Pass.	b. rail.	1	8

Other Accidents

*22.	Delaware & Hudson	Schenevus.	Ft.	boiler.	3	0

Of the few electric car accidents reported in the newspapers as occurring in the month of March, none had fatal results, so far as we have observed, though one derailment (in Detroit, Mich., on the 24th) resulted in the injury of 20 persons, besides as many more who sustained minor hurts. A car running about 25 miles an hour was derailed (by a defect in the track, it is said) and it ran into and demolished the front of a two-story building.

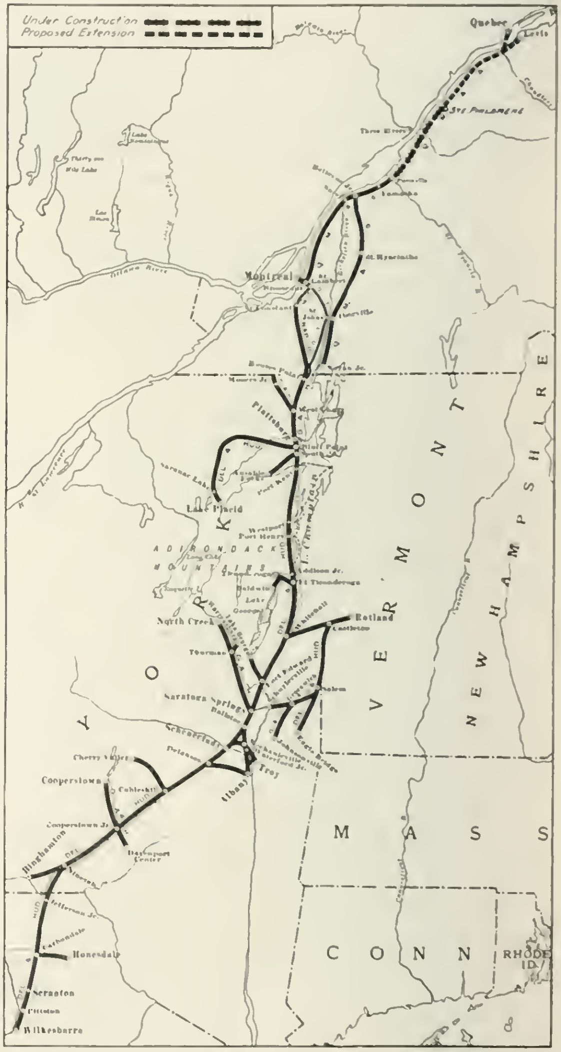
It must be remembered that no one has the least semblance of right to use a railroad as a public footpath or sidewalk. This salutary truth appears in Accident Bulletin No. 1, which has been issued by the State Railroad Commission of Indiana. It is not a novel declaration of truth, but it is especially welcome, coming, as it does, from an official body in one of those states where the lawless use of railroad rights-of-way has been glaringly common. People who have walked on the track all their lives and who deem the privilege a right, are not going to be subdued easily; but correction must come, some time, and it is well that a vigorous and authoritative warning should be sounded. The Indiana commission has issued two quarterly accident bulletins, which together cover the half year ending December 31, 1907. The statistics are not well arranged, and the commission has secured little or no useful information concerning the causes of the accidents reported, but the observations offered in the report show a commendable spirit. Attention is called to the fact that highway crossings, at which 28 persons were killed in the first three months, within the state of Indiana, are now in many cases more dangerous than formerly, because interurban electric railroads are laid parallel to the older steam roads, so that wayfarers have to cross two railroads practically at the same moment. The commissioners hear that enginemen do not sound the whistles for highways as clearly and regularly as they should, and they are going to issue a circular calling attention to the penalties prescribed by law for neglect to whistle, emphasizing the statement with a record of the number of deaths which have occurred at crossings. It is well that the engineman should be called to account in this matter, but it is to be hoped that the commissioners are not innocent enough to believe that a correction of this fault will have much effect in reducing the number of casualties at crossings. The first bulletin calls attention to the fact that in small towns the telegraph office, or the signal tower, often is made the village loafing place, though the rules of the railroads forbid it. It is suggested that the city and town police authorities ought to correct this bad practice.

[1] Abbreviations and marks used in Accident List:

rc........Rear collision.
bc........Butting collision.
xc........Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.........Broken.
d.........Defective.
dr........Defect of roadway.
eq........Defect in car or engine.
n.........Negligence.
unf.....Unforeseen obstruction.
unx......Unexplained.
derail. ...Open derailing switch (negligence of engineman or signalman).
ms........Misplaced switch.
acc obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.......Cars burned while running.
Pass......Passenger train.
Ft ......Freight train (includes empty engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

Delaware & Hudson Company.

The seventy-eighth annual report of the Delaware & Hudson Company has many points of difference from the company's previous statements. It reflects in many ways the new management of the property. The gross and net earnings and the net income are no longer given by divisions, nor are the assets and liabilities described in as great detail as formerly. On the other hand, more operating statistics, such as those for locomotive mileage and its cost, and home and foreign freight car mileage, are given. A new table shows the tonnage of different commodities carried during the years 1900 to 1907, inclusive. Over half of the 70 pages of the report are taken up with a description of the steam and electric

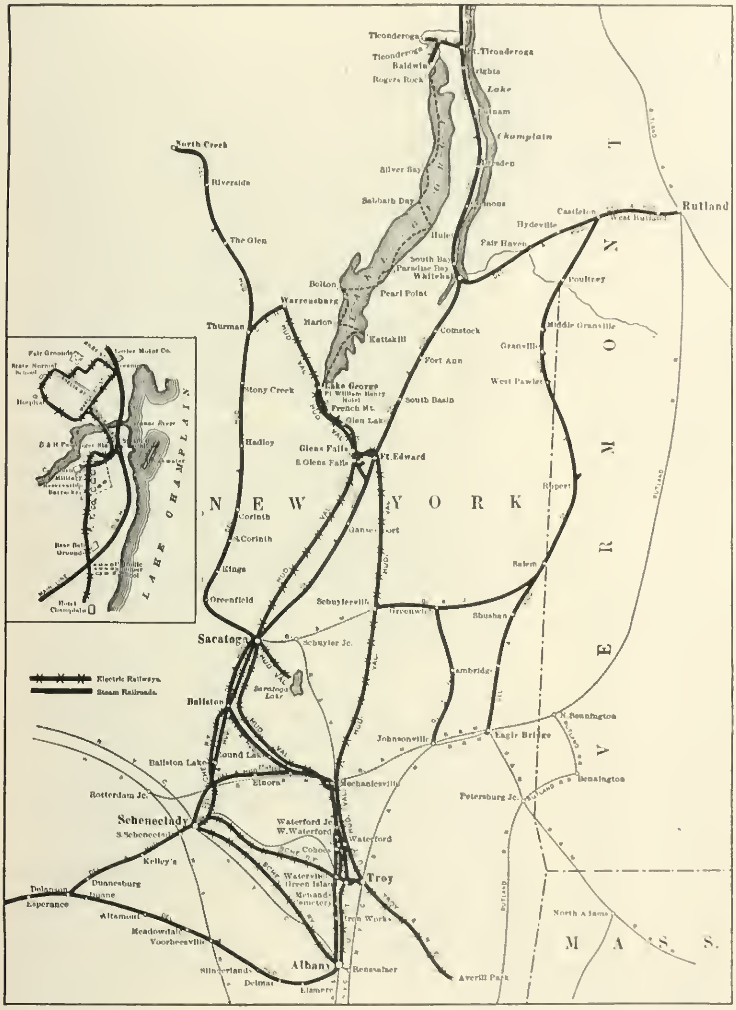


Delaware & Hudson Steam Lines.

railroads acquired during the last two years. The new coal properties during that time acquired are also described in detail.

The year was one of great activity in the company's operation. Its collieries and washeries were operated to their full capacity throughout the year, producing 6,600,000 tons of anthracite coal out of a total anthracite production of 67,100,000 tons. At the same time the railroad lines handled a much larger traffic than during any previous year. Gross railroad earnings increased 18 per cent., from $17,100,000 in 1906, the previous high record figure, to $20,200,000. The increase came largely in coal freight earnings, which rose from $6,700,000 in 1906 to $9,100,000 last year, an increase of 36 per cent. Merchandise freight earnings increased 8 per cent., and passenger earnings, 5 per cent.

Against the increase of $3,100,000 in gross earnings there was a rise of $1,500,000 in operating expenses. Of this increase, maintenance of way was responsible for $448,000, maintenance of equipment for $320,000, and conducting transportation for $723,000. The increased cost of operation was due both to the larger amount of traffic and the increased cost of materials and labor. The year marked the culmination of advances in prices of material that began in the fall of 1905. There was an increase in the price of ties in 1907 over 1906, ranging from 11 to 13 per cent.; of finished products of iron and steel, such as axles, gray iron castings, steel castings and malleable castings, from 12 to 20 per cent., while the prices of copper wire, brass castings, journal bearings, Babbitt metal and other material in which copper enters largely, increased approximately 22 per cent. The cost of miscellaneous supplies increased from 2 to 3 per cent. At the same time, in common with other railroads, the rates of pay in almost all branches of the track, shop, engine, train and yard service were increased during the early part of the year, the total increase being equal to about 7 per cent. of the aggregate pay roll. Yet net railroad earnings were $8,400,000, against $6,800,000 in 1906.



Electric Railway Properties of the Delaware & Hudson.

Gross receipts of the coal department increased $4,600,000, or 25 per cent., but operating expenses increased a little more than this amount, so that net earnings of the coal department were $36,000 less than in 1906, being just under $1,200,000. The combined net earnings of the railroad and coal departments, therefore, were $9,600,000. To this must be added $1,500,000 of other income, making a total fund of a little more than $11,000,000 from which to pay taxes, fixed charges and dividends, this being an increase of $1,700,000 over the similar amount available in the previous year.

Fixed charges were $500,000 larger than in 1906, chiefly because of interest payments on the new $10,000,000 first lien 15-year 4½ per cent. equipment bonds dated July 1, 1907, and a full year's interest on the debentures of 1906. Net income was $6,500,000, which is equal to 15.25 per cent. on the outstanding capital stock, against $5,200,000 in 1906, or 12.28 per cent. on the stock. Lacking the "general profit and loss" account it is not possible to follow the disposition of this net income in 1907. The company reports a surplus for the year, that is, an increase in the amount to the credit of profit and loss, of $3,025,218. There was paid in dividends $3,816,000 (9 per cent on $42,400,000), which, subtracted from net income leaves $2,650,173 surplus for the year, as shown in the table at the end of this review. No information whatever is given as to the charges to income (general profit and loss) for improvements in 1907 but from this showing it would appear that no such charges were made. The income account for 1906 has been similarly rearranged, as is explained in detail in the table, and it shows a deficit of $691,212, as against a reported surplus in that year of $493,891.

Maintenance of way expenditures per mile operated were considerably higher last year than in 1906. Unit maintenance of equipment expenditures were lower, as was naturally to be expected, because a large amount of new equipment was bought. Maintenance of way per mile cost $2,171, against $1,648 in 1906. "Expenditures on account of railroad department construction," amounting to $3,400,000, were charged to capital account. Repairs of equipment cost $1,907 per locomotive, against $1,917 in 1906, $303 per passenger car, against $311 in 1906, and $44 per freight car, against $55 in 1906. There were 53 locomotives, 48 passenger cars, and 7,678 freight cars added to the equipment during the year. Railroad equipment account on the balance sheet was increased $10,300,000. In December, 1907, an appraisement of the equipment of the company was made by a mechanical engineer who was until recently superintendent of motive power of one of the trunk lines. He spent five weeks in and about the various shops and yards personally inspecting a sufficient number of locomotives and cars in each class and series to give an accurate idea of the general average condition of the equipment. He reported that all classes of equipment were well maintained, and estimated the aggregate value on December 31, 1907, at $25,563,798, which exceeds by $598,295 the amount at which the equipment is carried in the accounts.

Freight earnings increased $3,000,000, or 22 per cent., and freight density from 2,550,000 to 2,970,000 tons one mile per mile of road. The ton mile rate rose from 6.33 mills to 6.6 mills, but this was largely due to a change in accounting. The practice of crediting to earnings a nominal rate per ton mile lower than the average rate for commercial freight, and charging to expenses an equal amount for the transportation of company material was discontinued on September 1, 1907. The practice necessitated considerable extra work by station and accounting forces, with no increase in net revenues. The train load was 452 tons, against 460 tons in 1906, and 455 tons in 1905. The average number of tons per loaded car, however, increased from 24.27 tons to 25.55 tons. The freight earnings per revenue train mile were $2.99, against $2.93 in 1906.

The following table shows in percentages the proportion of the various commodity groups to the total freight tonnage during the last eight years:

	1900.	1901	1902	1903.	1904	1905.	1906.	1907
Agricultural products	9.63	6.10	6.97	5.81	5.82	5.03	5.51	4.47
Animal products	1.09	.97	1.12	.83	1.26	1.35	1.43	1.22
Mineral products	65.79	68.78	60.46	70.38	67.15	68.12	65.16	68.39
Forest products	4.20	5.35	6.69	4.59	4.74	4.31	4.66	4.52
Manufactures	12.69	12.07	15.72	12.42	12.84	13.00	15.18	12.57
Merchandise	1.68	1.79	2.15	1.24	1.75	2.10	2.02	1.79
Miscellaneous	4.92	4.94	6.89	4.70	6.41	6.09	6.04	[illegible]

The two largest increases during the year were in anthracite and bituminous coal. The increased tonnage of the latter product, which does not originate on the Delaware & Hudson lines, suggests that the interchange business with the Pennsylvania at South Wilkesbarre increased during the year, and that the Delaware &

Hudson is becoming more important as a through route for carriage of bituminous coal from the Pennsylvania fields to the Albany, Adirondack and New England territory. The other principal increases of more than 50,000 tons in descending order of tonnage were: ores, miscellaneous, stone, etc., lumber and grain. There were three decreases of over 50,000 tons: rails, 133,000 tons; other mill products, 54,000 tons, and flour, 53,000 tons.

Important additions and betterments were made during the year. There were built five miles of new second track, 17 miles of third track, and 16 miles of fourth track, a total of 38 miles of new additional tracks, besides 51 miles of sidings. These included a third and fourth track between Ballston, N. Y., and Saratoga, which was electrified and is now being operated by the Schenectady Railway and the Hudson Valley Railway jointly. They also include third and fourth tracks from Green Ridge, just north of Scranton, Pa., north to Carbondale, a part of the line where coal, merchandise and passenger traffic is dense. Construction of second track between Watervliet, N. Y., and Waterford Junction is nearly finished. This line carries the heaviest passenger business of the company, amounting in summer to over 60 trains a day. The construction of second track between Delanson, N. Y., and Schenectady, including improvement of grades and alinement, is also nearly finished. All the northbound coal traffic and most of the merchandise traffic pass over this section of the road. This new second track will have a maximum and substantially uniform grade of 45 ft. to the mile southbound. Much expense for pusher engines will be done away with and an increase in the trainload will be possible, as well as a relief of the congestion of this strip, which has often hampered the rapidity of operation of the connecting sections. During the year, 45 miles of single track and 111 miles of double track were equipped with automatic block signals. Except for 25 miles between Rouse's Point and Plattsburg, the whole main line is now so equipped, also the Lake George branch, the Schenectady and Delanson branch, and the Schenectady and Mechanicville branch, a total of 408 miles of line, of which 177 miles is single track and 231 miles has two, three or four tracks. The work of grade crossing elimination at Schenectady has been finished, and the new union station, which is used jointly with the New York Central, was recently opened.

For the past year or more the Delaware & Hudson has been under fire from certain stockholders who have made general allegations of mismanagement and particular criticisms of recent purchases of steam and electric railways and of coal lands. In answer to the particular criticisms of recent purchases, the company devotes over half the report to a detailed description of the new properties and the reasons for buying them.

First, in regard to the new coal lands, President Loree states that it has been the company's policy for many years to acquire coal lands as opportunity offered. So far as could be ascertained there were no available tracts in the Lackawanna or the Wyoming valleys. The only tracts which could be found were in Schuylkill county, Pa., which is south of Wilkesbarre and is not now reached by the Delaware & Hudson lines. Here nine tracts were acquired, which are named and each described. They include 2,434 acres of surface area and 3,461 acres of coal land area, with an estimated mineable tonnage of 423,265,353 tons of coal. It was estimated that on December 31, 1904, the unmined tonnage of the Delaware & Hudson amounted to 218,644,286 tons, and mining has been going on rapidly since that time. It can easily be seen, therefore, that the new coal lands are a large and substantial reserve for the company to fall back upon as its previously owned supplies become exhausted. The total cost of the new properties was $5,219,-850, which amounts to 1.23 cents per estimated mineable ton. These new properties are owned by the Schuylkill Coal & Iron Company and the Shanferoke Coal Company, all of the stock of both of which is owned by the Hudson Coal Company, all of the stock of which is owned by the Delaware & Hudson.

Each of the new railroad properties which has been bought is described in detail, with a separate map, a chart showing earnings, and a description of its organization, property, mileage and traffic with, in the case of the electric roads, information under the additional heads of population and franchises.

Of the steam railroads bought, the largest is the Quebec, Montreal & Southern, which, as shown on the accompanying map, runs from Noyan Junction, at the northern end of Lake Champlain, and also from Montreal, to Pierreville on the St. Lawrence river below Montreal. From here an extension, which is to be finished about July 1, is being built to Ste. Philomene, 48½ miles. Eventually the line is to be extended to Levis and across the river to Quebec. Including the extension now under construction, the Quebec, Montreal & Southern has 206 miles of line. This road was bought "for the purpose of protecting the supply of pulp wood necessary for the continued operation and enlargement of the paper mills already located along the line of the Delaware & Hudson." The extension now building will draw supplies of wood both from the Lotbiniere & Megantic Railroad at St. Philomene and also from the northern side of the St. Lawrence by floats, thus tapping the great pulp supplies of that northern country. The line when finished to Quebec will also be, in connection with the Delaware & Hudson to Albany, and the New York Central from Albany to New York, the shortest line between Quebec and New York. As an unimportant local road the Quebec, Montreal & Southern is now earning a little over operating expenses, and the new extension should bring a large increase in earnings and in profits. Its gross earnings in 1907 were about $300,000. It is evident that the acquisition of this road was largely a protective measure. An estimate is given showing the total revenue of the Delaware & Hudson from the paper mill industry to be $2,800,000 a year. Unless the raw material supply of these manufacturers is protected their traffic cannot be retained by the road.

The Napierville Junction Railway, the second of the new properties, was organized to build a connecting line from the United States boundary one mile north of Rouse's Point, N. Y., to St. Constant, Que., 27 miles. St. Constant is about 20 miles southwest of Montreal. This connection from Rouse's Point to St. Constant has now been built, and negotiations are under way for trackage rights over the Grand Trunk from St. Constant to Montreal.

The Greenwich & Johnsonville runs from Johnsonville, Washington county, N. Y., on the Fitchburg division of the Boston & Maine, north to Greenwich, and from Greenwich, both east to Salem on the Rutland branch of the Delaware & Hudson, and west to Schuylerville on the Hudson Valley (electric) Railway, a total of 34 miles. In 1907 it had gross earnings of about $95,000 and net earnings of about $40,000. It runs through a farming country and there are about 20 manufacturing industries on the line, with numerous possibilities for further industrial development.

The electric roads controlled by the Delaware & Hudson are shown in the map on page 565, which also includes the Delaware & Hudson steam lines in their vicinity. The two services supplement each other in passenger service. President Loree states that the net income of all the electric lines controlled by the Delaware & Hudson is equivalent to a little over 4 per cent. on their cost. Returns on the Hudson Valley are only 3 per cent., but measures are actively under way to increase earnings and reduce expenses on this property, and it is believed that these results can be materially improved.

The United Traction Company operates the street railway service at Albany, Rensselaer, Watervliet, Troy, Lansingburg, Green Island, Cohoes and Waterford, N. Y., and maintains interurban service between these places, carrying freight and express as well as passengers. Its gross earnings in 1907 were about $2,000,000, and its net earnings about $900,000. By its ownership of the local lines it controls the entrance of other electric lines into Albany and Troy. The Albany & Hudson, the Schenectady Railway, and the Hudson Valley all have contracts for use of its tracks. It is evident that it is by far the most profitable of the Delaware & Hudson's electric railways.

The Hudson Valley Railway runs from Waterford, N. Y., from which it has entrance into Troy over the tracks of the United Traction Company, north to Warrensburg. Between Mechanicville and Glens Falls it has two lines, one via Schuylerville, the other via Saratoga. The Saratoga line is not continuous, but passengers have to walk across Broadway, in that city. The mileage operated, including short branches, is 127 miles, of which five miles is trackage rights of the United Traction Company, and six miles, Delaware & Hudson trackage. The company owns the Warren County Light, Heat & Power Company, which has valuable franchises for transmitting power across country which could not be acquired by an electric railway, the Fort William Henry Hotel and Park on the southern end of Lake George, and two other amusement parks. In 1903 its gross earnings were about $295,000 and its net earnings about $20,000. Last year its gross earnings were about $625,000 and its net earnings about $230,000.

The Schenectady Railway is owned by the Delaware & Hudson and the New York Central & Hudson River jointly, the New York Central interest being held by the Mohawk Valley Company. It owns the local street railway system of Schenectady and lines from Schenectady to Albany, from Schenectady to Troy, and from Schenectady to Saratoga, of which the Schenectady to Albany line is a strong competitor for passenger service of the main line of the New York Central. It gives the Fonda, Johnstown & Gloversville an entrance into Schenectady. It does a profitable package express business. Its gross earnings in 1907 were about $1,120,000, and its net earnings about $260,000.

The Troy & New England operates an unimportant electric line from Albion, a suburb of Troy, to Averill Park, a new "real estate" suburb further out. At Albion it connects with the United Traction Company. In 1907 its gross earnings were about $32,000 and its net earnings about $7,000. Its main value to the Delaware & Hudson is potential. It was chartered to build a line from Troy to State Line, Mass., and Pittsfield, on the Boston & Albany. This franchise would be valuable if the Delaware & Hudson should at any time desire to build a connection with the New York, New Haven & Hartford.

The Plattsburg Traction Company, which is shown separately on the map, operates eight miles of single-track electric line in the city of Plattsburg, N. Y., which has a population of about 10,000 people in addition to a large transient population. In the year ended June 30, 1907, its gross earnings were about $22,500 and its net earnings about $10,500.

It is evident that the various purchases of coal lands, railroads and electric railways recently made by the Delaware & Hudson are part of a policy of expansion. The value of most of them lies in the future rather than in the present. The report does not give the cost of these various properties, so that it is impossible to judge whether their probable value is commensurate with the price paid for them, but it would appear that each one of them is desirable in the future development of the company. Completion of the Canadian line will give the Delaware & Hudson shorter through lines to Canadian points and will protect sources of raw materials for one of its most important manufacturing industries. Ownership of the electric lines protects the most important local territory of the company. Ownership of the new coal lands insures a long extension of the most profitable part of the company's business. These purchases were made previous to the connection of Mr. Loree with the property; they are likely to be worked out to successful use under his direction.

In buying all these properties and making the various improvements mentioned, a considerable floating debt has been formed. Loans payable on December 31, 1907, amounted to $10,800,000, a new item, which did not appear on December 31, 1906. In order to meet these debts and other needs, the stockholders have been asked to authorize, on May 12, 1908, a first and refunding mortgage securing not more than $50,000,000 35-year (or longer) 4 per cent. bonds, the present issue of which is to be limited to $20,000,000. It is believed that these bonds will have a ready sale, for the credit of the Delaware & Hudson is high.

One of the strongest assets of the company at the present time is the fact that Mr. Loree is its president. His genius for railroad management has already been shown on the Delaware & Hudson, not only in the fine results obtained during the trying year of 1907, but by the monthly reports of earnings since the close of that year. The Delaware & Hudson is one of the very few roads to report increases in both gross and net earnings for the months of January and February, the latest months for which returns have yet been issued.

The results of the last two years' operation, not including the lines in Canada or the electric lines, are summarized below:

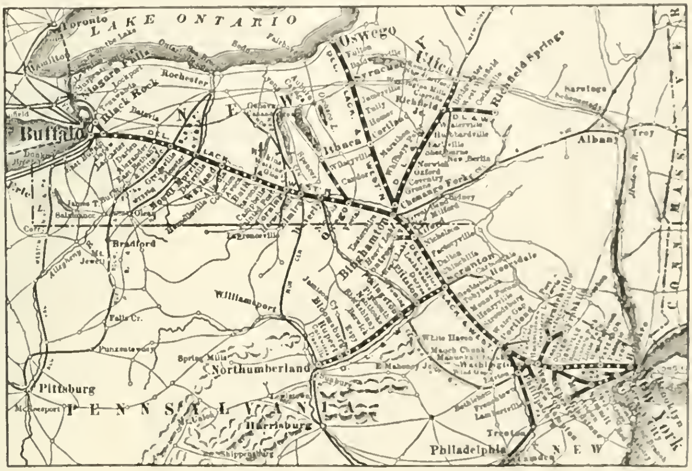
	1907.	1906.
Mileage worked	845	843
Passenger earnings	$2,945,408	$2,814,082
Coal freight earnings	9,081,664	6,665,732
Merchandise f't earnings.	7,533,169	6,949,898
Railroad gross earnings.	20,175,791	17,050,029
Maint. way and structures	1,836,871	1,388,884
Maint. of equipment	2,336,273	2,016,386
Conducting transportation.	7,227,310	6,504,653
General expenses	375,761	368,287
Railroad operating expenses	11,776,214	10,278,211
Railroad net earnings	8,399,579	6,771,819
Gross earnings, coal department	23,184,766	18,571,342
Net earnings, coal department.	1,173,206	1,209,519
Net earnings, railroad and coal	9,572,785	7,981,338
Other income	1,468,996	1,405,672
Net income	6,466,173	5,156,138
Dividends	3,816,000	2,867,174
*Improvement appropriations	....	2,980,176
Year's surplus	2,650,173	Def 691,212

*The sums charged in 1907 to income (general profit and loss) for improvements are not given either separately or in totals. The company, however, reports a surplus for the year (increase in amount at credit of profit and loss) of $3,025,218, which, added to dividend payments of $3,816,000, is $375,045 larger than the net income of 1907. In 1906 there was charged for new railroad construction $884,910, and for new railroad equipment $1,592,683, a total of $2,477,594 in the railroad department. In 1906 there was also charged for unmined coal $262,663, and for advances on unmined coal $239,919, a total of $502,582 in the coal department. There was, therefore, a total of $2,980,176 charged to income and credited to the various accounts mentioned in 1906. At the same time the company reported a surplus for the year of $493,801, which, added to the dividend payments of $2,867,174, is $691,212 larger than the net income for 1906. This difference is accordingly shown as a deficit for that year.

Delaware, Lackawanna & Western.

The Lackawanna to-day occupies probably a stronger financial position than any other American railroad. The profits from its anthracite coal mines are very large. They were particularly large during the year ended December 31, 1907. The production and the movement of anthracite coal has been little affected by the panic and industrial depression, so that the Lackawanna has had more favorable earnings than most other companies during the last few trying months. With a surplus for 1907 of $4,850,000 after a betterment appropriation of $3,820,000 the company is in a position to continue important improvements which were under way in more prosperous times.

This is a very great advantage for not only do materials and labor cost less than they would have one or two years ago, but improvements can be made more cheaply when there is not a rush of traffic. The average railroad makes large improvements only when forced to do so by pressing necessity of the breakdown of its facilities. New work is undertaken at a time when traffic is congested, costs are high and efficiency is low. When industrial depression comes, all improvements which have not progressed too far are indefinitely postponed. In this way the average railroad gets the least for its money and goes through the same experience on each recurring wave of increased traffic, never having sufficient facilities to meet its needs in busy times. By having sufficient resources to carry on improvement work during dull periods, a railroad gains a large advantage both in doing its new work better and more cheaply and also in being ready for great increases of traffic when they arrive. The Pennsylvania in carrying out the improvement work mapped out by Mr. Cassatt early in 1903 put itself in position to handle smoothly the immense traffic of 1906 and the first half of 1907. The Lackawanna is in an even stronger position in that it can continue improvement work even in the present trying times. It is probably the only railroad company, for instance, which is planning to begin work at once on an important cut-off.



Delaware, Lackawanna & Western.

This new line, 29 miles long, is to be built from a point between Dover, N. J., and Hackettstown, to a point near Portland, Pa. This section is the most congested part of the main line. The present line is crooked and hilly and has two tunnels, one of them a single-track tunnel operated on a gauntlet. The new line is to have reduced grades, light curvature and no tunnels and be 11½ miles shorter than the present line. About three years will be required for its construction. According to President Truesdale, "It is believed that contracts for the construction of this new line can be let to advantage in the near future, and that by the time it can be completed it will be urgently required to satisfactorily handle the company's traffic, which has been growing so rapidly in recent years that during the past year the capacity of the road for economical and satisfactory operation was reached for several months in succession."

Gross railroad earnings were $4,300,000 larger than ever before in the company's history. They were $37,300,000, against $33,000,000 in 1906, an increase of 13 per cent. Operating expenses increased $2,600,000, or 14 per cent., leaving net earnings of $15,700,000, against $14,100,000 in 1906, a gain of $1,700,000, or 12 per cent. Net earnings of the coal department were $4,200,000, against $2,700,000 in 1906, a rise of 56 per cent. The total income available for fixed charges and dividends was $20,900,000, against $17,600,000 in the previous year. During the year $438,000 first consolidated mortgage 7 per cent. bonds of the Oswego & Syracuse and also the outstanding $3,067,000 consolidated (then first) mortgage bonds of the Delaware, Lackawanna & Western matured, leaving the company without any bonded indebtedness of its own issue. There was a decrease in the item of interest on bonds of 32 per cent., and this item will disappear entirely in the income account for 1908. Net income was $13,900,000, which is equal to 53 per cent. on the stock, and this after including in operating expenses $2,000,000 for extraordinary expenditures. Dividends of 20 per cent. were paid. Last year renewals and betterments amounting to $3,800,000 were charged against income and in 1906 renewals and betterments amounting to $5,600,000. The surplus for 1907 was $4,850,000, against $590,000 in 1906.

As on the Delaware & Hudson, both gross and net earnings were the largest in the history of the company. One particularly favorable development was the fact that the increase in earnings from merchandise freight was larger than in any previous year, amounting to 18 per cent. This increase would have been larger if it had not been for the great falling off in general traffic during November and December. Coal freight earnings increased 11 per cent., passenger earnings 9 per cent., express earnings 7 per cent. and earnings from transportation of milk, which amounted to $786,000, or more than the express earnings, increased 2 per cent. Alone the mail earnings decreased, by 3 per cent., and Mr. Truesdale takes occasion to remark that the service required by the post office department is more expensive and exacting than ever before, while at the same time the pay has been reduced.

As against the increase of 13 per cent. in gross earnings, operating expenses increased 14 per cent. The cost of maintenance of way was substantially the same as in 1906. The cost of maintaining equipment increased 28 per cent. and of conducting transportation 17 per cent., while general expenses increased 6 per cent. The Lackawanna includes such a large proportion of improvements in its maintenance of way account that this division of operating expenses by no means represents the costs necessary to keep the road in condition for operation. Betterments and additions costing over $2,000,000 were included in operating expenses and most of these were in maintenance of way. Including these, maintenance of way cost $5,198 per mile in 1907 and $5,160 in 1906. These are very high figures. They indicate the extensive improvement work that is being carried out by the Lackawanna.

Unit maintenance of equipment expenditures are not high as compared with other roads, but the splendid condition of the company's equipment is responsible for this. Repairs cost $1,722 per locomotive, against $1,461 in 1906; $628 per passenger car, against $472 in 1906, and $59 per freight car, against $46 in 1906. The increase in the cost of each of these items was probably largely caused by higher prices for labor and materials. During the last two years there have been bought and paid for out of income, 75 new locomotives, 69 passenger train cars, and 6,688 freight cars. A reason for the increase in cost of locomotive repairs was the fact that during several months of the year the business handled taxed the capacity of the motive power to the utmost, a condition under which locomotive repairs increase disproportionately.

Although freight traffic has about doubled during the past nine years, the total number of freight cars owned is about the same as at the beginning of the year 1900. The modern cars have from 60 to 100 per cent. greater capacity than those generally in use in 1900. They are not, however, regularly loaded to their full capacity, so that to a considerable extent the large increase in tonnage handled, with no increase in the number of cars owned, has been due to more efficient handling of equipment.

Conducting transportation increased in every item but one, and that an unimportant one. Most of the increase was due to advance in wages. It cost more to mine anthracite coal, and bituminous coal bought was more expensive than during the previous year. Although there were no serious accidents during the year, the loss and damage account was considerably larger, due, Mr. Truesdale believes, to the fact that railroads are being constantly held to stricter responsibility for accidents to persons or damages to freight.

Under general expenses, salaries of clerks and attendants increased 31 per cent. This was partly due to an increase in pay and partly to the larger forces which had to be employed to meet the requirements of various railroad commissions. Mr. Truesdale remarks that, "The public generally little appreciates how great and onerous this burden is steadily growing upon the railroads."

There was an increase of 15 per cent. in the number of tons of coal carried one mile and of 19 per cent. in the number of tons of merchandise freight. The ton mile rate on coal was 8.48 mills, and on merchandise 6.82 mills, which is a reversal of this relation on most roads. The train load was 490 tons, against 466 tons in 1906. The earnings per freight train mile on all freight were $3.53, against $3.21 in 1906, and $3.01 in 1905.

Improvements which were carried on during the year included the general rebuilding of about 35 miles of the most important telegraph lines, work on the new terminal at Hoboken, both for passengers and freight; construction of a second double-track tunnel through Bergen Hill, which is to be finished by the end of the summer; new third track up the west side of the Pocono mountain, from Moscow, Pa., to Gouldsboro; new shops, passenger station and office building at Scranton, including general rearrangement of yards, and new block signals. The new locomotive repair shops at Kingsland, Pa., were put in service during the year.

Mr. Truesdale discusses the railroad outlook for 1908 at some length. Part of his remarks have already been quoted in the *Railroad Gazette* (March 6, 1908, page 325). It has always been his custom to speak frankly about these matters. He believes that the railroads are being used as the playthings of politicians.

The following table shows the income results for the past two years:

	1907	1906.
Mileage worked	957	957
Passenger earnings	$9,757,596	$8,216,224
Coal freight earnings	14,361,416	12,902,851
Mdse. freight earnings	12,235,868	10,342,423
Railroad gross earnings	37,264,473	32,962,880
Maint. way and structures	4,974,888	4,937,771
Maint. of equipment	3,731,082	2,909,335
Conducting transportation	12,254,278	10,563,943
General expenses	579,491	548,392
Railroad operating expenses	21,539,739	18,899,442
Railroad net earnings	15,724,734	14,063,438
Gross earnings, coal department	40,370,720	36,108,569
Net earnings, coal department	4,224,921	3,655,119
Net earnings, railroad and coal	19,949,655	17,718,557
Other income	940,234	844,256
Net income	13,909,415	11,378,691
Dividends	5,240,000	5,240,000
Improvement appropriations	3,820,088	5,551,619
Year's surplus	4,849,328	587,072

NEW PUBLICATIONS.

The History of State Regulation in New York. Being Appendix J to the Report of the Public Service Commission of the First District. New York: 1908. Paper; 20 pages; 5¾x9 in.

This pamphlet has a very considerable value to the historian, since it collates not only the facts of state regulation in New York in past years, but includes a brief history of the principal rapid transit enterprises in the state and a summary of the rapid transit acts.

The Earning Power of Railroads. 1908 edition. Compiled and edited by Floyd W. Mundy, of Jas. H. Oliphant & Co., New York. 376 pages, 5x7. Cloth.

This statistical volume presents in comparative form the income accounts of 131 railroads, comprising most of the mileage of the country, and adds notes on their financial and physical history. The careful student may not always fully concur in some of the methods of derivation, but the value of the book is intended rather to be in its usefulness for quick reference. Its approximations of earnings, different classes of expenses, and capital, on a per-mile basis, are readily available.

Interborough-Metropolitan Company. A chart compiled in the statistical department of Kountze Bros., Bankers, New York, by M. E. Hatfield, Statistician.

This chart, which is dated March 1, 1908, and has just been issued, was compiled from information obtained from authorized accounting officers of the Interborough-Metropolitan Company. It sums up in complete form the various companies in this merger of subway, elevated and surface lines in New York City and the territory north of it. The Interborough-Metropolitan Company is described as "a business corporation and not a railroad corporation." A summary shows in one table all the various companies, their mileage, their stocks and bonds and the proportion owned directly and indirectly by the Interborough-Metropolitan, annual interest charges, guaranteed rentals and total fixed charges of each company. The chart is an exceedingly painstaking piece of work and gives a clear view of the whole traction situation. A similar chart, though not as extensive in its information, which was compiled by the Public Service Commission, is published in another column.

Graphical Handbook for Reinforced Concrete Design. By John Hawksworth, C.E. New York: D. Van Nostrand Co. 61 pages, 9 in. x 11 in.; 15 plates; cloth. Price, $2.50.

The object of this book is to present a short cut to concrete designing, and it is intended chiefly for those architects and engineers whose work in this material is intermittent and does not warrant the steady employment of a concrete engineer. In such offices the use of a graphical handbook like this should render it unnecessary to call in expert assistance for the solution of the class of problems that are ordinarily encountered.

The book opens with an introduction in which there is a general discussion of the methods employed in the development of a reinforced concrete design and a broad statement of the basis for the several plates that follow. In the presentation of these plates, one scheme is invariably followed. A general and detailed description of the plate is first given, followed by discussion of what it is intended to accomplish. Usually some general data are assumed. For example, in the plates for the determination of the dimensions of hooped concrete columns, one plate assumes the longitudinal reinforcement at six equally spaced rods set around the outside; in another, the assumption is that there are to be eight such rods. With these data alone the plate is such that, for a given load, the diameter of the column, the diameter of the longitudinal rods, and the diameter and pitch of the hooping wires can be at once determined. The same thing can be done in the determination of the resisting moments, spacing of bars, bending moments, location of the neutral axis, shearing resistance of various combinations of concrete and steel, square columns with various unit stresses, square columns in accordance with the New York building code and various other matters concluding with the work of designing a reinforced concrete structure.

For those who are not disposed to accept such plates and tables as these on faith, there is an appendix in which the formulas upon which the plates are based are given and the methods of their determination fully discussed. The book will, therefore, serve two classes: those who do not care to check results, and those who are cautious and careful enough to be sure that they are right before going ahead. Hence its value for rapid calculations is very great, and in this respect will compare with the slide rule as a means for facilitating calculations where, if the instrument is properly graduated, the results are invariably accurate. In the same way, with a given plate, accurately drawn, the results must be true, and these plates ought to be useful in place of the elaborate and somewhat complicated calculations now employed.

The Strength of Chain Links.—This is the subject of Bulletin No. 18 of the Engineering Experiment Station of the University of Illinois. A series of experiments on chain links and circular rings, covering a period of two years, has been made for the purpose of confirming or disproving a theoretical analysis of the stresses in links and rings. A comparison of calculated and measured distortions affords the desired test. The result of the experiments is a complete confirmation of the analysis. Having a reliable theory, the bending moments and maximum stresses are calculated for links of various forms and the results of such calculations are applied to the formulas for the loading of chains given by Unwin, Bach and Weisbach. It is shown that the usual formulas for chain loads give maximum tensile stresses of 33,000 to 40,000 lbs. per sq. in., and maximum compressive stresses of 60,000 lbs. per sq. in. New formulas for safe loads are proposed. The bulletin has four appendices giving in full the theoretical discussion which is the basis of the experimental work. This bulletin will be of special interest to all engineers and manufacturers concerned in any way with hoisting and transmission. Copies may be had upon application to the Director, Engineering Experiment Station, Urbana, Ill.

CONTRIBUTIONS

Rolling a Compound Rail Section.

Crafton Station, Pittsburgh, Pa., April 6, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

During the recent Maintenance of Way convention, inquiries were made concerning the three bearing angles on the Heinle rail. A number of railroad men and rail manufacturers are as yet unable to see how these angles can be made practical.

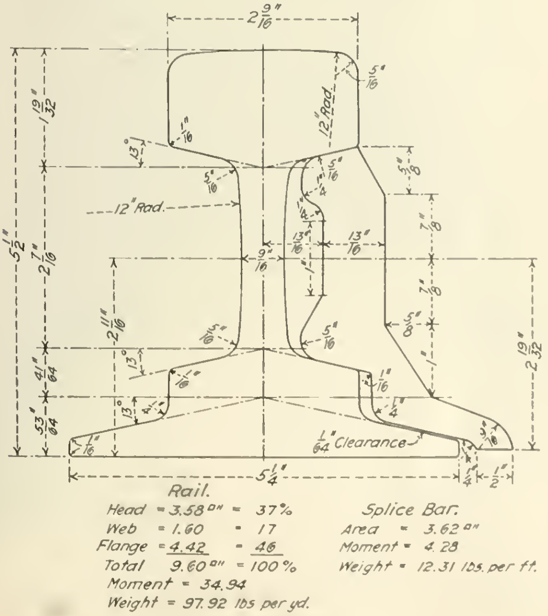
As explained in my communication in the *Railroad Gazette* of January 31, 1908, the standard flange is formed by lateral compression by the rolls, which churn the metal through the passes. The effect of this is to rapidly wear those roll surfaces depended on for accuracy, and, besides, to set up all kinds of internal strains in the metal while it is elongating. The mechanical disparities and the uneven cooling make the use of camber necessary; these influences also alter the relative position of all angles.

In rolling the Heinle section, no such mechanical difficulties are encountered; all angles are necessarily in the solid metal in the roll groove, and, therefore, all integral parts are elongated at the same rate of speed. This eliminates longitudinal tensions. There is no distortion, the cooling is uniform, and there is far less wear on the roll surfaces. Angles are not varied so much and there is more chance for accuracy, because there is less mechanical strain.

The conformation of the Heinle rail is easy on the rolls and material, and does not call for unnatural means to produce true sections. The purchaser will receive a structurally good article in spite of the present practice.

I intend that the third or lower angle on the splice bar shall be set off about 1/64 in. from the angle of the flange, so that the other two main bearing angles will engage the rail first. After they are drawn home, the third angle is brought to bear. This extra precaution will allow for variation in the section.

A. W. HEINLE,
Consulting Roll Turner



Heinle Rail and Splice Bar.

Record Steam Shovel Performance.

Abbottsford, B. C., April 3, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I should like to call your attention to a record for March made by a one and one-quarter yard traction shovel now working on the V. V. & E. construction between Cloverdale, B. C., and Sumas, Wash. During the 26 working days this shovel loaded a total of 62,000 yards, making an average of nearly 2,400 yards per day. The best day's work totaled 3,340 yards and the poorest one was 1,536 yards, the day consisting of two 10-hour shifts. During this time the shovel made four cuts, necessitating four "move backs." The usual delays were experienced such as derailments, shooting down the bank, etc. The shovel was served by two 10-car trains making an average haul of 500 ft. The material handled was fine gravel with some loose rock, but at several points blue clay streaks were encountered making the dumping of the cars somewhat slow. The work was in charge of Mr. J. P. Livingston for the Puget Sound Bridge & Dredging Co., of Seattle. I should be glad to know if you have knowledge of any records equaling this for the same sized shovel.

W. J. COLVIN.

(The *Railroad Gazette* will welcome letters from any of its readers who know of any steam shovel performance as good as this. —EDITOR.)

Economy of Better Rails at Higher Cost.

Philadelphia, Pa., April 13, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The problem of securing a better quality of steel in rails is one in which both the manufacturers and the consumers are always interested, particularly at this time, when wheel loads have apparently approached very closely to the limit of endurance of Bessemer steel. One of the elements in this problem is the question how far the price of steel can be increased to secure a given increase in the life of the rail. At first thought, one would say that a rail lasting 10 times as long as the ordinary rail would be worth 10 times as much. This off-hand conclusion, however, is quite erroneous.

Assuming the life of ordinary rail (costing $28 per ton at the mill) to be 5.8 years, and that its net cost per ton in track (including labor, and deducting the value of scrap received from track) is $23, its net cost for a period of 58 years (or 10 times the life of an ordinary rail) would be as follows:

10 tons ordinary rail at $23 per ton (in track)	$230
Compound interest, at 5 per cent, on ten successive investments of $23 each, intervals of 5.8 yrs.	1,257
	$1,487

Now, as $88 at compound interest for 58 years at 5 per cent. would = $1,491, it is evident that it would not be economical to pay more than $88 net cost in track (or $93 at the mill) for rail which would last 58 years. Hence, in this case, 10 times the life would not justify more than 3⅓ times the price.

Again, assuming the same figures as above for the cost and the life of ordinary rail, we find that $70 at compound interest at 5 per cent. would amount, in 5.8 years, to $93, so that this $70, invested, would perpetually renew the ordinary rail. Therefore, as we could pay $23 for a ton of ordinary rail and capitalize its perpetual renewal by a further investment of $70 making a total investment of $93, we could not afford to pay more than $93 net cost in track (or $98 at the mill) for rail which would last forever.

The formula below affords a convenient method of ascertaining what price could, economically, be paid for any special long-lived rail.

Let a = Net cost per ton of ordinary rail in track.
b = Life, in years, of ordinary rail.
c = Proportionate life of special rail.
("bc" would, of course, equal assumed life of special rail.)
x = Net cost per ton of special rail in track (to equal ordinary rail in economy).

Then,

$$\frac{\text{"ac" + comp. interest on "c" investments of "a" at "b" intervals}}{\text{Amount of \$1 at compound interest for "bc" years}} = x$$

Assuming that "a" = $23 and "b" = 5.8 years, and computing interest at 5 per cent., the corresponding values of "c" and "x" would be as follows:

"c"	"x"	"c"	"x"	"c"	"x"	"c"	"x"
2	$40	6	$76	10	$88	14	$91
3	54	7	80	11	89	15	92
4	63	8	83	12	90	z	93
5	70	9	86	13	91		

J. CRAIG CRAWFORD,
Assistant Engineer, Penna. R. R.

New Automatic Block Signals on the Erie Railroad.

The main line of the Erie Railroad between Jersey City and Middletown passes through Rutherford, Passaic, Paterson, Ridgewood, Suffern, Tuxedo and Goshen. There are two main tracks from Jersey City to Hackensack river bridge, 3.1 miles; four from Hackensack river bridge to Rutherford Junction, 4.8 miles; two from Rutherford Junction to Ridgewood Junction, 11.1 miles; four from Ridgewood Junction to Suffern, 11 miles, and two from Suffern to Middletown, 35.7 miles. The Bergen county cut-off, double-track, is a shorter line (10.3 miles) between Rutherford Junction and Ridgewood Junction.

Another division is the New Jersey & New York railroad, leaving the main line of the Erie about eight miles out of Jersey City, running north. It is double-tracked to Oradell, 19 miles. Automatic block signals, protecting the main tracks, have now been installed in all this territory, aggregating over 200 miles of track. The installation was made by The Hall Signal Company under the direction and specifications of W. H. Willis, the signal engineer of the railroad company.

The signals are of the electric motor semaphore type, with straight posts, set alongside the track, where there are two tracks, and carried either on overhead bridges or on bracket posts, where there are four tracks. The installation is the usual home and distant application without overlap. Between Jersey City and Suffern the average length of block is about one-half mile, and ordinarily a home and a distant signal arm are mounted on one post. Between Suffern and Middletown the average length of block is about 6,000 ft., and between stations some of the blocks are two miles long; and as a rule distant signals have separate posts. Pipe connected Hayes derailers are installed in all sidings leading to main track at about the fouling point, and there are indicators at all switches.

Within the territory protected by automatic signals are a large number of interlocking plants, the high signals of which are electrically slotted to work as block signals as well as interlocking signals. In each interlocking cabin there are annunciators, which indicate the approach of trains on the main tracks, and indicators, which repeat to the signalman the condition of each block controlled by a semi-automatic slotted signal. The signals are arranged on the normal danger plan. The home control wire is carried through a normally closed circuit contact on all facing switches. All switches, when moved from their normal position, shunt the track circuit. Wherever possible, switch indicators are operated in parallel, which permits the use of the same resistance for all electro-magnet windings.

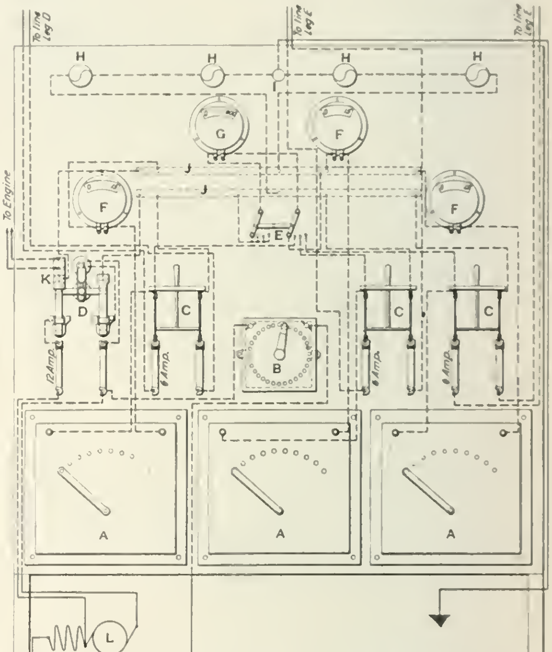
Indicator circuits are controlled from the home signal, which is at the entrance of the block in which the indicators are, in such manner that the indicators are set at stop when the home signal clears. The approach of a train to the home signal will not set the indicators at stop if the home signal remains at stop.

The line wires are carried on a line of cross-arms underneath the other wires on the telegraph pole line. They have triple braid weatherproof insulation. No. 10 B. & S. G. hard drawn copper wire is common for all signal circuits and No. 12 B. & S. G. hard drawn copper is used for all other purposes, except for battery charging wires. The charging wires are of various cross-sections, Nos. 10, 8 and 6 hard drawn copper, and are carried one at each end of the cross-arm for the signal wires.

All wires for connections to track and between pole line and instruments are soft drawn copper with okonite insulation and are carried in pine trunking supported on oak stakes. No. 14 B & S. G. wire with $^{5}/_{64}$ in. wall of rubber and one braid connects the pole line wires to the various instruments; No. 9 B. & S. G. wire with $^{5}/_{64}$ in. wall of rubber and one braid connects the charging wires on the pole line with the charging switches; and No. 6 B. & S. G. wire with ½ in. wall of rubber covered with one braid is used for all track connections. The braid on the common wire is red; on all other wire it is black.

Gravity battery, two cells for each section, operates all track circuits and is sheltered in cast iron chutes 7 ft. deep set in the ground in the usual manner.

Storage battery is used on all circuits other than track circuits. It is the Electric Storage Battery Company's Chloride Accumulator P T type box negative for 21 ampere hour capacity, excepting on the New Jersey & New York, where Westinghouse battery of a similar type is used. Each battery consists of five cells



A—Ward-Leonard special line resistance boxes, 61 ohms.
B—Generator field rheostat.
C—Charging line switches.
D—Double-pole underload circuit breaker — opens on 1 ampere.
E—Four circuit voltmeter switch
F—Charging circuit ammeter Weston Style 21 am.
G—Voltmeter.
H—Ground detector lamps, 250 volts.
I—Ground detector push button.
J—Bus bars.
K—Engine igniter, circuit breaker.
L—Generator.

Power Switchboard for Erie Railroad Block Signals, Ridgewood, N. J.

connected in series and there are only two plates in each cell. The positive plate of one cell is connected to the negative plate of the adjacent cell with one piece of heavy lead tape, the ends of which are welded into the plates. Thus there cannot be a poor contact in the connection between cells as is sometimes the case with bolted connections.

At signals the storage battery is sheltered in the iron case that supports the signal; at crossing bells, remote from signals, specially constructed iron cases are provided; in interlocking cabins the battery is in a cupboard in the basement of the building.

In no case are signal circuits operated from batteries that supply crossing bells. As a rule there is a battery at each one-arm or two-arm automatic signal. All storage battery is in duplicate, one set being charged while the other set is discharging.

Cells of 21 ampere-hour capacity were decided upon because it was desirable to charge them but once each week, and, on this basis for charging, this capacity was found to be sufficient for a possible maximum movement of 120 trains per day per track. At a few of the interlocking stations, however, because of the relatively large number of indicators and slots, it was found necessary to operate two sets of storage battery in parallel in order that the period of discharge be approximately the same as that for the battery on signals remote from the interlocking station.

The charging stations on the main line are at Rutherford Junction, Ridgewood Junction, Suffern, Oxford and Middletown; and on the New Jersey & New York, at Cherry Hill.

The illustrations show diagrammatically the location of the charging stations. It will be noted that the Middletown plant charges only one leg, or circuit, while all the others charge two, with the exception of the plant at Ridgewood Junction, which charges three legs, two on the main line and one on the Bergen County Railroad. It is expected that sometime in the future the automatic block signaling will be extended west to Port Jervis, in which event another charging leg will be added to the plant at Middletown. At Cherry Hill the limits of the north charging leg are to be extended with the signaling of the extension of the double-track north from Oradell.

Each charging leg, as shown, represents a maintainer's section, and the locations and limits for the charging plants were fixed upon mainly for this reason. Ordinarily all the legs, or circuits, served by one station are charged at the same time, but one leg can be charged at a time if so desired. Discharged battery is recharged as soon as it is cut out of service. Suitable switches are provided for cutting the discharged battery into the charging circuit and the reserve set, which is already charged, into the signal circuit. These charging switches are so constructed that the charging circuit cannot in any way become connected to the signal circuit; that both sets of battery may be cut in or cut out of the charging circuit at the same time; that one set of battery may be in the charging circuit while the other is in the signal circuit; or, that both batteries may be in parallel in the signal circuit.

Since the storage battery has a capacity of 24 ampere hours, the normal charging rate is three amperes. The circuits are designed so that the battery may be charged at this rate to a maximum of 2.6 volts per cell whenever it is considered desirable. The several legs of each charging plant are made to balance as nearly as possible so that there will be the same current in each. However, resistance rheostats are provided in series with the line so that, if for any reason the legs are out of balance, as would be the case if several sets of battery in one leg are cut out, balance could be obtained by throwing in resistance.

While the line loss in charging is considerable, it is not considered objectionable so long as the line voltage does not exceed 550.

The switchboard shown in the diagrammatic view is that at Ridgewood Junction. All the other switchboards are similar except that they provide for two charging legs whereas this board provides for three.

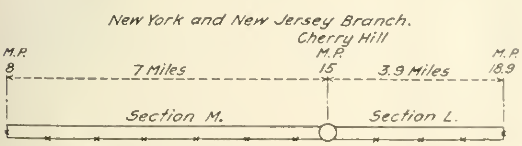
The electrical instruments and switches are of the usual isolated plant switchboard type mounted upon an extra quality heavy slate panel.

The circuit breaker, which is double pole, operates to open the generator circuit with a current of one ampere or less, and also takes the place of the usual generator circuit switch. Attached to one blade of the circuit breaker, as shown at K, is an insulated contact which opens the igniter circuit of the gasolene engine when the circuit breaker falls out. This avoids possible damage to machinery due to the engine racing when suddenly relieved of its load during the absence of the attendant.

The line rheostats have a total resistance of 64 ohms each, divided into equal steps. The resistance coils are built to withstand very high temperatures without injury.

All of the generators are of Crocker-Wheeler make. They are shunt wound, belt driven, and have a rated capacity sufficient to deliver six amperes at 550 volts, except at Ridgewood Junction, where the output is nine amperes at 550 volts. The gasolene engines driving the generators are Fairbanks, Morse & Company's vertical type. All of them are rated at 6 h.p., excepting that one at Ridgewood Junction, which is 9 h.p.

The storage-battery diagrams are as shown below. There are five cells of battery in each set and the maximum counter electromotive force is 2.6 volts per cell. The maximum current generated is 550 volts.



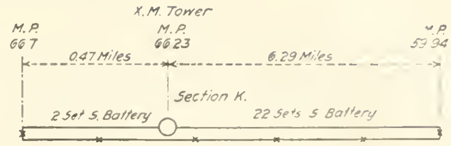
Section M.

Charging line	No. 10 B. & S. G.
Circuit resistance	70 ohms
Battery	15 sets
E. M. F. line drop	237 volts
Battery C. E. M. F.	195 "
E. M. F. generator termin'ls.	432 "
Charging rate	3 amperes

Section L.

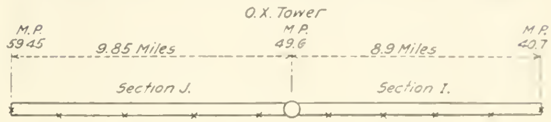
Charging line	No. 10 B. & S. G.
Circuit resistance	45 ohms
Battery	9 sets
E. M. F. line drop	135 volts
Battery C. E. M. F.	117 "
E. M. F. generator termin'ls.	252 "
Charging rate	3 amperes

Dynamo output .... 6 amperes.



Section K

Charging line	No. 8 B. & S. G.
Circuit resistance	54 ohms
Battery	24 sets
E. M. F. line drop	162 volts
Battery C. E. M. F.	312 "
E. M. F. generator terminals	474 "
Charging rate	3 amperes
Dynamo output	3 amperes



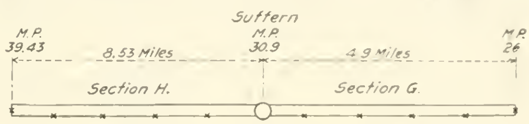
Section J.

Charging line	No. 6 B. & S. G.
Circuit resistance	50 ohms
Battery	28 sets
E. M. F. line drop	150 volts
Battery C. E. M. F.	361 "
E. M. F. generator termin'ls.	514 "
Charging rate	3 amperes

Section I.

Charging line	No. 6 B. & S. G.
Circuit resistance	47 ohms
Battery	28 sets
E. M. F. line drop	141 volts
Battery C. E. M. F.	377 "
E. M. F. generator termin'ls.	518 "
Charging rate	3 amperes

Dynamo output .... 6 amperes.



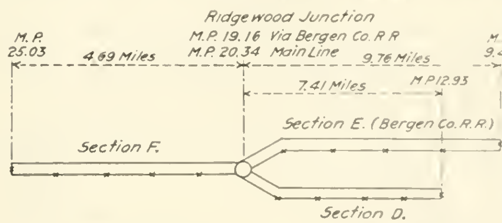
Section H.

Charging line	No. 6 B. & S. G.
Circuit resistance	46 ohms
Battery	28 sets
E. M. F. line drop	138 volts
Battery C. E. M. F.	361 "
E. M. F. generator termin'ls.	502 "
Charging rate	3 amperes

Section G.

Charging line	No. 10 B. & S. G.
Circuit resistance	56 ohms
Battery	28 sets
E. M. F. line drop	168 volts
Battery C. E. M. F.	364 "
E. M. F. generator termin'ls.	532 "
Charging rate	3 amperes

Dynamo output .... 6 amperes.



Section F.

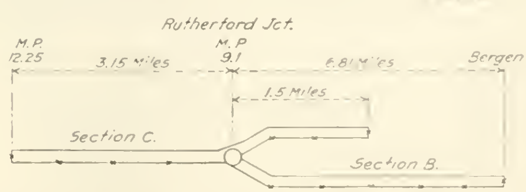
Charging line	(1) No. 8 B. & S. G.
Charging line	(1) No. 10 B. & S. G.
Circuit resistance	17 ohms
Battery	30 sets
E. M. F. line drop	141 volts
Battery C. E. M. F.	390 "
E. M. F. generator termin'ls.	531 "
Charging rate	3 amperes

Section E.

Charging line	No. 6 B. & S. G.
Circuit resistance	18 ohms
Battery	31 sets
E. M. F. line drop	144 volts
Battery C. E. M. F.	403 "
E. M. F. generator termin'ls.	547 "
Charging rate	[illegible] amperes

Section D.

Charging line	No. 6 B. & S. G.
Circuit resistance	[illegible] ohms
Battery	[illegible] sets
E. M. F. line drop	120 volts
Battery C. E. M. F.	[illegible] "
E. M. F. generator terminals	[illegible] "
Charging rate	3 amperes
Dynamo output	9 amperes



Section C.

Charging line	No. 10 B. & S. G.
Circuit resistance	57 ohms
Battery	27 sets
E. M. F. line drop	171 volts
Battery C. E. M. F.	351 "
E. M. F. generator termin'ls.	522 "
Charging rate	3 amperes

Section B.

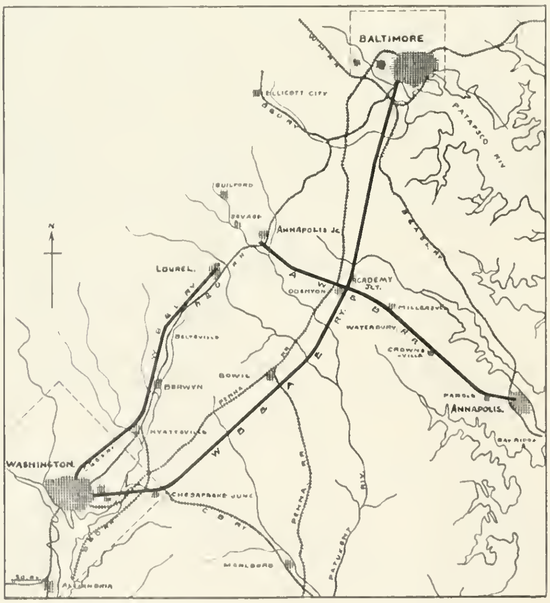
Charging line	No. 10 B. & S. G.
Circuit resistance	80 ohms
Battery	23 sets
E. M. F. line drop	240 volts
Battery C. E. M. F.	299 "
E. M. F. generator termin'ls.	539 "
Charging rate	3 amperes

Dynamo output .... 6 amperes

The Washington, Baltimore & Annapolis.

The Washington, Baltimore & Annapolis Electric Railway, the new 6,600-volt electric line which has been under construction (by three successive companies) for two or three years past, and which, on April 2, began running cars through between Baltimore and Washington, is now about finished. The company expects within a few weeks, in addition to the local cars, to run "limited" trains which will make no stops at way stations and will carry passengers from terminus to terminus, 38 miles, in one hour. This improvement in the service is delayed by the necessity of providing a number of additional cars and of further perfecting the track and roadbed. This improvement accomplished, the company, which thus far has not done much advertising, will actively bid for regular and excursion traffic between the two cities, and also from these cities to Annapolis, which, it is believed, should prove an attractive excursion resort. The officers of this road are not blind to the fact that the villages along the line between Baltimore and Washington are so small as to be almost beneath the notice of a passenger traffic manager, and they intend to pay special attention to the long-distance traffic, as just mentioned.

The cars now running, which start from either terminus every hour from 5.30 in the morning until 12.30 midnight, take one hour and 20 minutes, 25 minutes of this being consumed in the six miles of the line which lie in the streets of the cities. This low speed in the cities will, of course, be a limitation also on the express schedules, so that the 32 miles of the line which is on private right-of-way will have to be traversed by the expresses in 35 minutes. As the line is double-track and the track laid with 80-lb. rails, on good gravel ballast, this should be easily accomplished. As long as the business does not demand more than two trains an hour each way, the company proposes to continue to run by the time-interval and flagging system as at present; but the officers have in view the equipment of the line with automatic block signals, recognizing the necessity of using the space interval for dense traffic.



Washington, Baltimore & Annapolis Electric Railway.

The fare between Baltimore and Washington is 75 cents one way and $1.25 round trip. By the two existing steam railroads, the Baltimore & Ohio and the Pennsylvania, the one-way fare is $1.00 and the round trip $2.00, except on Saturday and Sunday, when it is $1.25. It is proposed to run the "limited" trains once an hour throughout the day. With such a service maintained with punctuality, and the freedom from smoke and cinders which constitutes such a strong "card" for electric lines in summer, the new line should be able soon to show what power it possesses to create new business and to take competitive business from its old and powerful neighbors.

The situation of the line as related to the steam railroads is shown in the sketch.

The length of the main line is 38 miles, which includes a trackage right over about four miles within the District of Columbia, owned by the Washington Railway & Electric Co. The Washington terminus is at 15th and H streets, N. E. From this terminus to the center of the city, at the Treasury Building, about two miles, passengers are carried on special cars of the Washington company.

The main line of the W., B. & A. is double track throughout and the tracks are laid with 33 ft. rails, weighing 80 lbs. to the yard. They are of A. S. C. E. section, and the ties are 6 in. x 8 in. All of the curves except one are of one degree or easier, and four-fifths of the main line is straight. There are no grade crossings, except in the case of two highways which are little used. The line at right angles to the main line, leading from the B. & O. to Annapolis, is a well-known and long-existing steam railroad, the Annapolis, Washington & Baltimore, now converted into an electric line. It is single track. From the junction with the B. & O. to that with the Pennsylvania this line has but a light traffic. From Academy Junction to Annapolis, 14 miles, the line is equipped with Blake electric signals, there being six meeting points. At Academy Junction the switches and signals are inter-locked by apparatus furnished by the General Railway Signal Co., of Rochester, N. Y.

The line between the District of Columbia and Laurel—the Washington, Berwyn & Laurel—is one which was bought by the present company, along with other properties, but it is operated by itself, having no traffic connection with the main line.

The capital stock of the W., B. & A. is $5,250,000, all owned in Cleveland, Ohio. The first mortgage bonds amount to $4,250,000, and the second mortgage bonds to $1,000,000. The President of the company is George T. Bishop, and the Vice-President and General Manager is J. W. Shannahan. Mr. Shannahan's office is at Baltimore, where the company has built a terminal station. This station, with offices in the second story, is at Liberty and Marion streets.

Special Shape Tool Steel.

The high cost of high-speed steels makes it necessary that these products should be used economically. It is in order to meet these requirements that the New Metal Tool Steel Co., Portland, Me., has put out a number of special shapes, so designed that the requisite strength to resist the imposed stresses is obtained, together with the necessary cutting surfaces and areas, while the metal is so disposed as greatly to reduce the weight as compared with the usual rectangular section. This steel is rolled in a wide range of sizes and in the seven general shapes shown by the illustration. By this means the saving effected amounts to about 43 per cent., in the case of the star section, as compared with round, and 57 per cent. as compared with square having the same over all dimensions.

Tools made from these profiles do not require any special tool holders with the exception of the V shape. This form is of especial interest to railroad officers as it is adapted for use in tire turning. With this shape, a holder or seat is used as shown, and it comes in bar form so that it can be cut off in lengths to suit requirements. The groove is made to fit the bottom of the steel, and the tool holder blocks in the lathe tighten down on the top of the tool, holding it in the usual manner, securely fastening it.


Profile High Speed Steel.

Foreign Railroad Notes.

The efforts to increase the performance of locomotives on the Prussian State Railroads have resulted in a comparatively short period in raising the average yearly mileage from 20,500 to 29,200 miles; but this has been attended, naturally, with a very large increase in the cost of repairs.

The Russian Ministry of Communications has introduced in the Duma a bill to provide for double-tracking the Trans-Siberian at an estimated cost of $80,000,000. The Ministry recently appropriated $5,500,000 for double-tracking about 400 miles of road from Slatoust, in the Ural mountains, east to Samara, on the Volga river.

The "Technolexikon," which the Society of German Engineers announced in 1901, inviting the co-operation of Americans and others, and which was to include the technical terms of all imaginable trades in German, French and English, is now given up, after an expenditure of $120,000, because it was found that it would need to be enormously large—an encyclopedia in size, rather than a dictionary. It is very true that to be complete it would need to be very large; but there is little doubt that, properly executed, it would be worth many times its cost. This is not saying that the money to pay for it could be had, however.

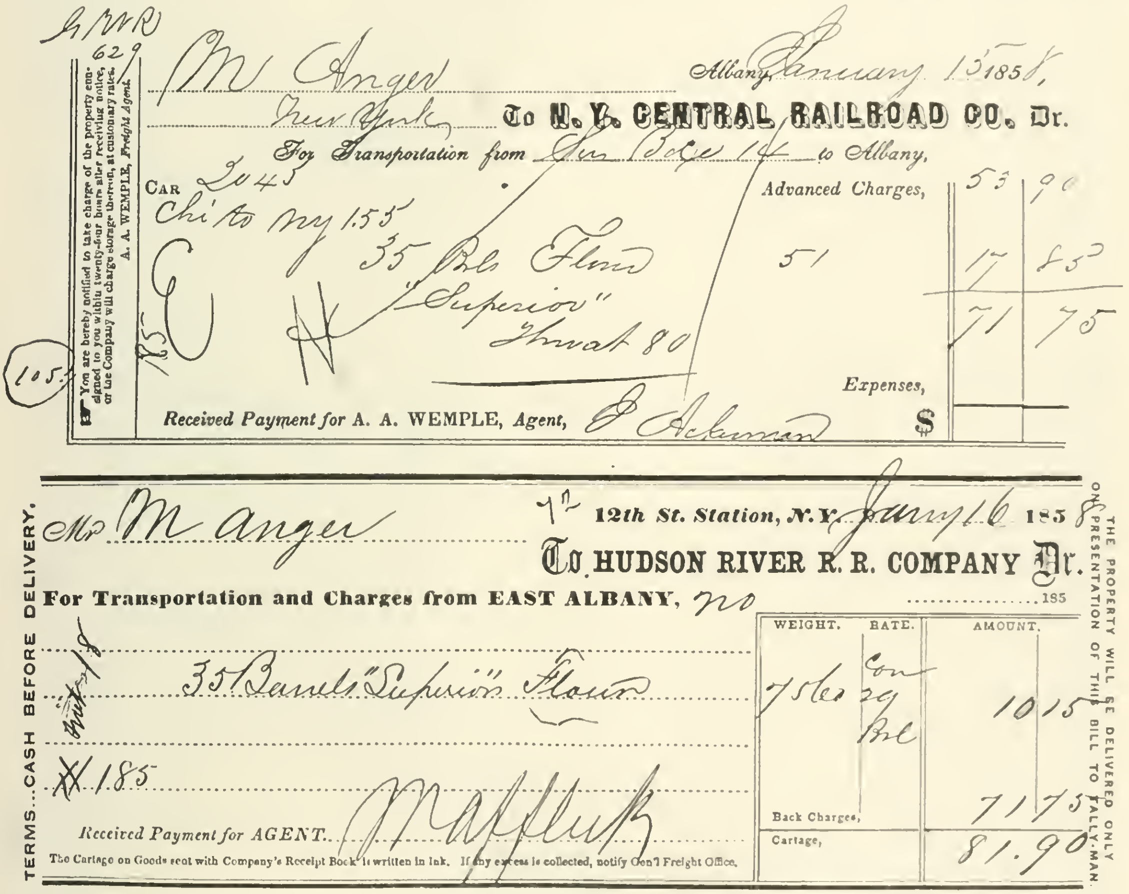
Two Freight Bills of 1858.

Two freight bills, one dated January 15, the other January 16, 1858, covering charges on a shipment of 35 barrels of flour from Chicago to New York, are reproduced herewith. The first covers the shipment from Suspension Bridge to Albany over the New York Central Railroad, including back charges from Chicago to Suspension Bridge, and the second covers shipment from East Albany to Twelfth street, New York City, over the Hudson River Railroad, the two parts of the present New York Central & Hudson River Railroad main line from Buffalo to New York being separate companies.

The striking thing about these freight bills is the difference between the freight charges 50 years ago and the freight charges now. These 35 barrels of flour were handled three times, and the freight charges were as follows:

Chicago to Suspension Bridge..........	per bbl.	$1.55	$53.90
Suspension Bridge to Albany	"	.51	17.85
Albany to New York	"	.29	10.15
		$2.35	$81.90

In contrast with this rate of $2.35 a barrel, the present freight rate on flour from Chicago to New York is 35 cents a barrel. The present cost of sending a full carload of flour from Chicago to New York is about the same as the cost of sending these 35 barrels in 1858.


G M R 629

You are hereby notified to take charge of the property consigned to you within twenty-four hours after receiving notice, or the Company will charge storage thereon, at customary rates. A. A. WEMPLE, Freight Agent.

M Anger — Albany, January 15 1858

New York — To N. Y. CENTRAL RAILROAD CO. Dr.

For Transportation from Sus Bridge 14 to Albany,

CAR 2045

Chi to NY 1.55

35 Bbls Flour "Superior" Thwat 80

Advanced Charges, 53 90

51 — 17 85

71 75

Expenses,

Received Payment for A. A. WEMPLE, Agent, E. Ackerman $

TERMS...CASH BEFORE DELIVERY.

Mr M Anger — 12th St. Station, N.Y. Jany 16 1858

To HUDSON RIVER R. R. COMPANY Dr.

For Transportation and Charges from EAST ALBANY, 185

WEIGHT.	RATE.	AMOUNT.
75 lbs	Con 29 Bbl	10 15
Back Charges,		71 75
Cartage,		81.90

35 Barrels "Superior" Flour

185

Received Payment for AGENT.

The Cartage on Goods sent with Company's Receipt Book is written in Ink. If any excess is collected, notify Gen'l Freight Office.

THE PROPERTY WILL BE DELIVERED ONLY ON PRESENTATION OF THIS BILL TO TALLY-MAN.

Two Freight Bills of 1858; New York Central Railroad and Hudson River Railroad.

The railroad in eastern China from Tien-tsin (the port of Pekin) south to Nankin seems assured. The Germans are to raise £3,150,000 for the northern 425 miles, which will connect with their railroad in the province of Shantung; and the English £1,850,000 for the 250 miles north of Nankin. The road, however, is to be a government enterprise, the Germans and English having inspecting engineers and accountants to assure that the security for their loans is adequate. The bonds, bearing 5 per cent., are offered at 98. This line will be nearly parallel with the existing Pekin-Hankow Railroad, and will be nowhere very distant from the Imperial Canal, which unites the Yang-tze and the Hoang-ho, passing through a thickly peopled and productive country, which has suffered terribly from floods since the Hoang-ho changed its outlet to the sea in 1852 to a point some hundreds of miles north of its old one.

French Railroads in 1905 and 1906.*

BY C. COLSON,
Engineer in Chief of Roads and Bridges in France, Councilor of State.

In the 10-year period from 1896 to 1905, gross earnings increased 23 per cent. in France; 26 per cent. in England and 54 per cent. in Germany. This does not show exactly the comparative increase in business in the three countries as the average rate per ton-mile has fallen 12 per cent. in France and only 7 per cent. in Germany. This decrease is continuing in France, but in Germany freight rates have been stationary since 1899. There are no statistics available, which show the average rate in England. It is true, however, that the increase in business in Germany is double to what it is in France and England. This condition is to be expected since the essential factors in growth of traffic are increased in people and commodities to be carried in the number of consumers and in the production of coal. In the 10 years referred to the population of Germany has increased 15 per cent., that of England 10 per cent. and that of France only 2 per cent. Coal production has increased 56 per cent. in Germany, 21 per cent. in England and 27 per cent. in France. In the United States during this period, gross earnings have increased 89 per cent. while the population has increased 19, and coal production 87 per cent.

In 1905, expenses in England and in Germany increased proportionately slightly less than earnings and in France slightly more. The railroads in France had made particular efforts to reduce expenses in previous years, so that there was less room for improvement. The returns on capital invested remain at 4 per cent. in England; increased to 4.3 per cent. in France and was more than 6 per cent. in Germany, where construction has been much easier

*From a paper "Review of Traffic Questions" in the *Revue Politique et Parlementaire*. Reprinted in the *Bulletin of the International Railway Congress*.

and cheaper than in France. The accompanying table shows the comparative results of operation in France, England and Germany during 1903, 1904 and 1905.

The estimates for 1906 show that earnings have increased about $20,000,000* in England, $40,000,000 in Germany and $210,000,000 in the United States, to a less extent France has also profited by the rebound from the period of depression, which ended in 1905. Two special reasons, however, prevented the roads from making as good a showing as the general prosperity of business might have led one to hope. The Courrières accident and the strikes which succeeded it led to a serious decrease in production of coal in the north and the Pas-de-Calais and the imports which made good the deficit, mostly brought by sea, did not provide our lines with as much traffic. On the other hand, the vintages of 1905 and 1906 were poor in quantity, especially in the Midi, and yet the fall in the selling price, which had followed the exceptional 1904 supply, continued, because the supplies derived from it were not yet exhausted. Thus, both at the north and the south of the country, the two most important items of traffic were heavily handicapped. Decrease in long distance traffic of coal from the northern districts, carried at very low rates, explains why the average rate per ton-mile has remained stationary from 1905 to 1906, although, as happens each year, several reductions in rates have been made. Still it really seems as if suggestions for reductions were becoming less and less frequent, in face of the growing protests aroused by the confirmation of special reductions to meet individual trade conditions, and also by the new burdens imposed upon the companies by legislative enactments of which later on we quote two instances. For the first time in a long while the operating ratio has gone up slightly. This growth is due mainly to the causes that always make themselves felt when there is an exceptional glut of traffic. Fuel and all consumption materials rise in price at times of universal prosperity; as regards coal, the effects of the rise, which are usually spread over several years owing to the long run of contracts, was felt suddenly in 1906 when our northern coalmasters had to suspend promised consignments. When it is necessary to cope with unexpected needs by chance methods, to free stations as soon as possible and take care to forward consignments at once rather than load trains properly, when one has to throw in a fairly large number of inexperienced helpers, etc., it almost always happens that the extra traffic arriving unexpectedly costs more than it brings in.

Besides these temporary troubles, two new laws have led to an extra expenditure that will recur regularly. The Rabier law, which repeals the clauses till now inserted in the special rates involving reductions of rate to lessen the liabilities of the carrier, means an increase in claims for damage. The weekly holiday law, on the other hand, though not legally applicable to railroads (whose business lends itself still less than any other to the application of uniform regulations), must necessarily force the companies to grant to their staff an increase in the days of freedom allowed at a regular interval, without its being possible for them to make good entirely this permanent decrease in the work they get out of their men by abolishing the customary annual leave; under this head, the year 1906 has begun to be burdened with expenses that will grow very markedly in 1907. The agitation which is being manifested throughout the working classes is not unnoticeable in its effects upon railroad operation; though such lack of discipline and attempts at coercion are, among this select staff, far from exerting such ravages as in many businesses and especially in government owned industries, yet we find in various ways some slackening in the zeal of the men, less keenness to do well, fewer attempts to cope with temporary difficulties, and the result is that the service is not only more costly but also less efficiently carried on.

Far from exceeding the estimates of the companies, the purchases of rolling stock were well below the figures they would have wished to attain, because the builders, being overwhelmed with orders, could not supply the requisite number. In 1906 the stock was increased by about 160 locomotives, 500 passenger cars and 3,000 freight cars; to this must be added some 30 motor cars, the trial of which seems to give satisfactory results and which will probably make it possible to improve greatly the service on unimportant lines by making it more frequent without unjustifiable cost. The orders given out, which will be filled in 1907 and 1908, reach the enormous total of 900 locomotives, 1,200 passenger cars and 31,000 freight cars, costing between $40,000,000 and $50,000,000. The issues made by all the great companies during 1906 did not exceed $13,000,000. The exhaustion of reserves, payment for large orders of rolling stock and for additional construction necessitated by the growth of traffic, will oblige the companies to issue more capital this year and next, and if the money market does not improve, this borrowing will cost all the more, because it will force prices down further still.

The Northern Railroad's net profits increased $1,200,000; when they increase $300,000 more, the company will begin to share profits with the state. But the rise in the cost of fuel and labor may prevent this further increase. Under the combined action of all the influences that are converging to diminish the duration and vigor of labor, the average output per day's work of the pitmen has fallen in the Northern and Pas-de-Calais mines from 2,469 lbs. between 1895 and 1899 to 2,282 lbs. between 1901 and 1905.

The most brilliant results are those of the Eastern Railroad. gross earnings increased $2,800,000, or 7 per cent., and net earnings $1,600,000. Doubtless the exceptional prosperity of the metallurgical industry, which has provided 250,000 tons extra for transport (on the top of an increase of 271,000 tons already realized in 1905), will only prove temporary. But the opening up of iron mines, permitted a few years ago, means a source of lasting prosperity, and may some day render the Meurthe-et-Moselle district one of the main metallurgical centers of the world. At present the absence of local coal and the shortage of labor prevent the district from reducing more than a part of the ore extracted.

The Paris, Lyons & Mediterranean has also seen the returns of its line improve extraordinarily, with an increase of $4,600,000 in gross and $1,700,000 in net profit. A sinking fund terminated in 1906, so that $900,000 additional is saved for surplus. This amounted to $2,900,000, of which two-thirds go to the state; no profits to the government were earned in 1905.

COMPARATIVE RESULTS, RAILROADS IN FRANCE, ENGLAND AND GERMANY.

	France.			England			Germany.		
	1903.	1904.	1905.	1903.	1904.	1905.	1903-'04.	1904-'05.	1905-'06.
Average mileage	24,203	24,358	24,514	22,308	22,556	22,742	32,561	33,182	33,803
Passenger earnings	$100,000,000	$101,400,000	$104,200,000	$202,000,000	$202,200,000	$203,400,000	$147,200,000	$154,000,000	$165,000,000
Fast freight earnings	33,600,000	35,800,000	37,000,000	40,200,000	42,000,000	42,600,000	21,200,000	22,600,000	24,400,000
Slow freight earnings	162,400,000	161,000,000	168,600,000	278,400,000	279,600,000	284,800,000	335,000,000	351,000,000	378,200,000
Miscellaneous earnings	4,800,000	4,800,000	5,600,000	39,400,000	40,600,000	42,400,000	36,000,000	38,400,000	40,800,000
Total receipts	300,800,000	303,000,000	315,400,000	560,000,000	564,400,000	573,200,000	539,400,000	566,000,000	608,400,000
Working expenses	160,200,000	157,400,000	164,600,000	346,200,000	349,200,000	353,800,000	341,600,000	360,000,000	386,000,000
Net earnings	140,600,000	145,600,000	150,800,000	213,800,000	215,200,000	219,400,000	197,800,000	206,000,000	222,400,000
Capital cost	3,455,000,000	3,488,400,000	3,514,200,000	5,320,000,000	5,428,000,000	5,496,000,000	3,457,000,000	3,545,000,000	3,638,000,000
Interest on capital, per cent.	4.08	4.17	4.30	4.00	3.97	4.00	5.72	5.81	6.10
Earnings per mile	12,360	12,425	12,875	25,040	25,040	25,200	16,545	17,060	17,990

In the companies serving the other half of France, the western side, we find a much less marked improvement. Running through what are mainly agricultural districts, they hardly benefit from the extra traffic which is brought about by a manufacturing boom, but they do feel the effects of the rise in prices that accompanies it, so that in years like 1906 their increased expenses absorb almost the whole of the increased earnings. More especially, in that particular year, the substitution of English coal, disembarked at the ports they serve, for the French coal which usually reaches them loaded on the Northern Company's cars, forced them to run, with their own resources and their own rolling stock, a service for which in normal times they have nothing to provide except hauling power for trains reaching them ready marshalled; the result was to increase greatly the difficulties of conducting transportation and they gained nothing because the mileage run on their own lines was no greater.

The Western Railroads with $2,000,000 more in gross earnings, found its net profit only $340,000 greater. The deficit after interest charges which the state had to make up according to its guarantee fell below $1,200,000 and precisely because the improvement is not dependent upon the sudden boom in manufacturing, we may hope it will last.

The Orleans Company realized nearly $2,200,000 more in gross earnings, with an increase in expenses of over $1,800,000, so that, after allowing for first charges, the payment made to the state for the repayment of its debt is only $120,000 more than before.

The Midi Company, with nearly $600,000, increased gross earnings, has an increase in expenditure of over $600,000, half of which is due to the extra charge relating to pensions. These new charges, coinciding with the crisis in the wine trade, cause a decrease of $60,000 in the net profit, which just leaves the company the income requisite to avoid its again beginning to call upon the guarantee of interest.

The State system has a still heavier decrease in net profit, amounting to $100,000, despite an increase in gross of nearly $400,000.

Despite these charges, three of the great companies are paying over to the state, out of the profits for 1906, a total of $7,500,000,

*Francs converted into dollars at $0.20.

whereas one only calls upon the guarantee, and that for $1,200,000 only. Doubtless this period of prosperity will be followed, like the others, by a period of bad times, and on the other hand we see already appearing increases of certain charges owing to the new construction and supplies of rolling stock requisite to carry on the service, for the weekly rest, etc. But the last year has already borne sufficiently heavy special charges to lead us to hope that its net profit does not correspond with any specially favorable situation. Moreover, 1907 commenced under favorable auspices. Even if we do not count fully upon the continuation of such high repayments as those which the treasury received last year, we may hope that the era of deficits is closed, and that we have definitely entered upon the period, once regarded as chimerical, when the guarantee and sharing accounts of the great companies, which showed in 1893 a balance against the state of $20,000,000, will show the state receiving a respectable sum, provided that no new law intervenes to add additional charges again to all those with which the working of railroads has been loaded.

The present question, in the matter of traffic, which for several months has upset the commercial community, filled the papers and occupied parliaments, is that of the rolling stock on railroads and the delays resulting therefrom in the service. The characteristic feature of this crisis is its generality. Those in favor of state operation have seized this opportunity for blaming the companies, and the companies' organs have taken a vindictive pleasure in exposing the shortcomings of state operation; the truth is that throughout the whole world, states and companies have found themselves coping with similar difficulties and have overcome them well or ill, more often ill than well, according to their individual resources and ability. We shall lay no stress on the facts pointed out in France, not in order to shirk them, but because they are not the ones that are likely to be forgotten at home. In Germany, in that pattern country of state working, complaints are universal and the Minister for Public Works in Prussia was obliged, in the budget debate, to acknowledge that they were well founded. Already, in the preceding winter, his predecessor had confessed that the service was in unprecedented confusion, and this winter the situation was no better; the coal owners affirmed that there was no assurance that their consignments would be forwarded and there were even some who requested leave from their French customers to deliver English coal by sea, for lack of trucks to despatch them German coal.

In Austria and in Hungary, some mines were on the point of closing down, some works had to be shut, for want of means of transport. In Belgium, traders and passengers continue to cry out. And if we take in the other hemisphere the country where company operation enjoys the most extensive liberty, we find that in the United States there is a clamor on all sides against the inability of the railroads to give a proper service, inquiries are opened on the causes of the trouble and the remedies necessary. But in this wholesale competition, the palm belongs unquestionably to Italy. Not doctrinally, but because they could not come to terms with the leasing companies to prolong their tenure, the state took over the operation of its roads in 1905; forgetful of the proverb, it changed horses, if not in mid-stream, at least on entering the water, just when the boom in industry in Lombardy and the approach of the Milan exhibition made exceptionally heavy traffic probable. The impossibility of coping with it, the resulting confusion, the block in Genoa where half the goods disembarked had to lie unattended to, and the closure of works for lack of fuel, are facts universally known.

The universal character of the crisis depends upon the fact that the underlying cause is itself universal; it is in fact the return of great activity in business which comes periodically with the regularity of the swing of a pendulum, and the coincidence of which throughout the whole world becomes more and more precise in proportion as the facility of communications renders the dependence of markets upon each other more complete. It should be added that, now that railroad traffic possesses an international character, as soon as the crisis becomes somewhat acute at any one point, it necessarily leaves its mark; countries which are short of rolling stock do not resist the temptation of using the cars that reach them loaded from foreign countries, instead of returning them immediately empty or full; those whose stations are blocked keep at the frontier trains which would accentuate this block still further, blocking in their turn thus the roads of their neighbors and laying idle their rolling stock. The Paris-Lyons-Mediterranean thus felt the effects at Modena of the confusion reigning in Italy, and Austria was on the point of ceasing sending cars to Italy.

If the crisis returns periodically, some one will say, nothing can be easier than to foresee it and make provision ahead. To a certain extent, that is true. The able investigations of Mr. Juglar have established the regular character of the waves of prosperity and of stagnation in business, and experience proves this law with astonishing precision. We have stated frequently that it would be wise on the part of railroads to provide themselves beforehand with rolling stock, when the builders would be only too happy to work for them at low prices and not expose themselves to the risk of having to give out late, when prices are at their highest orders which often will not be filled until the need is past. Dare we say it? The enormous orders being filled, instead of reassuring us, frighten us a little.

We know well that under pressure of the inspecting department, in face of the public clamor, the companies have no other way of shifting their responsibility, in times of traffic blocks, than to prove that they have hammered at all doors to increase their equipment. But in order to arrive at giving out their orders regularly, it is not a wiser way to overdo them during times of stress than to stop them when requirements slacken. In 1905, the Prussian Minister of Public Works, in order to excuse his management for not having bought during the lean times of 1901-1902 the rolling stock that he needed when times got better, recalled the plethora in which it found itself at that moment; having received delivery, towards the close of the preceding period of activity, of cars ordered to meet the previous deficiency, they had to build sidings to accommodate the idle cars. We had a similar experience in 1885 and 1886. It is to be feared that about 1908-1909, when all the rolling stock so impatiently awaited to-day is lying idle, orders will have to be stopped and that then, forgetting the noble resolutions everybody is now making for the future, they will delay too long in beginning to give out orders.

And it is not only cars that are deficient, everywhere professional men say that the fault lies less in the want of sufficient rolling stock than of siding and sorting yards, facilities suitable for hastening the handling and making up of the trains. In a remarkable article recently published in the *Revue du Mois*, Mr. Labastie showed how the rapid movement of rolling stock possesses as much and more importance than the increase in its quantity and what difficulties this offers. As regards fixed facilities too, it is during the peaceful times of stagnation that preparations ought to be made to carry on the war against coming difficulties. But in that case, forecasts are more uncertain; it is not sufficient to know that a recovery will surely come; one must know, moreover, at what points the new requirements will appear, and there is a serious risk, in putting down equipment beforehand, of not doing it at the right place.

But, do what one may, it will always be financially impossible to provide railroads with enough equipment to make the service run as well during times of exceptional business activity as in normal times. No country could stand paying interest on such an exorbitant capital. Every paper has been quoting a letter in which one of the American railroad kings, Mr. Hill, estimated $1,100,000,000 per year for five years as the sum needed to put the railroads of the United States in a position to meet their requirements. As we have not seen the original statement, we do not know whether Mr. Hill was posing as an ironical cynic or as a bragging millionaire; but it is anyway true that even if he lived among a group of financiers who could in five years find for the American railroads the $5,500,000,000 he wants, the contractors and laborers able to get through the money in so brief a time, provided only a pause ensued at the end of the five years, at the very first moment of revival that followed there would be a deficiency of rolling stock or men or yards and stations at some point or other. It is not possible always to keep standing idle but ready the equipment requisite to meet the maximum needs which will arise during one or two seasons, during the eight or ten years of the cycle which brings the periodical crises. The only reasonable method in practice is to regulate the growth of men and equipment according to the average increase, and to cope with sudden increase of traffic by a sudden surplus of energy.

But at the moments when this surplus is necessary, any accident is enough to bring about serious trouble. For a little time, one can get from the men and from rolling stock exceptional work. But suppose at a certain point, the abundance of traffic renders it impossible to balance the outgoing and incoming consignments, then promptly the lines get blocked and rolling stock accumulates; it is no longer possible to clear the loaded cars and take them to the point where they ought to be unloaded; there is no longer time to arrange them once they are empty to suit requirements, to make up trains when they are reloaded, so as to fully utilize the tractive power of the engines, one has to resort to pooling engines, running the same locomotives constantly with different crews, instead of leaving each under the control of the same engineman who is responsible for its condition; being less carefully inspected, despatched less often to the shops, because they cannot be dispensed with, the engines end by causing more irregularities and breakdowns in the service. Soon the work got out of them, instead of growing with requirements, decreases, and the difficulty of dealing with the increased traffic becomes an impossibility.

To escape this calamity, it is necessary, from the very commencement of periods of activity, to make demands upon everybody's good will and overwork the indolent a little. It is no longer upon the railroad that the public authorities can usefully make demands at this moment; naturally they intervene to keep it up to the mark during periods of stagnation, but at extra busy times, the needs it has to meet, and the responsibilities it incurs stimulate its zeal better than any abuse. Then it is the consignors and consignees who must be urged to facilitate the promptness of the public service, by cutting down, for instance, the time they are allowed for loading and unloading cars when this business depends upon them. Under these circumstances, the position of private companies is always more difficult than that of state systems, because the latter have always backing them public authority of which they are an emanation, whereas between the companies and the public, the inspecting department naturally tends to side with the public whose representative it is. During the present crisis, we have seen the government, in Italy, frequently suspend consignments to such or such overcrowded points—in Austria, suspend for several days the ordinary freight service between Vienna and Galicia; in Hungary, suspend entirely the consignment of freight from January 28 to February 8; in Belgium, close the frontier on January 30 and 31. In France, the companies could not get leave to make a few alterations they asked to be allowed to make temporarily in the regulations.

Not only has the state not come to their aid, but it has singularly aggravated their position by the law on the weekly rest-day. It is true, the law is not applicable to the railroads; but by stopping entirely the loading and unloading by private persons on Sunday, both at stations and on private sidings, it has seriously delayed the liberation of a number of cars. Those in favor of state intervention in the operation of railroads, frequently support their theories by adducing the necessity of alleviating periodic crises which give rise to speculative commitments; the moment selected for applying the new law is a typical instance of the small amount of foresight with which public authorities, when they intervene in economic phenomena, do it in a manner most likely to aggravate crises instead of alleviating them. Whatever opinions one may hold about the utility of measures which limit the hours of labor, it must be acknowledged that the act of putting them into force must always bring about transitory difficulties; the latter become particularly prominent when there is a scarcity of labor everywhere, as at the present moment. If originally applied at a time when the number of those involuntarily idle was considerable, the law on the weekly rest-day might have decreased distress, by obliging manufacturers to make good the decrease in days of labor by an increase of their employees; then, until the next revival, industry would have had breathing space to accustom itself to the new regime. The wise thing would be even to suspend or temporarily alleviate the stringency of laws of this kind, when hands are everywhere deficient; but by putting them into force just at these times, the legislator aggravates the difficulties of the service of which he then makes a grievance to traders.

Despite these difficulties, it really seems as if France is one of the countries in which the recent crisis was least felt. As far as can be judged, except in the case of England, which appears to have almost entirely escaped it, all the manufacturing countries have suffered more than we have. Our railroads are, moreover, among those best supplied with rolling stock, considering their traffic. The main difficulty in their management is the lack of elasticity in the regulations upon which we have insisted in this review on many former occasions. The intervals allowed under our special tariffs are certainly excessive in normal circumstances; but they equally apply in critical times, whereas in Germany, a railroad is only bound to supply rolling stock as and when it is at liberty. Of course we have no desire to see extended to France a regime under which the public is at the absolute discretion of the railroad management; but to grant some relief in the obligations of the companies in times of stress, to subject their customers to some hardships in order to set at liberty the rolling stock, would not be asking too much, and as some compensation for these easements, the time limits might be decreased under normal circumstances, once it was understood that lack of fulfilment did not render the company liable when it was due to an abnormal increase of traffic.

Our whole legislation is based on the notion that railroads ought at all times to insure under similar conditions the carriage of all the traffic entrusted to them; but this idea is contrary to the very nature of things. Unquestionably, railroads being invested with a monopoly, cannot be left free to grant or refuse their services according to their convenience, and it must be assumed as a principle that they are bound to meet all demands, so long as a judge has not decided that they were prevented by conditions beyond their control. But in order that the exceptional growth of traffic, at times of extreme business activity, may not produce these conditions, it is essential they should be given all the facilities compatible with the requirements of the public. No industry in the world, no traffic organization whether by land or water can be so equipped permanently as to satisfy all the clients who may offer themselves at a busy time in the same manner as in normal circumstances. When the blow comes, railroads submit to the terms of their contractors who only accept such orders as they can carry through; railroads too have to accept all the traffic that their usual competitors, barges and coastwise ships, refuse for lack of room, at least they should be helped to accommodate it.

In insisting upon these considerations we certainly do not intend to entirely shift the responsibility from the shoulders of the companies in the present crisis. We have often enough affirmed and reaffirmed that it would be wiser on their part not to reduce as much as they often have done the purchases of rolling stock in lean years. It is during these years that it would be well to remind them of the advisability of these measures of precaution. What is requisite at times of crisis, owing to superabundance of traffic, is to help them through with it, and not forget above all things that crises of this kind are an inevitable consequence of the irregularity of business, that all countries suffer therefrom like ours, and that we have been far this year from being the worst hit.

The Source of Internal Tire Defects.

Sometime ago there was a breakage of two tires under passenger cars and one under a locomotive on the Paris, Lyons & Mediterranean Railroad that disclosed some interesting peculiarities, as reported by Eug. Vanderhoeym, in the *Revue Generale des Chemins de Fer*. The two car wheel tires, designated B and C, had a tensile strength of 104.155 lbs. and 102.879 lbs. per sq. in., respectively, and an elongation of 17.1 and 15.6 per cent. The original thicknesses were 3 in. and 2.28 in.; and they had been worn down to 2.2 in. and 1.8 in. at the time of their rupture. The locomotive tire had a tensile strength of 106,425 lbs. with an elongation of 15.6 per cent., and is marked A.

An explanation of the formation of the defects found in these two tires was somewhat difficult to find, for it was not easy to understand how it was possible for the cavities, that are shown in the illustrations, to exist in the body of a mass of metal that has been rolled and drawn out as these tires had been. The investigators showed, however, that the cavities were due to internal flaws in the metal. That is to say a local dislocation, produced in the mass of the casting in the form of a disc as a result of internal stresses; and that these internal stresses were themselves due to a too sudden and unequal reheating of the ingot.

The granular and crystalline appearance of the interior surface of the cavities of the two tires supported this hypothesis. The local dislocation or flaw was produced at a rather low temperature, at which the material would still preserve its crystalline structure, with the result that the surfaces of separation would still preserve this structure, and if the subsequent forging operations should tend to still further separate these surfaces, they would, nevertheless, still retain their original appearance, since the temperatures, at which this work is done, are not sufficiently high to sensibly change the structure.

However attractive or even plausible such an explanation might be it could hardly be accepted without some further proof by direct experiment. An endeavor was made to artificially reproduce a local separation of surface, in an ingot of the same form and dimension as that forming the first phase in the manufacture of the tires. For this purpose it was suggested that a very thin plate of highly refractory material be put into the mold before pouring. This was to be chosen keeping in mind the very high temperature of steel in fusion and a very well known mineralogist suggested using a certain rock crystal. It was feared, however, that a rock crystal would crumble at the instant or pouring and the experiment thus be rendered valueless. It was then suggested that a plate of mortar formed of fine sand such as that employed in the lining of crucibles be used. The mortar was reinforced with iron and the whole bound together with a refractory clay. The plate thus obtained was suspended in the mold by a wire protected with a refractory covering, and after the steel was poured in and the metal cooled it was found that the plate had been neither broken nor deformed.

This encouragement led to a more definite experiment. The cores of refractory mortar were put in a mold shaped to make a cast-steel circle exactly like the ingot for the tires. The locations of these discs were as follows: Two thin refractory plates were located in a plate passing through the axis of revolution of the slab and on radii forming an angle of 90 deg. with each other as shown at *a a*.

One plate of the same shape was placed in a plane normal to this axis, and at the center of depth of the slab as at *b*. A ball of the same refractory material was put in at *c* as representing a blow hole or shrinkage cavity. Each of these pieces was suspended in the mold by a wire about 0.2 in. in diameter, surrounded by a refractory protection. The pouring was then done very carefully so as to avoid all injury to the refractory nodules, and, after casting, the ends of holes made by the supports were cleaned out and the iron wire with its refractory jacket was withdrawn. The support on one side of Nos. 1 and 2 was easily removed but on the other side the wire was welded to the metal so that it could not be withdrawn. The spherical sand nodule was entirely removed and the others partially removed.

This heavy disc of cast-steel was then reheated and rolled into a tire of the ordinary section, and after it had cooled an examina-

Fig. 1.
Broken locomotive tire.

Fig. 2.
Section of broken car wheel tire.

Fig. 3.
Section of broken car wheel tire.

Fig. 4.
Section of broken car wheel tire.

Fig. 5.
Section of broken car wheel tire.

Fig. 6.
Section of broken car wheel tire.

Fig. 7.

Fig. 8.

Fig. 9.

had been thus artificially created. For this purpose cross sections were cut from the tires, the left hand side of which are shown in the illustrations. The following observations were made of the four sections:

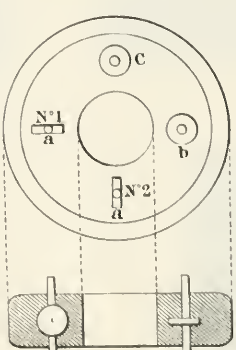
G 3 (Fig. 6). This section corresponds to the artificial defect at No. 1 produced by one of the plates set in the cast steel ingot in the plane of the axis. It will be seen that under the compressing action of rolling, the interior space has opened. The length of the cavity thus produced is about 2.75 in. in the direction of rolling, and its height is practically equal to that of the original plate, or about 2.93 in. This is explained by the fact that the disc as well as the ingot had a thickness equal to the width of the tire, and that the

Fig. 10.
Section of tire with artificial defect caused by a ball.

Fig. 11.
Section of defective bar forged from ingot containing a flaw.

rolling, as in the transformation of the ingot into a tire, acted only in the direction of the thickness and not in that of the width. Thus a flat space, representing a flaw, set in a plane passing through the axis of revolution of the disc, has produced a cavity of thickset form. This confirms the hypothesis as to the cause of the cavities in the original tires. Further, the two lines extending outward from the top and bottom of the cavity will be noticed. These indicate the location of the two supports of the plates.

G 33 (Fig. 7).—This section, corresponding to the artificial defect No. 2, shows that the rolling has transformed the flattened space, situated in the field of pressure like the preceding one, into a thickset cavity. This cavity has a breadth of 2.6 in. in the direction of the rolling and a height of 3.5 in., or exactly the same as the original diameter of the plate.



G 333 (Fig. 8).—This section, which corresponds to the defect B, produced by the plate set normal to the axis of revolution of the disc, and midway of its thickness, shows that the artificial flaw was compressed.

By cutting other sections 2.6 in. on either side of the first section, as indicated by Fig. 9, the same sort of cavity was found but of smaller dimensions, showing that the cavity extended over a length of at least 5.8 in., or twice 2.6 in. plus the thickness of the original section G 333, or 0.6 in.

We see, then, that a flat flaw would be crushed and elongated circularly in the direction of rolling, and it can be readily conceived that if the flaw is small enough, the amount of flattening produced by the rolling may be such as to close the cavity entirely, and leave merely a line of separation as shown in the illustration of the broken locomotive tire.

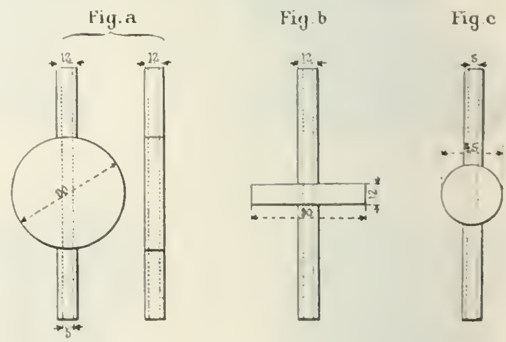
This goes to support what we have already said that a surface of separation existing in the body of a tire can produce, under the forging action a cavity corresponding to a cavity or a mere flaw previously existing in the ingot. It is to be presumed, however, that a flat flaw will be produced in the ingot, rather than in the disc, provided, of course, that it has been heated too rapidly.

G 3333 (Fig. 10).—This section corresponds to the artificial defect formed by the ball. It was found that the cavity was entirely crushed by the rolling, and that it was reduced in section to a simple line, situated on the prolongation of the lines formed by the flattening of the cavities in which the supporting bars of iron or chaplets were located. By cutting other sections on either side of the original one, it was found that the surface of separation, due to crushing of the original cavity, extended in a circle in the direction of the rolling. It may be remarked that a cavity of approximately circular form can only be produced in a casting by crushing out under a hammer a pre-existing cavity that was somewhat elongated vertically in the ingot, or by opening a vertical flaw, as may undoubtedly occur. A spherical cavity in an ingot will always be flattened under the hammer in the transformation of the ingot into a slab, and this will be found to be the case with defects of the character of a No. 1 and a No. 2, as indicated on the line engraving.

Now it will be readily understood how such cavities as those found in tires B and C, which broke in service, can be produced moreover from the experiments that have been detailed above, it must be acknowledged that an internal flaw is the most probable original cause of the formation of these cavities.

The conclusion to be drawn, therefore, is that the reheating of the slabs should be performed with the utmost care. The same precaution should be observed in the reheating of ingots, though the flaw caused by unskillful heating of the ingots seems to have a tendency to appear in the horizontal plane, causing a circular line of separation in the tire as shown in the broken locomotive tire. The consequences of this type of defect are less serious than those resulting from a defect which makes a considerable reduction in the section of resistance. More recent observations have tended to confirm the conclusions drawn from the experiments thus detailed.

At the steel works of St. Etienne an ingot weighing 3,960 lbs. of octagonal section measuring 20.47 in. at the base and 14.57 in. at the other end, cast by the Harmet compression process and consequently entirely free from cavities was forged into a bar 7.87 in square. When this had been done a cavity measuring 11.82 in in the direction of the length was found in the center of the bar. The interior surface of this cavity was coated with perfectly white crystals, whose form alone had been slightly changed by forging. These two characteristics, as well as the method of manufacture, by compression, make it impossible to attribute the formation of the hollow to any other cause than that of a flaw. The flaw was produced by



Method of Placing Cores in Ingots to Produce Tire Defects.

the too rapid heating of the ingot in a plane normal to the axis so that sufficient heat did not reach the inner surfaces. The drawing out under the hammer, after having compressed this flaw, and having transformed it into a cavity, had gradually elongated it so as to form a cavity with a final length of 11.82 in. as stated.

The illustration, Fig. 11, shows the appearance of a section of this 7.87 in. square bar on a plane normal to its axis and through the center of the cavity.

Interborough-Metropolitan Organization.

The accompanying chart was compiled for the New York City Public Service Commission to illustrate the organization of the Interborough-Metropolitan system. But the complexity of the organization is not fully shown by the connecting lines on the chart. The

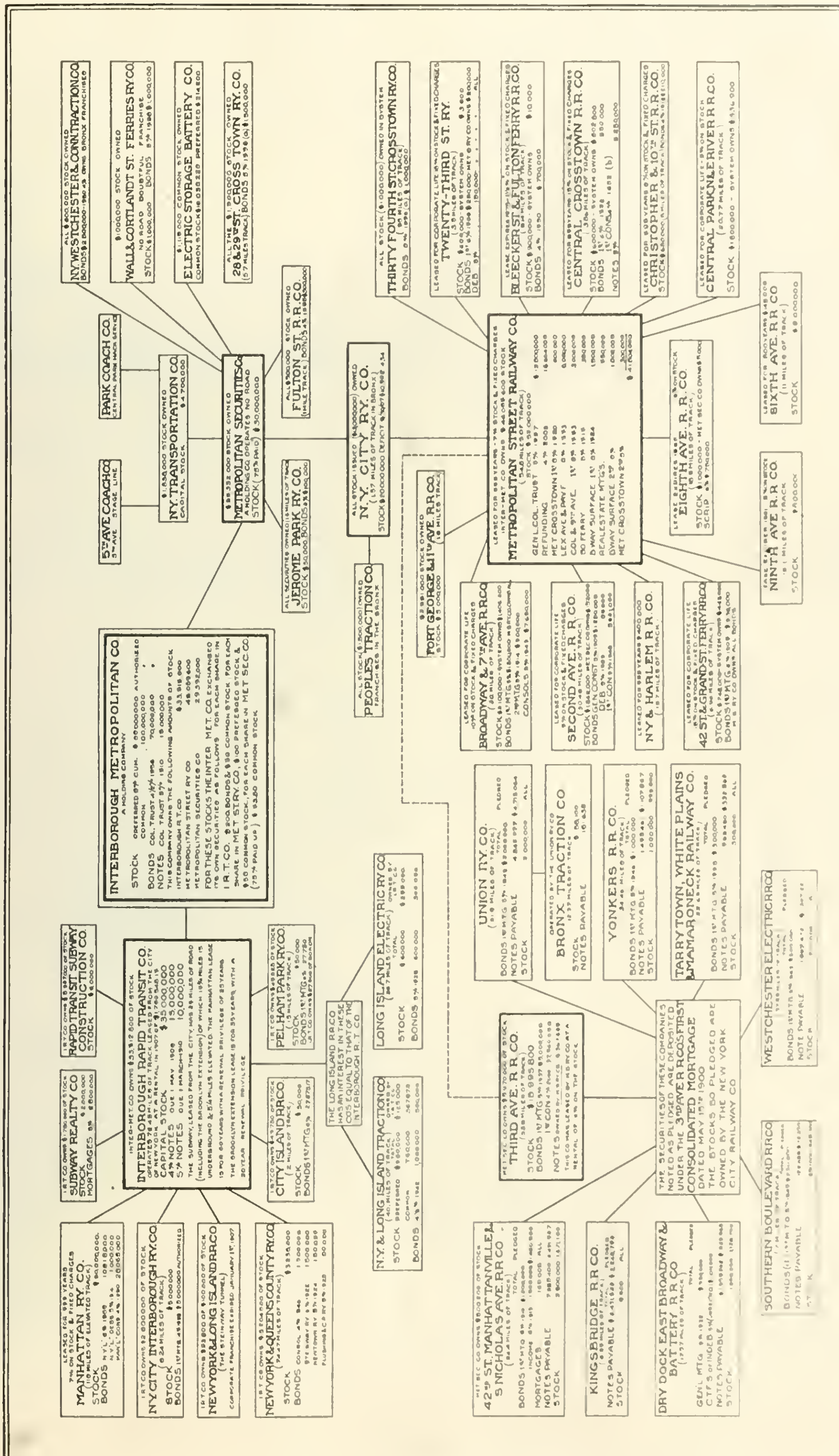
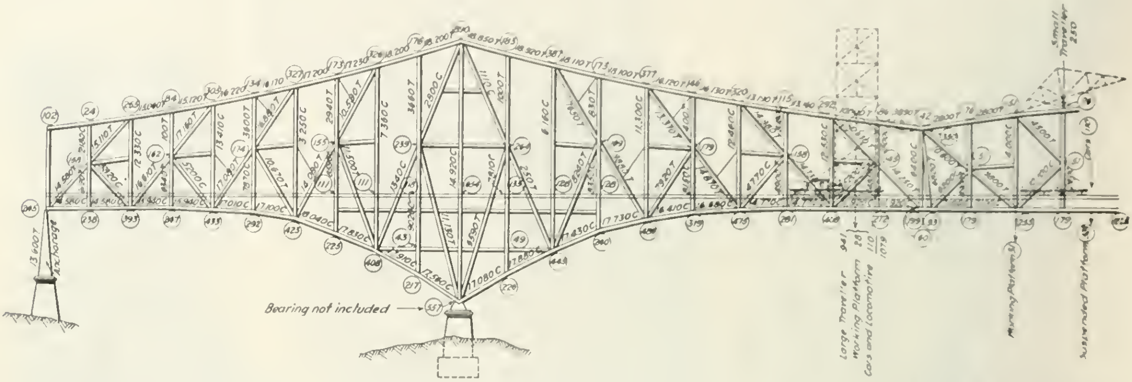


Chart of Interborough-Metropolitan System, Compiled for New York City Public Service Commission.

Interborough-Metropolitan Company controls the Metropolitan Street Railway Company because it owns all the stock of the Metropolitan Securities Company, which owns the stock of the New York City Railway Company, which is lessee of the Metropolitan Street Railway and guarantees dividends on its stock. But the Inter-Met. company also owns over 88 per cent. of Metropolitan Street Railway stock direct, that is to say, it rents to itself, through two brokers, a property which it already owns, and guarantees itself the rental.

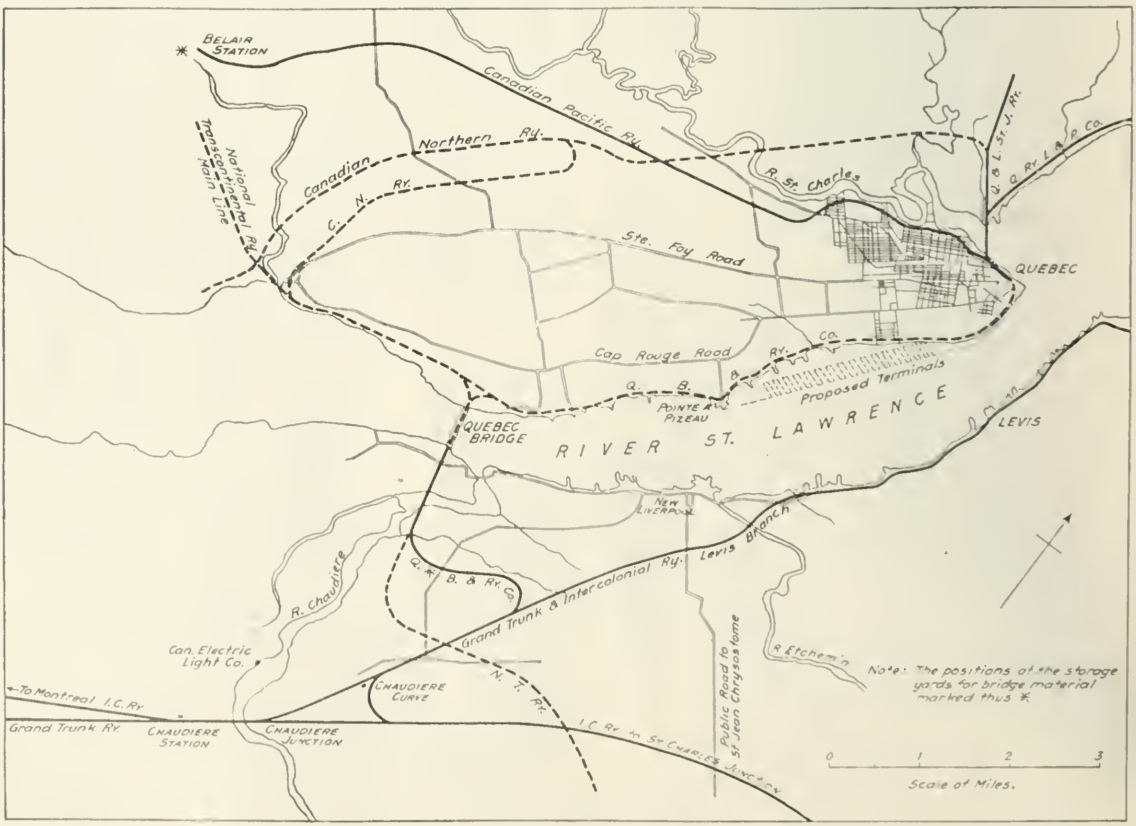
The Wreck of the Quebec Bridge.

Accompanying the report of the Royal Commission on the failure of the Quebec bridge across the St. Lawrence river were a number of blueprints illustrating the various stages of the structure and the stress sheets as calculated before and after the disaster, as well as a map showing the location and the proposed and existing railroad connections. Three of these drawings are reproduced herewith. The outline drawing of the location shows the



Note: Figures shown above thus ◯ are in units of one thousand pounds per truss and include weight of steel work only except as indicated. To these should be added 250 lbs. per lin. ft. per truss throughout entire bridge for weight of track, applied at floor line, giving a panel weight for Anchor Arm of (12.5) thousand per truss, and for Cant. Arm and Suspended Span of (14) thousand per truss.
In the unit stresses C = Compression and T = Tension. Figures from calculations of Phoenix Bridge Co. and verified by independent calculations by C. C. Schneider, Consulting Engineer.

Stress Sheet of Quebec Bridge at Time of Collapse.

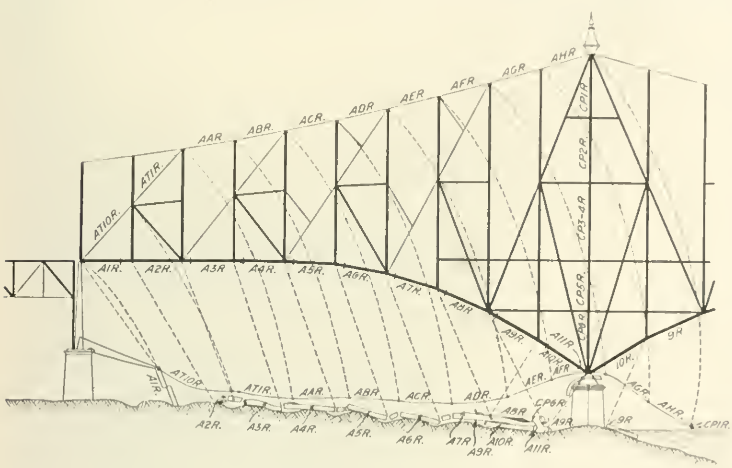


Location of the Quebec Bridge.

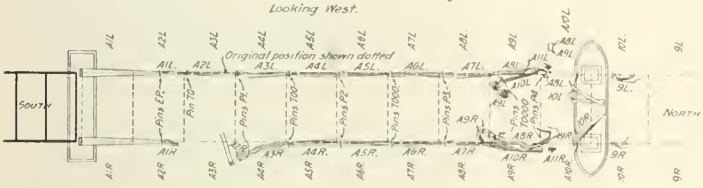
position of the bridge with reference to Quebec. It is above the city and somewhat remote from the existing lines centering in the city. The crossing was to have been effected at the narrowest part of the river, about six miles above the point upon which the city is situated and nearly opposite the mouth of the Chaudiere river.

The stress sheet of the bridge is that calculated as existing at the time of the collapse with the locomotives, cars and travelers in position. This is fully self-explanatory and shows very clearly the conditions prevailing.

The diagram of the course of the members in falling is interesting, as indicative of the method of failure, and as conveying some slight idea of the probable entanglement of the mass of wreckage



Elevation of East Truss and East Truss System.
Looking West.



Plan of Bottom Chord System in Wreck.

Course of Bridge Members in Falling.

that lay strewn on the ground immediately after. Accounts published at the time indicated that the inextricable confusion of this pile of debris was almost beyond the power of imagination.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XVI.

Trans-Atlantic Freight Rates and Their Control.—1. The Lines Between America and Great Britain.

There is probably less organization and less general rate agreement among the carriers in the trans-Atlantic trade than in any other in the world.

All other important ocean trades differ from the North Atlantic in at least three respects: (1) none is so large and none is over so short a route; (2) none has such geographical unity on one end, making competition easy, nor so many nationalities on the other end, making agreement difficult; (3) none is so dependent on raw materials.

1. The first cause is a dual one producing one effect, many carriers. The shortness of the route permits a comparatively few vessels to render line service, while the magnitude of the Atlantic trade requires so many lines that they have never been able effectually to get together. The trade from America or from Europe to the commercial districts of other continents is smaller in volume and over routes so long that the formation of a line is relatively more difficult, and therefore the task of starting new competition is greater. Competition in line traffic, it should be noted, requires another line able to offer the same service. The trans-Atlantic voyage is but one-half to one-fourth the length of that from Europe or America to South America, South Africa, India, Australia or the Orient.

The stupendous size of the trade from America to Europe puts it almost or quite beyond the limits of what the human mind can grasp, control and weld into an agreeing whole. In 1902 when the International Mercantile Marine Company was forming it was stated that this trade was giving employment to about three million tons of shipping. The Morgan interests succeeded at great financial sacrifice in getting possession of but one-third of this, and with it they met losses for several years that threatened to engulf them. The remaining two million or more tons of shipping working here are possessed by many owners having little common interest.

2. The geographical and political conditions of America tend to weld the commerce of that continent with any particular part of Europe into one great unit by enabling it to reach the sea anywhere.

For this trade the United States and Canada are one. American goods go down the St. Lawrence, and Canadian goods go out by United States Middle Atlantic ports. The peculiar geographic form and transportation conditions of the center of North America make easy the access from the central region to the sea at any point between Montreal and New Orleans and Galveston. If Montreal rates do not suit, the shipper in the central basin will turn to Boston, or New York, or Philadelphia, or Baltimore, or Newport News, or New Orleans. The trans-Atlantic traffic is, at its American end, one traffic despite the variety of the geographic factors involved in the trade of all America with all Europe, and a rate agreement to be successful must cover the whole. Possibilities of effective combinations are very different in a trade like that from the same coasts to Australia, which requires five or six steamers per month all from one port instead of 15 or 20 per day from a long row of rival ports.

There is in Europe no such commercial unity. European land forms, politics and transportation conditions unite to produce commercial separateness. A half dozen different nations, each commercially independent and commercially hostile, give to the trade of Austria, Italy, France, Great Britain and Germany an isolation that is entirely unknown in America and make much easier the agreement of European carriers to the different corners of the world, because each group of carriers has a territory of origin in which rivals can not compete without coming to the same ports.

The lack of any geographic or commercial unity in Europe corresponding to that in America, causes the carrying trade with America to fall at its eastern end into three main divisions: (1) the United Kingdom; (2) the Continent, (3) the Mediterranean. The trade of each of these divisions with America makes a commonly used unit in rate problems and plans, although they sometimes apply to the smaller unit of the carriers to a certain European port.

3. The longer European and American trades stand apart from the trans-Atlantic, having less raw materials and more manufactures in their freight. The great quantities of manufactures going out from Europe require a fast, frequent and reliable service over long routes. Lines agreeing and co-operating can easily give such service, which, moreover, a new rival finds it hard to give. Competition from Europe to the more distant continents cannot, therefore, be so active a force as it is in the European trade with eastern North America.

The greatest factor of confusion in trans-Atlantic rates is grain, the great staple commodity in the trans-Atlantic cargo. To begin with, this is essentially charter vessel cargo and the liner that gets it must bid down to do it; hence the rate is constantly lower on line than on charter vessels. The line vessels make this sacrifice of space because grain serves as good ballast. A certain amount of it brings the ship down to her intended draught and causes her to sail better. In connection with higher class freight the difference is that between profit and loss. Grain therefore, brings the line vessel in direct competition with the tramp. If grain is abundant, the ships can usually fill up at good rates; but if it is scarce, many of the ships must have it at any price. There are cases on record of grain being carried for nothing. With such an imperative demand rate agreements are difficult to enforce. The frequent fluctuations in the grain supply are familiar to all. The shipping on the Atlantic must be able to handle, when it comes, the large surplus above America's growing requirements. This surplus varies. In 1901 the grain and flour exports from the United States to Europe amounted to about four and a half million tons.

The preceding year the same commodities furnished seven and one-half million tons of freight. Since the grain trade is irregular in quantity, it renders the trans-Atlantic trade hard to organize through rate agreements. The fact that the unit of shipment is large, usually tens of thousands of bushels, gives the smallest fraction of rate difference a deciding influence.

In a trade as great as that across the Atlantic there are possibilities of numerous small agreements which have limited scope but can yet do something to steady conditions in given grades of exports and benefit shipper and carrier alike. It is possible for two lines from the same port to have some kind of an understanding, and it is possible for the carriers to any one European port to get together, as do the London and Liverpool carriers. This is made easy and almost necessary by the fact that nearly all the freighting arrangements and final bargains for the New York lines are made on the floor of the Produce Exchange by freight brokers representing the shippers, and the agents or representatives of the steamship lines. Not only are New York freight bargains, and therefore rates, made there, but nearly every steamship line sailing from America, whether it be from Montreal or Galveston, is represented. Most of the important American railroads also have representatives there trying to get seaboard work for their lines. It is therefore physically easy for the representatives of any group of traders to get together, and temporary agreements without number have been made and constantly are made.

The carriers are always seeking agreement rather than competition. Where two principals of competing services send their representatives on "change" in the daily search for freight, it is with instructions to get the best rates that can be obtained, to work together to that common end and not rashly to disturb rates for the sake of a small lot of visible freight, as this causes dissatisfaction among shippers in addition to reducing income. Sane business methods demand as much.

The freight market is governed in the main by supply and demand, but the minor adjustments are made by continuous conference. One agent on the floor of the exchange says to the representative of a rival line: "We are holding for 8s. on flour for next week's sailing. What are you booking for?" "Seven shillings 6 pence." "Well, you are making a mistake, you had better hold for 8s." "All right, we will, if we can." A day later the second party may announce to the first that he is not getting any flour at 8s. and may declare his intention to quote a 7s. 6d. rate. The first may or may not adopt the same rate, but for one day at least there has been an attempt at an understanding. Not a stroke of writing is involved, no contract, no penalties, no time limit, and there is perfect freedom of secession. The traders to any city or country may get together daily or weekly and make agreements to last till the next meeting. Sometimes the agreements are more formal and may last for a considerable period, but their existence at best is precarious. For example, about 1880 there was a Liverpool agreement (minimum) on grain along the Atlantic seaboard. Port by port it was broken at all the "out ports" but still stood at New York until at last a firm of brokers bought a steamer badly in need of repairs which were to be made in England. She could get no freight at the agreed minimum and her owners cut the rate a farthing, took the cargo and ended the agreement which had until that time been observed.

It is more than accidental that the name of an ocean freight agreement is a "conference" as the "South African Shipping Conference" or the "Trans-Atlantic Shipping Conference." The name is indicative of the method of formation and often of the actual result. There has been a "Trans-Atlantic Shipping Conference" since 1868. As the date indicates, it was the outgrowth of the disturbances of the American Civil War and of the final triumph of the steam lines over the sailing lines in this trade. This conference has attempted little in the direction of the formation and regulation of rates. It has busied itself with numerous other matters of importance to all Atlantic carriers. For example, it has worked for changes in the printed form of bills of lading for the benefit of the carrier; it has secured a practically uniform bill of lading; it negotiated with the National Lumbermen's Association for certain improvements in the method of receiving and inspecting lumber for export; it acts in behalf of all in regard to legislation on quarantines, channels, etc. In 1902 this conference, with operating headquarters in New York, was made the mechanism for carrying out a minimum freight agreement to the United Kingdom which was made in Liverpool and planned for the relief of all interests. The trans-Atlantic carriers were suffering from a rate depression which in 12 months had cut their earnings from exceptional prosperity to hopeless loss. At one time this agreement included 46 lines and services.

The rate agreement involves of necessity a rate classification—a task beset with difficulties. One commodity may be incidental to one line and fundamental to another. For good loading and best income a ship must have a mixture of heavy and light goods. A ship full of wooden ware or furniture would ride high in the water with unused buoyancy. She would even be in grave danger of overturning. A shipload of steel rails would leave three-fourths of the hold space absolutely empty. By combining these two classes of freight a ship can carry at one time three-fourths of a full cargo of rails and three-fourths of a full cargo of light goods, and at the same time be in the best possible shape for safe navigation. This advantage of mixed cargo gives the loading agent a perennial but ever-changing problem. He is seeking some particular kind of freight to complete a ship's cargo; having already made enough contracts for light goods, he wants a thousand tons of heavy cargo to make the ship ride well. He must have it, and it may be that the contracts already made provide almost enough income for the voyage. He would willingly, therefore, cut the rate to get heavy cargo. But there stands the agreement, and the heavy goods can only be had at forbidden rates. The next month his desire may be to sacrifice on light goods. The attempt to lay down a classification for the numerous lines and services results every day in some firm having a strong desire to break the rate on some commodity, and in the course of time every shipper desires at some time to break almost every rate.

Shipowners are not prone to make public the details of their little-known business and it is fortunate for the writer's purpose that the Atlantic Shipping Conference got dragged into the Interstate Commerce Commission hearings on differential rates to the various Atlantic ports. The detailed history of this agreement as narrated in testimony before the Commission* reads like a description of an attempt at making ropes of sand. The original agreement, made in Liverpool, January, 1902, was signed by nearly all lines plying between the Atlantic seaboard and the United Kingdom, and the testimony showed that, at the beginning at least, the same rates were observed by lines, not signers. The agreement showed its inherent weakness by providing that:

> Any of the signers may withdraw from same at the expiration of fourteen days after the receipt by others of his or their desire to do so, and the withdrawal of one shall *ipso facto* release the others from their obligations under this agreement unless they may otherwise determine.

The inherently competitive nature of their business drove the companies to this device of unanimous consent to any action, and unanimous consent, as may easily be seen, reduced the sphere of action to small proportions, but without it no agreement was possible. The life of the agreement was one rapid series of adjustments and readjustments, concessions and compromises, made necessary to heal the dissatisfaction of some line which had served notice of its intention to withdraw. Finally, after an existence of two years and four days, a break in rates brought about such a condition that the final meeting of the conference found that there was no proposition upon which they could unite, although several of the many attempts were negatived by the votes of but one or two lines. The agreement was thereby ended, but the carriers to London met again the same day and continued the agreement so far as the American trade to that port was concerned.

During the life of the general agreement the committee of management had frequent meetings in New York and some changes were effected by correspondence through the secretary's office. Rates were promulgated for trial during two or three weeks, and the life of the agreement was continued from meeting to meeting. These extensions never covered so much as one month, and one week was the more common period of their duration. The rates were fixed with differentials to make living conditions for all ports. This included the right to adjust out of the rate any marine insurance differences between the port in question and New York and Boston. From time to time difficulties arose and concessions in rates would be granted, permitting the carriers from a certain port or ports to cut the rate a certain amount to secure a prescribed maximum amount of named articles of freight in order to get ballast, after which the usual rates were resumed. The converse of this was also practiced when lines from certain ports refused by agreement to carry certain commodities for a period so that other ports might get their share. This refusal to carry was brought about by the mere quotation of a rate sufficiently high to drive the freight to the ports agreed upon. Witnesses stoutly maintained that there was no percentage division of traffic, and minutes placed in evidence showed that the following motion was lost at the last meeting of the conferees: "That a committee be appointed to arrive at some equitable way of dividing the results of the traffic, if not by a physical division, then by pooling the earnings."

Special agreements to change temporarily the conditions of shipment from certain American ports were duplicated by similar agreements concerning the carrying of goods to certain of the European ports. The agreement covered only named articles; the list was occasionally changed, or the rates on single commodities altered. At times the desire to compete would be gratified by withdrawing the agreement on some article or articles for a named period, and when the London agreement succeeded the general agreement, February 4, 1904, it postponed the enforcement of its rate on flour until May 1. It must be borne in mind that these rates were minimum rates only. Higher rates were always hoped for, and in at

*Differential Freight Rate Case 746, N. Y., Vol. 1, May 18-20, 1904, pp. 303-502. See also N. Y., Vol. 2, June 20 and 21, pp. 1002-1042.

least one case they were definitely recommended by the conferees. The changing nature of ocean rates and the method of their making is indicated by the telegram from the Allan line at Montreal to the secretary of the conference, stating that "We are accustomed to revise our rates weekly on Fridays, in conference with the other lines (at Montreal). The rate on sacks (flour) to Liverpool will be discussed to-morrow, and the result will be communicated to you by telegraph."

In summary, it may be said that the minimum freight agreement did control rates from the Atlantic seaboard to the United Kingdom for two years. The agreement practically covered only articles essentially requisite as ballast cargo. The owners aver that they intended by this so-called minimum agreement to lay down the principle that they would rather not carry than go below the rates they named. To show the economy of trans-Atlantic service it is only necessary to state that the minimum on flour was 8 11 cents per 100 lbs., and on provisions (meats) $2.50 per ton.

Even this feeble minimum freight agreement was rendered nugatory by the American railroad differentials between the interior and the seaboard. Montreal, Philadelphia, Baltimore, Newport News and Norfolk have since the early eighties, as a result of railroad agreements, had a lower rate on heavy articles than New York, Boston or Portland. The ocean freight agreement had this differential to deal with. In the beginning the full differential of 3 cents per hundred on flour was equalized by adjusting ocean rates, thus establishing a common through rate to Europe via all ports. Later the inland differential was reduced gradually to one-half, but it was on this point that the 1902 agreement was wrecked. The end was due to the demand of a Boston line for full equalization in through rates by ocean adjustment. This was declined by a line from Baltimore, which refused to submit to sea differentials that absolutely wiped out the advantage of those by land.

As stated above, the disruption of the general agreement in February, 1904, was not the end of the practice of rate agreements. It was the end of the service of the Trans-Atlantic Shipping Conference as the means for conducting a rate agreement. The general federation broke up into practically the component parts that had formed it, and these went on as before. The London traders met immediately and continued the agreement so far as it affected them and their agreement is still in operation. The Glasgow traders and various other traders after the general break gathered themselves together as before and made and informally maintained their agreements. Forty-six services, embracing all the complications of the trade of a continent, were too many to be harmonized under one management, at least at the first attempt.*

A complicating element in any such rate agreement as that described above is the ownership of steamship lines by railroads. The Canadian-Pacific openly owns a trans-Atlantic steamship company and other trans-Atlantic lines are practically in the same condition. These lines are particularly hard to satisfy in any ocean rate agreement because the motives of their managers differ from those dominating the purely ocean carriers. The railroad steamship line (see chapters printed Feb. 21 and Feb. 28) is merely a feeder to the vastly more valuable railroad. The combined management can easily afford to lose some money on the ships to get more freight for the railroad. Private car lines and their mileage rebates and other indirect cuts in through rates have also entered in as factors here. The result is that satisfactory agreements are made with extreme difficulty between steamship lines that are *bona fide* investments and those that are mere props to a modern American railroad system.

This adjunct line—an ocean carrier with different and additional motives for cutting rates—has moreover easy means of hiding its policy. For practical purposes the through rate from the inland point to Europe may be easily cut. The other steamship lines may remonstrate, and be informed that the ocean rate is being maintained. This may be literally true; but since the railroad and the steamship line are financially one, a cut in the railroad rate has had the same effect upon competitors as a reduction in the steamship rate.

An effort at rate control was the fundamental motive back of the formation of the International Mercantile Marine Company. It was also intended to effect savings through consolidation but the control of trans-Atlantic rates was the most pressing point. During the period of the Boer war, ocean rates everywhere were prosperously high and all carriers made unwonted dividends and added phenomenal sums to their reserve funds. In the spring of 1901 rates went down to the loss point, and with large ship-building operations still in progress there was no relief in sight. Early in 1902 the minimum rate agreement was made, but it was never counted upon as a dividend earner. It was made merely to prevent rates from sinking below the cost of handling in and out of the ship. During this same winter and spring the Morgan combination was in process of negotiation and formation. The aim was to make it as large as possible; large enough to exercise, with the aid of its German allies, a controlling, supporting and steadying influence on rates for both passengers and freight. There was apparently no idea of excessive monopoly rates, but there was great confidence of easy control and of avoiding rapid fluctuations and the low points of depression that had at recurring intervals been bringing loss. The path to this goal was beset with difficulties. In the first place, some of the lines that were bought could be secured only at extravagant prices, and the capital was still further increased by stock-watering in the style of franchise-tenure finance. The Cunard line, one of the greatest factors in the North Atlantic and from this distance apparently an essential to the success of the venture, could not be bought because the stock was in strong hands. The alarmed British nation came to the rescue with new mail contracts and loans at low rates for new and faster ships. The general public thought this was a great aid to the Cunards. Some of the New York leaders in trans-Atlantic shipping think that the government agreement is a handicap to the Cunard line because in consequence of it $13,000,000 is tied up in two ships fastened to one route, and that a route of declining supremacy. The two great subsidized German lines, with the personal backing of the Emperor and the strong financial and moral support of the rest of the government, appear to have been impressed by the promising force of the new undertaking. They made an offensive and defensive alliance with the combine, and later joined with it in the purchase of the Holland-America line leaving the French line the only continental interest of the first rank remaining outside, and with it they have apparently since concluded a firm alliance.

As a rate controller the great corporation of Mr. Morgan and Mr. Griscom has been a failure. Ocean rates showed no indication of new influences in the autumn of 1902 when the new company went into operation. The combine and its allies have had to deal with a world condition of depression in ocean rates, and they have had the lively competition of the Cunard line, which has had a more independent attitude than any of the other and smaller independent lines. It is an old, well-established, conservatively financed and admirably located line, which is in a position to hit back with equal or better force after every move the Mercantile Marine or their associates may make in competition against it. The fast services of the combine are rivalled at Liverpool by that of the Cunard, and the continental emigrant business is drawn off at the Adriatic side door. The Cunards could not be absorbed at formation, they have not been coerced by competition and rate wars, and the conditions of truce under which the rivals have at times been acting in the intervals do not seem yet to have reached a basis for long duration. In addition to Atlantic competition, the International Mercantile Company, which is essentially a carrier from Atlantic ports, has had to meet the vigorous and uncompromising efforts of the Illinois Central and other Gulf railroads in building up Gulf commerce in bulk goods at the expense of the Atlantic ports.

(*To be continued.*)

*Space prohibits any detailed narration of the agreements and wars in the trade of the United States with the Mediterranean. It is one series of changing episodes similar to those that have been narrated in connection with other trades.

New Tracks and Signals at Broad Street Station.

The Pennsylvania Railroad has just completed the lengthening of the platforms in its Broad street terminal station, Philadelphia, by which the most important ones are made about 1,000 ft. long, and has entirely rebuilt the signals and signal apparatus of the station and its approaches; and has sent out photographs showing the principal features of the new plant, which are reproduced herewith. The signaling embraces five important new features, as follows:

1. The use of track circuits to lock the switch levers, and the complete elimination of mechanical detector bars (or "locking bars"). These track circuits, like those installed at Hoboken, N. J., and described in the *Railroad Gazette* of January 31, last, are arranged so as to lock all switches in a route when a train passes the signal governing that route. Each switch is released behind the train as the train clears the track circuit protecting that particular switch.

2. The use of small electric lights on the interlocking machine in connection with the switch levers, to indicate the passage of a train over a track circuit. Lights also show when each signal is free to be cleared.

3. Signal arms moving in the upper quadrant.

4. The use of "three-position" signals. Horizontal indicates stop. Inclined 45 degrees is used to indicate that the train has a clear track, but must expect to stop at the next signal; and an arm standing upward vertically indicates that the track is clear and also that the next signal is clear. The speed limit is 15 miles an hour, so that a single arm can be and is used to indicate for all of the routes leading from a given signal. The short arm fixed 12 ft. below the high arm, is used for movements where the speed of the train must be kept absolutely under control. The short arm is never raised except to the 15-degree position.

5. All high signals are semi-automatic. Every arm goes to "stop" immediately on the passage of a train, and it cannot be

Fig. 1—Outside of Broad Street Station, Philadelphia, Looking East.

Five of the platforms have been lengthened. That at the left is covered for a part of its length, outside the train shed, by a "butterfly" roof. A building was removed to admit of the extension of the tracks at the extreme right. In the foreground are seen double slip switches without detector ba

cleared until (a) the train has cleared the track circuit controlling that arm, and (b) until the lever has been put back normal. Thus all signals can be kept in the stop position, except as the signalman clears them, and he must clear the signal for each and every train movement.

The signal plant is electro-pneumatic, as before. There are 12 signal levers working 100 signals and 47 levers working 158

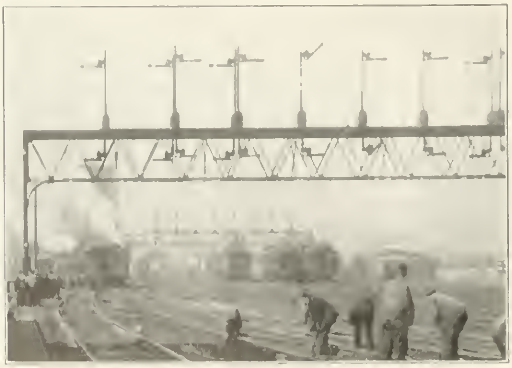


Fig. 2—Broad Street Station Looking West; Three-Position Signals, Upward Inclination.

Only one high speed signal arm on each post. On the signal bridges in the distance the old signals are still in use.

switches, frogs and facing point locks. There are in the plant 431 relays and about 800,000 ft. of electric conducting wire. The train-shed tracks will now accommodate 250 cars in the aggregate, as compared with 80 cars before the enlargement, and the shortest tracks are now 750 ft. long, while under the old arrangement the minimum length was 350 ft. The regular movement in and out is now 568 trains each week day. In the last five years the traffic at this station has increased 8 per cent. annually, and in 1907 the number of passengers, in and out, was 21,318,589.

Fig. 3—Nine Tracks on Viaduct Leading to Broad Street Station, Pennsylvania Railroad. Philadelphia.

Two ladders connecting eight of the tracks; double slips at all crossings.

GENERAL NEWS SECTION

NOTES.

The Erie canal is to be opened May 5.

F. A. Delano, President of the Wabash, has been chosen President of the American Railway Association.

At Chicago last Wednesday Judge Kohlsaat in the United States Circuit Court enjoined the five principal express companies from issuing franks or carrying interstate commerce in exchange for franks.

At a hearing before the State Tax Board at Indianapolis, Ind., April 15, an officer of the Standard Oil Co. testified that in the last year the business of the Union Tank Line had resulted in a net loss of $169,073.

A Chicago press despatch says that the Chicago Subway Company has lost the mail contract, and that the government will restore the old system of horse and wagon transportation between the post office and the railroad stations.

The New York Public Service Commission, First District, has begun proceedings to impose a fine of $2,400 on the Brooklyn Rapid Transit Co. for noncompliance with an order of the commission requiring that a wrecking car be kept at the Brooklyn Bridge terminal.

Canadian papers report that the number of emigrants going into western Canada is now the largest ever known, most of the people being bound for Saskatchewan and Alberta. Five special trains passed through St. Paul in one day. Home seekers are going to Canada from Iowa, Nebraska, Kansas and Oklahoma, and thousands are coming from Great Britain.

At the Master Mechanics' Convention at Atlantic City, June 22-24, the Committee on the Apprenticeship System will exhibit models, drawings and photographs to show the rapid advancement which is being made in this phase of railroad activity. The Central of New Jersey, the Grand Trunk, the New York Central Lines and the Atchison, Topeka & Santa Fe will be represented.

The New York, New Haven & Hartford is now using electric locomotives between New York and Stamford, 33½ miles, on some of its through express trains. The trains running through between New York and Boston are hauled between Stamford and Boston 199 miles, by one engine without change. Most of these runs take five hours or less, and the enginemen run five days in a week.

A press despatch from Helena, Montana, says that residents of the town of Big Timber, in that state, which was almost entirely destroyed by fire in March, have been notified by the Northern Pacific that they will be paid 50 cents on the dollar by the railroad toward their losses. The fire started from a spark from a locomotive and left hundreds of people homeless. This action of the railroad was voluntary.

Superintendent R. T. Morrow, of the Pittsburgh division of the Pennsylvania, has directed that circulars issued to trainmen announcing changes in tracks, switches or signals must hereafter show the new or changed part of the plant in red ink. It appears that there have been cases where an order was not fully understood, and the explanation proved to be that the employee had not fully comprehended the diagram of the tracks.

At Chicago last week the United States circuit court, on the application of the Beatrice Creamery Co. and others, issued a temporary injunction forbidding a proposed advance in freight rates on milk and butter to the Atlantic seaboard. The increased rates had been announced by the Michigan Central, the Grand Trunk and the Pere Marquette, and these companies are accused of conspiracy to raise rates in violation of the Anti-trust law.

Artesian wells have been successfully bored at Suwanee, Valencia county, N. Mex., on the Atchison, Topeka & Santa Fe, on land which belongs, under an old land grant, to the St. Louis & San Francisco. Every alternate section for some distance along the line of the Santa Fe in this region belongs to the St. Louis & San Francisco, which owns about 450,000 acres of land in this region, all of it supposed to be arid until this recent discovery was made.

The New York State Public Service Commission, First District, has issued an order to the Receivers of the New York City Railway specifying in detail the number of surface cars which the state will require to be run on the Twenty-third street crosstown and two other New York City lines. Inspectors of the commission will estimate the probable number of passengers desiring to board the cars at the principal points during various 15-minute periods of the day, and the road is called upon to provide seats for 10 per cent. more than the estimated demand. If the demand should be such as to require more cars than the track or street will accommodate, the company must run as many cars as can be accommodated.

According to press despatches from Washington, the Attorney-General has issued a circular intended to gather complete information throughout the country concerning the ownership by railroads of commodities such as coal, lumber, etc., which, according to the Act of 1906, it will be unlawful, after May 1, for the railroads to transport, except for their own use. Congress is expected to pass a resolution under which the constitutionality of this law, forbidding a railroad to transport its own products, can be tested without requiring a road to run the risk of incurring enormous penalties.

"Pay-as-you-enter" cars have now been in use on the Madison and Fourth avenue surface street line in New York City for several weeks, and the general manager of the line says that they are proving satisfactory to the passengers and to the company. The entrance, with a very large platform, enclosed, is separate from the exit, and 20 or more passengers can board the car and then pay the conductor after it has been started. The cars carry large placards requesting passengers to have the exact fare ready, and passengers are complying with this request. There are 155 cars in service on this line, providing considerably greater passenger capacity than has ever been provided on this line before.

Bonds and Notes Maturing in 1908.

Analysis of the outstanding funded obligations of the principal railroad systems of the country reveals the fact that between now and the end of the year there will mature only about $24,000,000 of bonds, very few, if any, of which will require the issuance of new securities for refunding purposes.

It is unquestionably a fortunate circumstance that during a year when requirements for other purposes are running up to considerable amounts, the railroads are under the necessity of arranging for a smaller amount of maturing obligations than they have been in the past four or five years. The nine largest maturing issues are as follows:

Chesapeake & Ohio 1st 6s, series A and B	$2,013,354
Erie-Buffalo & S. W. 1st 6s	1,500,000
Erie-S. W. Div. 5s	1,000,000
Maine Central-Portland & Ogdensburg 5s	2,119,000
Pennsylvania-Ashtabula & Pittsburgh 1st 6s	1,500,000
Kansas City, Fort Scott & Gulf 1st 7s	2,103,000
Alabama Great Southern 1st 6s	1,750,000
Utah & Northern 1st 6s	4,993,000
Fitchburg 5 per cent. plain bonds	2,000,000

With regard to short term obligations of the total amount of about $115,500,000, whose maturities fall within the current year something over $52,000,000 yet remains to be taken care of. Most of these are in considerably larger amounts than the maturing bonds, and will require financing of some sort. Since the arrangements made by E. H. Harriman to pay off the $5,500,000 Erie discount notes, which fell due on the 8th inst., and the action of the Public Service Commission in granting permission to the Interborough to issue new securities to refund the $15,000,000 notes maturing on May 1, the following are left unprovided for:

Cincinnati, Ham. & Dayton 4½s, due September 1	$15,000,000
Detroit, Toledo & Ironton 5s, due December 1	5,500,000
St. Louis & San Francisco 4½s, due December 1	7,013,831
Underground of London 5s, due June 1	16,550,000
Wheeling & Lake Erie 5s, due August 1	8,000,000

In addition to these short term obligations, Delaware & Hudson has a bank loan of $6,000,000 maturing about August 1, which will in all probability be paid off from the proceeds of the new bonds which the stockholders are asked to authorize at the meeting next month.—*Wall Street Journal*

Improved Street Car Service on Brooklyn Bridge.

The New York State Public Service Commission, First district, reports that since September last there has been a material diminution in the number of delays of trolley cars on the New York and Brooklyn bridge, and that there has been a large increase in the number of cars in service, particularly in the rush hours. The time of delays has been reduced from 1,060 minutes in September to 385 minutes in March.

During the month of March 133,000 surface cars crossed the bridge, being an increase of 11,000 over the preceding September, which means that about 396,000 more seats were provided in March than in September. The average number of surface cars passing over the bridge in September in the evening rush hour was 288. In March this average was increased to 310.

At this time one year ago the largest daily number of surface cars that crossed the bridge was approximately 1,000. Now it is approximately 1,700, an increase of 17½ per cent. At this time a year ago the average number of surface cars crossing the bridge between 5 and 6 p.m. was 236. Now it is 310, an increase of 33⅓ per cent.

The Commission has ordered, and effected, many improvements in cars, reducing the delays from defects, and has secured the exclusion of heavy wagons from the bridge roadways during the rush hours.

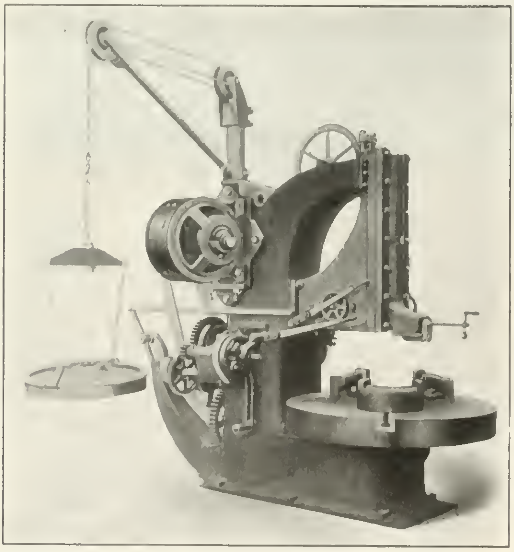
Disastrous Collision Near Melbourne, Australia.

Press despatches of April 20 report a rear collision of passenger trains at Braybrook, eight miles from Melbourne, Australia, on Sunday evening, April 19, in which 42 persons were killed and 80 or more injured. The leading train was just starting from the station. The wreck took fire and three of the cars, with many bodies of victims, were burned up.

Improved Motor Driven Car Wheel Boring Mill.

The illustration shows a motor-driven car wheel-boring mill with improved automatic chuck, friction feed discs and crane attachment. It is a 51-in. machine and its heavy construction and powerful gearing makes it capable of taking the heaviest cuts required for this class of work.

The automatic chuck is self-closing, self-opening and self-centering. It has three adjustable abutments, each provided with an equalizing steel jaw with two bearing points. The work is thus held and centered by six points on the circumference. The first movement of the driving shaft causes the jaws to close in on the



Motor Driven Boring Mill.

work, after which the table begins rotating. When the work is completed, the chuck is released by disengaging the driving clutch and retarding the driving shaft by the friction brake. The inertia of the table and work imparts the force necessary to open the jaws. The work is secured in position in the machine and released with no loss of time and without labor. Since the power of the clutch grip increases with the resistance of the cut, it is never necessary to stop the table to tighten the chuck.

The boring mill is especially arranged for electric drive; the motor is mounted on the vertical housing of the frame. The motor is a Westinghouse, 7½ h.p., type S with a speed variation of about two to one. The mill is made by William Sellers & Co., Inc., Philadelphia, Pa.

Corrugated Round Reinforcing Bars.

The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., announces that, to meet the requirements of those who prefer a round bar for reinforcing purposes, it is prepared to furnish round corrugated steel bars in addition to its present type of squares and flats. The different sizes of these bars have the same net area as the corresponding sizes of plain round bars.

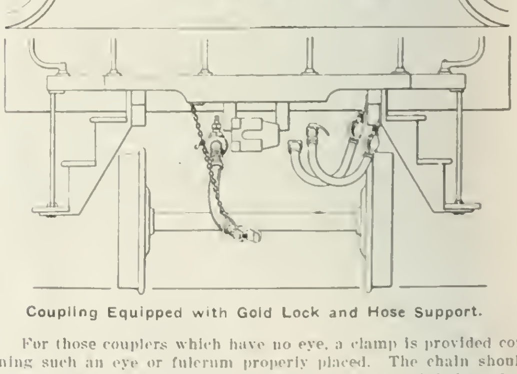
Combination Automatic Lock and Hose Support.

The Gold Car Heating & Lighting Co., New York, has designed a device for automatically locking steam hose couplers and properly supporting the hose and coupler. In this arrangement the hose is relieved of the weight of the couplers both when coupled and when separated, the life of the hose being thus lengthened. Each coupler is supported by a chain from the platform end sill, attached to the long arm of a lever hinged on the coupler. The short arm bears on the mating coupler of the adjacent car in such a manner as to force the gaskets into close contact. This takes all the weight from

Gold Combination Lock and Hose Support.

the hose and presses the gaskets together with a force much greater than that due to their weight and the action of the cam and wedge, which are still retained as integral parts of the coupler. With a coupler weighing 8 lbs. the pressure against the faces of the gaskets in contact is about 200 lbs. Additional pressure can, if desired, be produced by simply increasing the length of the long arm of the lever, but service during the past winter on several railroads has shown that the present proportions are ample for maintaining tight joints.

The locking lever is made of drop forged steel, and while light in construction is amply strong for the work required of it. It can be applied to existing Gold couplers with little or no labor. If the coupler has an eye cast integral with the body, the rocker of the lever is simply passed through this eye and secured with a cotter



Coupling Equipped with Gold Lock and Hose Support.

pin. For those couplers which have no eye, a clamp is provided containing such an eye or fulcrum properly placed. The chain should be of such length as will hold the couplers, when coupled, from 1 to 1½ in. higher than they would be if supported by the hose alone. This chain is provided with an extra hook to be used in case further adjustment be required. The hooking up of the couplers when they are separated is often neglected, causing damage to hose and couplers and sometimes serious accidents to trains. With the use of this device, this is absolutely impossible, as the chain is never detached from the lock, whether the couplers are coupled or uncoupled. In case the train parts, the couplers separate without damage; neither can they drag on the ties.

Ventilation of the Interborough Rapid Transit Subway.

Shortly after the opening of the New York subway it was decided to ventilate the station toilets by some positive means. Small-volume blowers were adopted, and 60 outfits were bought from the American Blower Co., Detroit, Mich. Later, the Rapid Transit Commission decided on a plan for ventilating the subway itself by centrifugal exhausters. "ABC" steel plate exhaust fans were adopted, 25 of which have been installed in vaults (Fig. 1) built in ventilating ducts under the sidewalks along the line of the subway, about midway between stations, from Fulton street to Fifty-ninth street. These exhausters draw the air from the subway, many thousand cubic feet a minute, causing an equal amount of fresh air to flow in at the stations. This action is helped by the plunger effect of the trains themselves forcing the air out through the ventilating ducts. Connection between the ducts and subway is governed by louvers or gills, balanced to open to let the air out, but to automatically close when the air tends to move in the opposite direction. These louvers are shown opened and closed, respectively, in Figs. 2 and 3.

Fig. 1.

Fig. 2.

Independent of the ventilating equipment, a cooling plant has been installed at the Brooklyn Bridge station, using four large "ABC" fans. A view of this installation is shown in Fig. 4.

In the tunnel extension under the East river from the Battery to Brooklyn fresh air is supplied by "ABC" blowers, two being installed at each end of the tunnel. They drive the air in the directions in which the trains run.

These blowers are also used for ventilating the Hudson & Manhattan tunnels between New York and Hoboken and for the Hudson Terminal buildings. Other buildings in New York using these blowers for ventilating are the Singer, the City Investment, the Trinity, the U. S. Realty, the West Street, the Bank of America, the Tribune, the St. Paul, the U. S. Express and the Flatiron buildings; also the Macy, the Wanamaker, the Altman, the McCreery and the Claflin stores, the New York *Press* and the Saks buildings, the Hippodrome, police headquarters, Fordham Hospital, the public baths, and many others.

Fig. 3.

Fig. 4.

A Trip on the South Manchuria Railway.

The following is taken from a recent folder of the South Manchuria Railway. It describes the pleasures and comforts of travel on that railroad:

> The locomotives have been supplied by the most popular American Locomotive Co., and the Pullman Car Company has furnished the passenger coaches with the unsurpassed equipments of the Grand American Express. Under the present plan, parlor cars are to be connected with the Grand Express, which are, by the way, sort of observation cars, provided in addition with the comforts of a superior drawing room so that the eye being fed on the shifting landscape, the tedium of a journey through wild Manchuria, which must be quite unbearable otherwise, will be reduced to an almost imperceptible burden.

After devoting 17 pages to describing in language and with pictures of various colors, the delights of the line, the following announcement is made:

> Before concluding, we are honor bound to inform the [illegible] to finishing the converting work of the line into the broad gage by the summer next year, the second-class accommodation in common vogue in Japan proper will be best at command, no first-class cars with dining equipments being run on the line before that time.

Location of Wheat Areas.

Kansas stands at the head of wheat states in percentage in acreage. The government report of April 1 gives that state 19.1 per cent. of the United States acreage in wheat. Indiana comes next with 8.9 per cent., Illinois with 7.7 per cent., Nebraska with 7.6 per cent., and Missouri with 7.3 per cent. Fully half of the acreage of the winter wheat belt lies beyond the Mississippi, south of Iowa, so completely has the great producing district shifted away from the west. Its first stronghold was in the Susquehanna Valley, then later in the Mohawk, and on the southern shore of Lake Erie. Finally its last stand east of the Mississippi was in the three states of Ohio, Indiana and Illinois, where something less than a quarter of the total winter wheat area is still to be found. Winter wheat is working southward to a warmer climate, while spring wheat is creeping farther north toward the Arctic circle, on the American continent.—*Wall Street Journal.*

INTERSTATE COMMERCE COMMISSION RULINGS.

Rate on Ground Iron Ore Reduced.

In Winter's Metallic Paint Co. v. Atchison, Topeka & Santa Fe et al., opinion by Commissioner Prouty, it was held that a rate of 90 cents per 100 lbs., minimum 60,000 lbs., for transportation of ground iron ore, from Chicago and Chicago points, to Pacific coast terminals, is excessive, and should not exceed 60 cents per 100 lbs.

Old Rate Restored Before Hearing.

The Commission, opinion by Commissioner Cockrell, has announced decision in the case of T. H. Bunch Co. and Merchants Freight Bureau of Little Rock, Ark., v. Chicago, Rock Island & Pacific and eight other railroads. The complainants informed the Commission that their complaint had been satisfied by the carriers by the re-establishment of the rate previously in force. The complaint was therefore dismissed.

Classification of Masurite.

In Masurite Explosive Co. v. Pittsburgh & Lake Erie et al., opinion by Commissioner Prouty, it was held that masurite, which is a high explosive but not dangerous to handle, should be accorded a lower rate than dynamite, the handling of which is attended with great danger. The Commission ordered masurite to be classified as 1½ times first class in Official Classification in less than carloads and second class in carloads, with a minimum weight of 20,000 lbs. to the car.

Demurrage on Private Cars.

The Commission, opinion by Commissioner Lane, has announced its decision "In the Matter of Demurrage Charges on Privately Owned Tank Cars." The conclusion reached is that private cars owned by shippers and hired to carriers on a mileage basis are subject to demurrage when such cars stand on the tracks of the carrier, either at point of origin or destination of shipment, but are not so subject when on either the private track of the owner of the car or the private track of the consignee. The carrier must charge demurrage in all cases where such demurrage is imposed by tariff provision on its own equipment, except when a privately owned car is on a privately owned siding or track, and the carrier is paying, or is responsible for, no rental or other charge on such cars. A privately owned car, in the sense in which that expression is here used, is a car owned and used by an individual, firm, or corporation for the transportation of commodities which they produce or in which they deal.

In expressing this opinion the Commission is not to be regarded as bound thereby, either to the recognition of the right of a carrier to refuse to furnish proper and appropriate facilities for the shipment of oil or any other commodity, or of the right of a carrier to so contract with a shipper for the use of facilities as to permit any discrimination as between shippers or consignees.

Loading Cars to Marked Capacity.

The Commission (opinion by Commissioner Clark) has decided the case of Georgia Rough & Cut Stone Co. v. Georgia Railroad et al. A lower rate on stone paving blocks was made to allow shippers to compete with producers in other states, on condition, which was expressed in the tariff, that the minimum weight should be the marked capacity of the car. Complainant knew the weight of a cubic foot of paving block and always counted the number placed in a car; never specified capacity of car desired, although on request he could have had cars ranging from 40,000 to 100,000 lbs. capacity; always had sufficient material to load to marked capacity of car received, which could have been easily loaded to and beyond that capacity; and from October 1, 1904, to November 30, 1907, found no difficulty in loading to marked capacity of the cars received. The Commission decided that on these facts the regulation making the minimum carload weight the marked capacity of the car was not unjust nor unreasonable, and reparation based thereon was denied. An order was entered dismissing the case, but if complainant and defendants are unable to reach an agreement as to the correct amount of overcharges unlawfully collected from complainant, or if such overcharge is not promptly refunded by defendants, the facts may be brought to the attention of the Commission and the case will, if necessary, be reopened for the entry of such order, or the inauguration of such proceeding as may be warranted.

TRADE CATALOGUES.

Trucks.—A circular issued by the Fairbanks Company, New York, gives the sizes, weights and prices of a number of warehouses and baggage trucks, and other trucks and similar carts for special uses.

Small Motors.—Bulletin No. 4,548, of the General Electric Co., Schenectady, N. Y., illustrates direct and alternating current motors installed for individual motor drive of a large number of machine tools.

Crossing Bells.—Supplement No. 2 to Bulletin No. 24 of the Union Switch & Signal Co., Swissvale, Pa., gives price lists of parts of the Union electric crossing bells, each part being illustrated.

Switch Indicator.—Bulletin No. 4,563, of the General Electric Co., Schenectady, N. Y., describes a switch indicator, type SI-104. This was described in the *Railroad Gazette* of January 3.

Ratchets.—A circular of the Ashcroft Manufacturing Co., New York, describes and illustrates, with sizes and price lists, several styles of Packer ratchets.

Staybolts.—The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, is sending out a pamphlet on Staybolts, Their Use and Abuse, by John Hickey.

Gages.—A circular issued by the Ashcroft Manufacturing Co., New York, gives sizes and price lists of Scotch gage glasses.

MANUFACTURING AND BUSINESS.

P. H. Griffin has resigned as manager of the New York Car Wheel Co., Buffalo, N. Y.

The New York office of The Curtain Supply Co. has been moved to the Hudson Terminal buildings, 50 Church street.

William E. Moran, of the Moran Bolt and Nut Manufacturing Co., St. Louis, Mo., died Friday, April 10, aged 62 years.

The New York office of the Adams & Westlake Co., Chicago, has been moved to the Hudson Terminal buildings, 30 Church street.

The offices of the American Locomotive Co., New York, have been moved to the Hudson Terminal buildings, 30 Church street.

The New York office of the Duff Manufacturing Co., Allegheny, Pa., has been moved to the Hudson Terminal buildings, 50 Church street.

The Wells Light Manufacturing Co. has moved its main office from 46 Washington street, New York, to 14 Church street, corner Cortlandt street.

W. H. Cowell, formerly Purchasing Agent of the Algoma Central & Hudson Bay, is now with the Wellman-Seaver-Morgan Co., Cincinnati, Ohio.

E. G. Smith, Secretary of the Railroad Supply Manufacturers' Association, moved his headquarters from Chicago to Atlantic City, N. J., on April 20.

W. J. Fauth, formerly Assistant Engineer of the C., B. & Q. Ry., has been appointed Engineer of Sales of the W. K. Kenly Co., Chicago, dealer in rails and track materials.

Wesley Meeteer, 26 Cortlandt street, New York, is asking catalogues and prices on a complete line of machinery and equipment for a car building plant producing both wooden and steel cars.

Samuel M. Curwen, Second Vice-President and General Manager of the J. G. Brill Co., Philadelphia, Pa., has been elected Vice-President and General Manager and also a Director, succeeding, as Vice-President, the late John A. Brill.

The Vulcan Iron Works Co., Toledo, Ohio, hereafter will be known as The Vulcan Steam Shovel Co. This is to make the corporate name more fully indicative of the principal business of the concern, which is the manufacture of steam shovels.

The executive offices of the Westinghouse Electric & Manufacturing Co., heretofore at 111 Broadway, New York, and the New York sales offices and export offices, heretofore at 11 Pine street, have been moved to the City Investing building, 165 Broadway.

L. W. Horne & Co., New York, Consulting Engineers, announce that capital is being procured for building Boyes mono-rail structures, "scenic railways," at Coney Island and at 110th street and Fifth avenue, New York. It is expected that bids will soon be asked on steel castings and structural steel.

The American Car & Equipment Co., Chicago, announces the association with that company of H. H. Sessions and W. H. Horine. The officers are: H. H. Sessions, President; I. J. Kusel, First Vice-President and General Manager; C. R. Powell, Second Vice-President and General Superintendent; W. H. Horine, Secretary and Treasurer. The directors are: H. H. Sessions, M. A. Garrett, A. R. Warner, I. J. Kusel, C. R. Powell, Phillip Lawrence and S. T. Rowley.

A contract has been given to the Meriden Britannia Co. (International Silver Co., Successor), Meriden, Conn., for all the silverware for the cars, steamships, hotels and restaurants of the Union Pacific, the Oregon Short Line, the Oregon Railroad & Navigation, the Southern Pacific, the Northwestern Pacific, the Illinois Central, the Southern Pacific Company's Atlantic Steamship lines and, probably, the Pacific Mail Steamship Co. The contract runs for several years and is similar to those which the Harriman Lines make with makers of other supplies. At present, the Harriman Lines have 100 dining cars, 50 buffet cars and 50 private cars.

The General Railway Specialty Co., Chicago, H. U. Morton, Vice-President, advises that its metallic sheathing has been applied to a number of passenger coaches of the Chicago & North-Western and Atchison, Topeka & Santa Fe; to 31 baggage cars of the St. Louis & San Francisco, and to 82 Pullman sleeping cars. The Pullman Co. has adopted it as standard for all cars built hereafter. The "National" steel trap-door and lifting device has been applied to 35 coaches of the North-Western, to 15 coaches and three diners building for the C., M. & St. P., and to 10 coaches building for the N. Y., O. & W. "Schroyer" friction curtain rollers have been specified for the 350 street cars building by the Pullman Co. for the Chicago Railways Co., and 300 of this lot will have "National" standard roofing.

The Ajax Manufacturing Co., Cleveland, Ohio, has the following recent orders: from the New York Central, for its West Albany shops, one No. 9 Ajax motor-driven, reversing crosshead bulldozer, and two Ajax belt-driven heading, upsetting and forging machines, 3/4 in. and 1 in. respectively; from the Curtis Motor Truck Co., Decatur, Ill., one 4 in. Ajax motor-driven heading, upsetting and forging machine, one No. 8 motor-driven bulldozer with reversing crosshead, and one No. 4 motor driven bulldozer, from the Wyman & Gordon Co., Worcester, Mass., one 5 in. heading, upsetting and forging machine. Shipments have lately been made to the National Tube Co., McKeesport, Pa.; the Mulvey Manufacturing Co., Chicago; the Intercolonial Railway; the Atchison, Topeka & Santa Fe; the Egyptian State Railways, and the Japanese Government.

Iron and Steel.

The McClintic-Marshall Construction Co. has orders for 1,800 tons of bridge material for two viaducts on the Pacific extension of the St. Paul, and for 3,000 tons for track elevation on the Chicago & North-Western.

Orders for rails have been placed by the New York Central Lines as follows: Lake Shore, 20,000 tons; Michigan Central, 14,000 tons (8,000 tons for lines in the United States and 6,000 tons for lines in Canada); Chicago, Indiana & Southern, 2,000 tons; Lake Erie & Western, 1,000 tons, and Boston & Albany, 8,000 tons. These rails are in addition to the 24,000 tons recently ordered for the lines east of Buffalo.

OBITUARY NOTICES.

Henry C. Urner, Secretary and Treasurer of the Little Miami Railroad, and formerly United States Marshall, died on April 18 after a lingering illness. Mr. Urner was 78 years old.

Hall Wilson Watts, Master Car Builder and Car Accountant of the Monongahela Connecting Railroad, and President of the Railway Club of Pittsburgh, died on April 14, after several weeks illness.

John H. Ames, formerly Purchasing Agent at St. Paul, Minn., of the Northern Pacific, died at his home in Ware, Mass., on April 14. Mr. Ames was born in Housatonic, Mass., in 1838. He served throughout the war in the U. S. Navy, retiring in 1865 as assistant engineer. He was Superintendent of the Yale & Towne Manufacturing Co., New York, for 10 years, and later Superintendent of the Grant Locomotive Works, Paterson, N. J. In 1874 he took a consignment of export locomotives to Odessa, Russia. He was made Purchasing Agent of the Northern Pacific in 1879, in which office he served until 1890. He then retired, and had not been actively engaged in business since.

Everitte St. John, formerly Vice-President and General Manager of the Seaboard Air Line, died on April 21 at his home in Wellesley, Mass. Mr. St John served on the Rock Island for 32 years. He was born in 1844 at Kent, Conn., and began railroad work on the Housatonic Railroad, now part of the New Haven, and in 1862 went west to become clerk in the general ticket office of the Quincy & Toledo, now part of the Wabash. The next year he went to the Chicago & Rock Island, the predecessor of the Chicago, Rock Island & Pacific. In 1864 he was made chief clerk in charge of the general ticket department. In 1869, he was appointed General Ticket and Passenger Agent, and six years later was appointed also Assistant to the General Manager. After a year in these positions, he was made Assistant General Manager and in 1887 was appointed General Manager. He held this position until 1895 During the Pullman strike in 1894 he was Chairman of the General Managers' Association, representing all the roads entering Chicago. In 1895 he went to the Seaboard Air Line as Vice-President and in 1900 was appointed also General Manager of that road. He retired from railroad service in January, 1901.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

St. Louis Railway Club.

At the annual meeting of this club John J. Baulch (Manufacturers' Railway) was re-elected President; E. F. Kearney (Missouri Pacific) was elected First Vice-President; S. D. Webster (Terminal R. R. Assn.), Second Vice-President, and Charles Waughop, Third Vice-President; B. W. Frauenthal, Secretary, and C. H. Scarritt, Treasurer. The club has 1,148 members, of whom 160 were admitted during the past year. The treasurer reports a balance on hand at the end of the year of $3,968.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers

Grand Trunk Pacific.—M. M. Reynolds, Fifth Vice-President of the Grand Trunk, has been elected also Third Vice-President of the Grand Trunk Pacific, with headquarters at Montreal, Que. He will have special supervision of the treasury and accounting departments of this road.

Illinois Central.—E. F. Stovall has been appointed General Agent at Birmingham, Ala. He will perform such duties as may be assigned to him in the executive, financial and legal departments, effective April 18.

Long Island.—F. G. Bourne has been elected a Director, succeeding the late Franklin B. Lord.

Mexican International.—P. H. L. King, Assistant Auditor, has been made Auditor of Freight Receipts and his former position has been abolished.

Operating Officers.

Atlantic Coast Line.—After May 1 the road will be operated in three divisions instead of four. The First division will extend from Richmond, Va., to Florence, S. C. This is the same as the present First division. The Second division will extend from Florence, S. C., to Thomasville, Ga., thus merging the present Second and Third divisions. The new Third division will extend from Jacksonville, Fla., to Fort Meyers, taking the place of the present Fourth division. W. H. Newell, General Superintendent of the present First division, will be General Superintendent of the new First division, his headquarters remaining at Rocky Mount, N. C., succeeding C. L. Porter. General Superintendents of the present Third and Fourth divisions will retain their offices in Savannah, Ga., and Jacksonville, Fla., respectively, and act as General Superintendents of the new Second and Third divisions. A. W. Anderson, at present General Superintendent at Florence, S. C., will become General Superintendent of the Charleston & Western Carolina, with headquarters at Augusta, Ga. G. G. Lynch, General Superintendent of the Charleston & Western Carolina, has been appointed Superintendent of the Columbia district, First division of the Atlantic Coast Line, with headquarters at Florence, S. C.

Charleston & Western Carolina.—See Atlantic Coast Line.

Erie.—T. B. Duggan has been appointed Trainmaster at Salamanca, N. Y., succeeding W. H. Daley, transferred.

Louisville & Nashville.—J. B. Arbegust, formerly Trainmaster at the Louisville terminals, has been appointed Superintendent of the Louisville terminals, succeeding the late C. J. Klein, and the office of Trainmaster at the Louisville terminals has been discontinued.

Norfolk & Western.—W. J. Jenks, formerly Superintendent of the Seaboard Air Line at Jacksonville, Fla., is now Chairman of the Car Allotment Commission of the Norfolk & Western, with headquarters at Bluefield, W. Va.

Seaboard Air Line.—See Norfolk & Western.

Traffic Officers.

Canadian Pacific.—H. S. Carmichael, Acting General Passenger Agent at London, Eng., has been appointed General Passenger Agent for Great Britain and Europe, with office at Liverpool, Eng. Mr. Carmichael succeeds Mr. Flanagan, who retired some months ago on account of ill health. H. G. Dring will succeed Mr. Carmichael as Assistant General Passenger Agent, with office at London.

Central Vermont.—C. E. Dewey, Assistant General Freight Agent of the Grand Trunk at Montreal, Que., has been appointed General Freight Agent of the Central Vermont, succeeding Robert L. Burnap, transferred.

Grand Trunk.—A. E. Rosevear, freight claim agent at Montreal, Que., has been appointed Assistant General Freight Agent at Montreal, succeeding C. E. Dewey, who has been appointed General Freight Agent of the Central Vermont.

Pennsylvania Lines West.—Guy S. McCabe, division freight agent of the Richmond & Logansport division, has been appointed General Western and Division Freight Agent at Chicago, succeeding M. S. Connelly, promoted.

Engineering and Rolling Stock Officers.

Colorado Southern, New Orleans & Pacific.—B. B. Gordon, Chief Engineer, has resigned, and the position has been abolished. C. H. Fisk, Chief Engineer of Maintenance of Way, with headquarters at Beaumont, Tex., assumes the duties of Mr. Gordon's office.

LOCOMOTIVE BUILDING.

The Iowa Central is said to be in the market for six locomotives. This item is not yet confirmed.

The Lehigh & New England is said to have ordered three locomotives from the Baldwin Locomotive Works, for July delivery. This item has not yet been confirmed.

CAR BUILDING.

The New York City Railway expects to buy 150 pay-as-you-enter cars.

Morris & Co., Chicago, have ordered 200 refrigerator cars from Haskell & Barker.

The American Railway & Lighting Co., Dallas, Tex., is in the market for 10 electric cars.

The Northern Pacific is again figuring on the passenger cars mentioned in the *Railroad Gazette* of March 13.

The Northern Pacific has ordered from the American Car & Foundry Co. the 500 refrigerator cars mentioned in the *Railroad Gazette* of April 17.

The Chicago & North-Western has ordered 300 steel ore cars of 100,000 lbs. capacity from the Pullman Co. and 250 from the American Car & Foundry Co.

The Lehigh & New England is said to have ordered 50 gondolas from the Cambria Steel Co. in addition to the 250 forty-ton cars mentioned in the *Railroad Gazette* of April 3. This additional item has not yet been confirmed.

The Minneapolis & St. Louis has been figuring on two combination mail and express cars. These cars will be 70 ft. long and 9 ft. wide, inside, and 6 ft. 9½ in. high to top of plate. Platforms are to be equipped with the National centering device, and the cars are to have a 40-ft. mail compartment with two doors on each side and equipped with Harrison postal bag racks. The special equipment will include:

Brake beams	Simplex
Brake-shoes	Cast iron—Christy brake heads
Couplers	Tower
Draft rigging	Harvey tandem draw bar spring—Miner draft lug
Journal boxes	Symington
Light	Pintsch gas and oil
Platforms	Am. Car & F'dry Co. standard I beam construction
Springs	Crucible steel
Vestibules	Pullman dummy
Wheels	Davis sol'd steel

RAILROAD STRUCTURES.

BARRIE, ONT.—An agreement, it is said, has been reached between the city authorities and the Grand Trunk, under which the road will build new shops here. The work is to be finished within three years.

HAINSBURG JUNCTION, N. J.—The Lehigh & New England, it is said, has given a contract to the Pennsylvania Steel Co. for a 155-ft. bridge over Paulins Kill.

NEW WESTMINSTER, B. C.—The Victoria Terminal Railroad & Ferry Co. is applying for permission to build steel bridges across Serpentine and Nicomeki rivers, near this city.

PORTLAND, PA.—The Lehigh & New England is said to have given a contract to the Pennsylvania Steel Co. for a bridge over the Delaware river. The river spans will be 925 ft. long, and the viaduct approach, 934 ft.

RENSSELAER, N. Y.—It is said that the Boston & Albany will at once start work on a roundhouse here.

TEMISKAMING & NORTHERN ONTARIO.—Bids are wanted by A. J. McGee, Secretary and Treasurer, Toronto, Ont., May 7, for some station buildings, also other structures and a number of small concrete arches.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS ROADS.—Surveys are reported made for a line from Mountain Home, Ark., south to a connection with the St. Louis, Iron Mountain & Southern, 11 miles. W. L. Marshall, of Mountain Home is the principal promoter.

BAINBRIDGE NORTHEASTERN.—This company, organized last year to build a line from Bainbridge, Ga., northeast to Pelham, 35 miles, and eventually south through Florida to a point on the Gulf coast, has finished 18 miles of its proposed line, and has material for building three miles additional. (Sept. 20, p. 338.)

BUFFALO & LAKE ERIE TRACTION.—Bonds have recently been issued by this company to build a five-mile extension in Mill Creek township, Pa.

CANADIAN NORTHERN.—The Provincial Government of Ontario has undertaken to guarantee the bonds of this company to provide for the construction of 50 miles of new railroad at \$20,000 a mile, and of terminals in Toronto to the amount of \$1,500,000.

CANADIAN PACIFIC.—The company has decided not to proceed with the construction of the Moosejaw extension this spring, as was previously intended.

CANADIAN VALLEY (ELECTRIC).—An officer writes that the projected route of this line is from Fort Supply, Woodward county, Okla., southeast down the Canadian river to Oklahoma City, 150 miles. Thomas Martin, President, Mutual, Okla. (March 27, p. 161.)

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CHICAGO, MILWAUKEE & GARY.—Bonds have recently been issued by this company to build an extension from Momence, Ill., north to Gary, 42 miles. Surveys made and rights of way being secured. Also to build from the northern terminus at Rockford, northeast through Beloit, Wis., and Janesville, to Milwaukee, 100 miles, and to secure large terminals at Gary and at Milwaukee. This company owns the railroad and property of the Illinois, Iowa & Minnesota, operating 125 miles of railroad from Momence, Ill., northwest to Rockford, and when the extensions and improvements are made will have a total length of 267 miles. It will form a complete belt line around Chicago, connecting with all of the 32 railroads entering that city. (March 20, p. 429.)

GRAND TRUNK PACIFIC.—According to a report recently made to the Dominion Parliament, the estimated cost of this line is now \$85,000,000. On the eastern division, Moncton, N. B., to Winnipeg, work amounting to \$44,389,393 is under contract, and \$19,030,173 is the estimated cost of lines for which contracts are yet to be let on this section. The Prairie section is to cost \$21,872,200. From a point 193 miles west of Quebec, west to Winnipeg, the surveyed distance is 1,147 miles, of which 571 miles is already let, leaving 576 miles not yet under contract. West of Winnipeg lines aggregating 1,014 miles are under contract, of which 415 miles is finished.

Hon. George P. Graham, Canadian Minister of Railways, recently stated that contracts have been let for all sections between Moncton, N. B., the eastern terminus, and a point known as Waymontachene, 193 miles west of Quebec.

Track laying, it is said, has been started from the terminus of the present track, four miles east of Portage la Prairie, Man., where a bridge is to be built over the Assiniboine river east to Winnipeg. It is expected to have all the track laid on this section by the middle of May, and that the line will be in operation between Fort William and Edmonton, Alb., this fall.

Contracts for grading the sections from Macleod river, Alb., west 100 miles, are to be let May 15, and for the next 80 miles on June 22. This 180 miles, in addition to the 120 miles now being graded, will carry the line through Yellowhead Pass in the Rocky Mountains. (April 17, p. 559.)

Foley, Welch & Stewart, who have the contract for the first 100 miles from Prince Rupert, B. C., east, have sublet one mile through solid rock at Prince Rupert to Ross & Carlson.

An extension of time of two years has been granted to the Grand Trunk Pacific Branch Lines Co. for the following branches from the main line of the Grand Trunk Pacific: Belt line around the city of Winnipeg, Man., to connect with the other railroads, and passing, if deemed advisable, through the outlying portions of that city. Winnipeg, Man., to a point on the international boundary within a distance of 25 miles east or west of the Red river. Neepawa, Man., to a junction with the Grand Trunk Pacific to Brandon and from thence to Regina, Sask. Line from Brandon to a point on the southern boundary of the province in the vicinity of Turtle mountains. From a point on the western division in the vicinity of township 22, range 6, west of the second meridian, to Yorkton, Sask, and from thence to a port on Hudson's Bay. From the same point as the above branch southward to Regina, Sask., and thence to the international boundary near North Portal. From a point on the western division between 105th and 107th degrees of longitude to Prince Albert, Sask. From a point on the western division between 108th and 109th degrees of longitude to Prince Albert, Sask. From a point on the western division between 111th and 113th degrees of longitude to Calgary, Alb., and from thence to the international boundary near Coutts, Alb. From Vancouver, B. C., to a junction with the Grand Trunk Pacific or to a junction with the Pacific Northern & Omineca, or both between the 122d and 124th degrees of longitude. From a point on the north shore of Vancouver Island southerly to Victoria, B. C. From a point on the western division between 127th and 129th degrees of longitude to Dawson City, Y. T.

Grand Valley (Electric).—It is said that this company, operating $21\frac{1}{2}$ miles of electric lines connecting Brantford, Ont.; Paris, Glen Morris and Galt, will build an extension to Port Dover, 35 miles; also an extension to Woodstock, 18 miles.

Kentucky North & South.—Projected from Greenup, Ky., south to Bristol, Tenn., 220 miles. Surveys reported made from Greenup to Palm Gap, 180 miles. L. E. Niles, President; T. J. Kirkpatrick, Treasurer, and E. E. Parsons, Chief Engineer, all of Springfield, Ohio. The office of the company is at Covington, Ky.

Lake Erie & Youngstown (Electric).—This company, incorporated to build an electric line from Conneaut, Ohio, south to Youngstown, about 60 miles, recently increased its capital from $10,000 to $3,500,000. J. H. Ruhman, of Youngstown, who is promoting the enterprise, is quoted as saying that 75 per cent. of the right of way is secured, and that construction work is to be started as soon as the remaining 25 per cent. has been obtained. The increased capital is to prepare for this work. (Aug. 30, p. 247.)

Laramie, Hahn's Peak & Pacific.—Additional grading contracts are reported let to J. F. White & Co., of Rock River, who previously had contracts for some of the work on the extension building from Centennial, Wyo., south to Hebron, Colo., 77 miles. Contract is also reported let to Peter Cain for some of the work. (March 13, p. 392.)

Minneapolis, St. Paul & Sault Ste. Marie.—Thomas Green, Chief Engineer of this road, is quoted as saying that about $6,000,000 is to be spent this year on extension and improvements, including a tunnel into the city of St. Paul, Minn., from Minneapolis. The company has work under way on an extension from Brooten, Minn., northeast to Duluth, 189 miles, of which 49.6 miles was built in 1907. At the Duluth end about 500 men are at work. Foley, Welch & Stewart, of St. Paul, contractors. (March 13, p. 392.)

Mexican Central.—According to reports from Mexico City, work has been suspended on the Tampico cut-off, building from Mexico City east to Tampico. This line is 304 miles long and about 191 miles remains to be built. (March 13, p. 396.)

This company, it is said, will begin work this summer on widening the gage and reconstructing the line from Colima to the Port of Manzanillo. (March 13, p. 396.)

Mexican Pacific Coast.—See Southern Pacific.

Mexican Roads.—Permission has been given by the Mexican Government to Carlos A. Hamilton, of Oaxaca, to transfer the concession granted to him, to a company to be organized in Oaxaca. It is to build a line from San Pablo, Huitepec, in the district of Zimatlin, Oaxaca, to San Juan Tavlche, Ocotlan. An extension of two years' time to finish the work has also been granted.

Contract, it is said, will shortly be let by Percy N. Furber, of Mexico City, President of the Oil Fields of Mexico Company, to build a line from its works at Furbero, Vera Cruz, to the port of Tuxpan, 50 miles. Contract also to be let for the construction of an oil pipe line parallel to the proposed railroad.

Panhandle Short Line.—This company was organized last year to build from Dalhart, Tex., south via Hereford and Midland, to San Antonio, also to Rockport, on the Gulf, with branches, a total of about 800 miles. According to statements credited to W. A. Squires, of Henrietta, Tex., General Manager, the work is to be pushed. The section from Carrizo Springs southeast to Artesia is being built by Asher Richardson. Grading south from Stanton has been finished for 22 miles, and north from Stanton for 24 miles; also from Dimmit, north to Hereford, 22 miles. Contracts are to be given to Suderman, Dolson & Co. for grading from Artesia east to Rockport; to Harris & Co. from Uvalde to Crystal City, and to the Southwest Texas Construction Co., north from Hereford. (March 13, p. 393.)

Pennsylvania Roads (Electric).—Horace Snyder, of Pittsburgh, is organizing a company to build an electric line from Franklin, Pa., north via Wyattville, Bradleytown and Townville, to Cambridge Springs, 36 miles.

Pleasantville Electric Traction.—Organized in Pennsylvania to build an electric line from Oil City, Pa., north via Rouseville, Pit Hole and Pleasantville to Titusville, 12 miles. The promoters are residents of Oil City and Pleasantville.

Southern Pacific.—J. Kruttschnitt, Vice-President, is quoted as saying that work on the Mexican Pacific Coast building from Navajo, Sonora, south of Coral on the Cananea, Yaqui River & Pacific, southeast to Guadalajara, Jalisco, is finished to Macerita river, about 270 miles south of Guaymas. About 15 miles additional is graded, and track laying is soon to be started on this section. It is expected to have the line finished as far as Culican early in July.

The Grant Bros. Construction Co., of Los Angeles, Cal., building the branch of the Cananea, Yaqui River & Pacific, from Rio Yaqui Sonora, north to Nacozari, 108 miles, has a large number of men at work, said to be about 1,000. (March 13, p. 396.)

Youghiogheny & Cheat River.—Incorporated in Pennsylvania with $200,000 capital, to build a line from Ohio Pyle, Pa., where connection is to be made with the Baltimore & Ohio, south 21 miles to the West Virginia state line. Contracts, it is said, are to be let at once. A charter is to be asked for in West Virginia to extend the line south to a point in Preston county. E. W. Mudge, President, Pittsburgh, Pa. J. V. Thompson, A. L. Keister and A. Overholt are said to be interested.

RAILROAD CORPORATION NEWS.

Bainbridge & Northeastern.—J. M. Wilkinson, as receiver of E. Swindell & Co., has taken entire charge of all the property of the Bainbridge Northeastern Railroad.

Baltimore & Ohio.—Commencing May 1, the Little Kanawha Railroad, which runs from Parkersburg, W. Va., to Owensport, 31 miles, from Owensport to Enterprise, three miles by steamer, and from Enterprise to Creston, 16 miles, will be operated by the Baltimore & Ohio. The Little Kanawha Railroad is owned jointly by the Pittsburgh & Lake Erie, the Baltimore & Ohio and the Pennsylvania, through the Little Kanawha syndicate.

Gross earnings for March were $5,300,000, a decrease of $1,200,000 from March, 1907. Net earnings were $1,150,000 for March, a decrease of $469,000 from March, 1907.

Boston & Maine.—A syndicate of six banking houses composed of R. L. Day & Co.; Lee, Higginson & Co.; Kidder, Peabody & Co., Estabrook & Co.; Blodget & Co., and Merritt & Co., are offering $2,400,000 Fitchburg Railroad $4\frac{1}{2}$ per cent. 20-year bonds at $103\frac{1}{2}$ to yield $4\frac{1}{4}$ per cent. The bonds were sold by the road to provide funds to take care of $2,000,000 bonds maturing the first of next month. The balance, $400,000, will be used to reimburse the Boston & Maine for construction money already spent on the Fitchburg.

Buffalo, Rochester & Pittsburg.—Gross earnings for the second week in April were $115,000, a decrease of $52,000 from the second week in April, 1907.

Chesapeake & Ohio.—This company will probably sell in the near future $2,000,000 5 per cent. consolidated mortgage bonds of 1889-1939, to meet an equal amount of 6 per cent. mortgage bonds which fall due on July 1. The new bonds are part of an authorized issue of $30,000,000, of which there are outstanding $25,858,000. The company also has $1,200,000 6 per cent. notes falling due on June 28. It is proposed to meet these by issuing new notes.

Chicago, Indiana & Southern.—J. P. Morgan & Co. are offering at 91 and interest, $15,150,000 of the Chicago, Indiana & Southern's $20,000,000 (authorized) 50-year 4 per cent. mort gage bonds, 1906-1956, guaranteed by the Lake Shore & Michigan Southern. These bonds are a first lien on 329 miles of road and equipment, except that there are outstanding $1,850,000 bonds of 1901-1950 of the Indiana, Illinois & Iowa, which are a first mortgage on the Kankakee division only, and to provide for which bonds of the new issue are reserved. On December 31, 1907, there were $7,000,000 Chicago, Indiana & Southern bonds in the treasury of the Lake Shore.

CHICAGO, MILWAUKEE & GARY.—This company has authorized $20,000,000 40-year 5 per cent first mortgage bonds. Of these $5,500,000 have been issued in exchange for the Illinois, Iowa & Minnesota Railway and its subsidiary lines, which operates 125 miles. The balance of the bonds will be issued to pay for extensions south to Gary and north to Milwaukee, and for terminals at Gary and at Milwaukee.

CHICAGO, MILWAUKEE & ST. PAUL.—The Milwaukee Terminal Railway was incorporated in the state of Washington last week, to act as a common carrier and to supply facilities for handling freight and passengers at railroad terminals.

ERIE.—Gross earnings for February were $3,200,000, a decrease of $500,000 from February, 1907. Net earnings for February were $196,000, a decrease of $516,000 from February, 1907.

FITCHBURG RAILROAD.—See Boston & Maine.

GALVESTON TERMINAL RAILWAY.—The stockholders have authorized $5,000,000 bonds to pay for improvements now under way. The company's facilities are to be used by the Trinity & Brazos Valley, the Colorado & Southern, the Chicago, Rock Island & Pacific, and the St. Louis & San Francisco.

GREAT NORTHERN.—It is said that the Northern Pacific is to give the Great Northern an entrance to Tacoma, Wash., and in return get an entrance into Vancouver, B. C., from the Great Northern.

GULF & SHIP ISLAND.—The $460,000 car trust certificates offered in January, 1908, by Cramp, Mitchell & Shober, of Philadelphia, were never issued, owing to a change in plans.

ILLINOIS CENTRAL.—A first lien equipment mortgage for $30,000,000 has been filed for record by this company. The mortgage is to secure an issue of 4 per cent. bonds 1908-1923. The mortgage covers the entire rolling stock of the company.

INTERBOROUGH RAPID TRANSIT.—The New York City Public Service Commission has authorized a mortgage securing $55,000,000 45-year bonds, of which $35,000,000 5 per cent. bonds are to be deposited as security for $25,000,000 three-year 6 per cent. notes, dated May 1, 1908. It is said that these notes have been sold to J. P. Morgan & Co. The proceeds of the sale will enable the company to redeem the $15,000,000 4 per cent. notes due May 1, 1908, and to pay off other obligations.

INTERNATIONAL & GREAT NORTHERN.—Steps have been taken to foreclose the company's second mortgage. This is the Texas Railroad which several months ago was placed in the hands of a receiver.

Gross earnings for the week ended April 14 were $118,000, a decrease of $35,000 from the corresponding week in 1907.

LAKE SHORE & MICHIGAN SOUTHERN.—See Chicago, Indiana & Southern; also Lehigh Valley.

LEHIGH VALLEY.—The Lake Shore & Michigan Southern has already disposed of approximately 50,000 shares of its Lehigh Valley stock. (April 17, p. 560.)

LITTLE KANAWHA.—See Baltimore & Ohio.

METROPOLITAN STREET RAILWAY.—See New York City Railway.

MEXICAN CENTRAL.—See National Railways of Mexico.

NATIONAL RAILWAYS OF MEXICO.—S. M. Felton, President of the Mexican Central, in discussing the Mexican Railroad merger, said that it does not mean a government ownership, but a control which is most desirable. The conditions there are entirely different from those in the United States. Mexico is undeveloped, and what it needs most is railroads. Through a government control railroad construction will be carried on so as to benefit the country as a whole, and thus avoid needless parallel lines and unnecessary expenditure for the purpose of competition.

NEW ENGLAND INVESTMENT & SECURITY CO.—See New York, New Haven & Hartford.

NEW YORK CENTRAL & HUDSON RIVER.—The Public Service Commission, Second District, has authorized the New York Central to issue $4,000,000 3½ per cent. refunding mortgage bonds of 1897-1997. There are outstanding $85,000,000 of a total authorized issue of $100,000,000. It also authorized the issue of $20,000,000 4 per cent. debenture bonds of 1904-1934. The total authorized issue of these bonds is $50,000,000, of which $30,000,000 are now outstanding. The proceeds of the bond sales are to be used for improvements.

NEW YORK CENTRAL LINES.—See Baltimore & Ohio.

NEW YORK CITY RAILWAY.—Judge Lacombe, of the United States Circuit Court, has filed a memorandum in which he states that the New York City Railway Co. should be held liable for the $3,500,000 which is needed to put the property of the Metropolitan Street Railway in good condition. The New York City Railway Co. is the lessee of the Metropolitan Street Railway.

NEW YORK CONNECTING.—Ralph Peters and John F. Stevens have been elected directors to succeed Thomas B. Rea and Charles S. Mellen, respectively. Other directors have been re-elected.

NEW YORK, NEW HAVEN & HARTFORD.—Mackay & Co., of New York, are offering at 81½, to yield 4.85 per cent., a small amount of the New England Investment & Security Co.'s cumulative preferred stock, which is guaranteed by the New York, New Haven & Hartford.

NORTHERN PACIFIC.—See Great Northern.

PATERSON RAILWAY (ELECTRIC).—F. K. McCully, of Paterson, N. J., and W. E. R. Smith & Co., of New York, are offering $202,000 6 per cent. consolidated mortgage bonds of the Paterson Railway Co. at 116½, yielding 4.80 per cent. These bonds will, after June 1, 1908, be a first mortgage on 39 miles of street railway in Paterson, N. J.

PENNSYLVANIA.—This company has sold to Kuhn, Loeb & Co., New York, and N. M. Rothschild & Co., and Baring Bros. & Co., Ltd., of London, $40,000,000 of its 40-year, 4 per cent. consolidated mortgage bonds, which is part of an authorized issue of $100,000,000 of 1873. There are now outstanding $12,500,000 of these consolidated mortgage bonds. These bonds are a first lien on all the main line and branches of the Pennsylvania Railroad between Pittsburgh and Philadelphia, subject only to $20,000,000 general mortgage bonds now issued, which mature in 1910 and which will be refunded by an issue of the consolidated mortgage bonds first mentioned. The new bonds also cover the lease of the United New Jersey Railroad & Canal Co., which forms the main line of the Pennsylvania from Philadelphia to Jersey City. Incidentally this is the first time in about 30 years that the Rothschilds have handled an American security. It is understood that the bonds will be issued at 96.

See Baltimore & Ohio.

PITTSBURGH & LAKE ERIE.—See Baltimore & Ohio.

PITTSBURGH, CINCINNATI, CHICAGO & ST. LOUIS.—Gross earnings decreased during March more than operating expenses and taxes, so that the net earnings after taxes were $30,000 less than in March, 1907.

TEXAS & PACIFIC.—Gross earnings for the week ended April 14, 1908, were $212,000, a decrease of $76,000 from 1907.

UNDERGROUND ELECTRIC RAILWAYS OF LONDON.—The directors have sent out circulars to the noteholders and shareholders giving them details of the reorganization plan. A receiver was appointed for the Underground Electric Railways of London on April 15. Under the plan of readjustment the holders of $35,000,000 5 per cent. profit sharing notes due June 1, 1908, will be given in exchange 40 per cent. in new 4½ per cent. bonds due 1933, and 70 per cent. in new 6 per cent. income bonds due 1948. No assessment is asked for from stockholders. Of the 4½ per cent. bonds there are to be issued $15,000,000 (£3,000,000), and of the income bonds there are to be issued $26,000,000 (£5,200,000). There are also to be sold to Speyer & Co. $5,500,000 (£1,100,000) prior lien 12-year 5 per cent. bonds to meet the cash requirements of the company. Speyer & Co. agree to provide $1,500,000 (£300,000), for any possible deficiency in fixed charges during the next few years "in order that the noteholders may not suffer so serious a reduction in their income as might otherwise be the case during the further developments of the enterprise." The three issues of bonds will be secured by a deposit of $17,500,000 (£3,500,000) par value of the Tube shares and the equity in the power house in addition to $55,000,000 (£11,000,000) par value of the stocks now held by the London and Westminster Bank as trustee for the noteholders, the prior lien bonds ranking before the other issues.

UNITED STATES EXPRESS.—A semi-annual dividend of $2 per share has been declared. This is a reduction of $1 per share from the dividend declared six months ago. Prior to that time $2 per share had been paid semi-annually.

WABASH.—The company has sold to Tailer & Company, New York, $889,000 first mortgage, 5 per cent. bonds, 1889-1939. With the sale of these bonds, the total authorized issue $34,000,000 is outstanding. Tailer & Company are offering these bonds to yield 4$^{70}/_{100}$ per cent.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N. Y., and the names of the officers and editors of the Railroad Gazette:

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CONTENTS

VOL. XLIV., No. 18. FRIDAY, MAY 1, 1908.

THE MOVEMENT FOR HIGHER FREIGHT RATES.

In the aftermath of so-called hard times which follow a financial panic the rule and law of recovery is expressed curtly by the single word "contraction." There is contraction of the price of securities, contraction in the rate of wages and contraction in the cost of living. From the low and solid level thus resulting new prosperity is built up with greater or less speed. Low securities sooner or later induce buying of them. Low wages reduce the price of commodities and when they are low enough demand once again sets in. When demand sets in trade grows brisk, the commodities bought reach the railroads and pass over them, earnings increase and hard times shift into good times. Such is the sequence of events and the normal law of recuperation from panics in this and every other country. It may almost be called a historical as well as logical axiom. Here and there in the past one may find a modifying fact. In 1873, for instance, the recovery in this country was undoubtedly much delayed because gold imports could not be used for the relief of a market not then on a specie basis. But, in general, and up to our present depression the rule stated of relief of financial distress has held.

But in the panic and hard times of 1907-8 we are fronting certain new and strange conditions. For the first time three novel and unprecedented resistive forces are setting themselves athwart the law of healthy reaction from hard times. Organized labor, notably in the case of the railroads, refuses to accept reductions of wages—and does so with some strength in its plea that it faces cost of living reduced very slightly and, in many leading items, not at all. Labor even takes the short-sighted view that it will accept reduced hours and the privations of idleness rather than a lower wage-rate. Next we have the organized trusts, in tacit if not formal agreement not to lower prices and accepting smaller sales rather than lower the profit percentage—their position in the matter thus being strikingly similar to that of organized labor. Finally, on what seems the political motive, we have federal authority throwing all its influence against wage reduction and threatening investigation of alleged railroad "misconduct" if the distressed railroad corporation cuts down wages.

In the case of the railroads, as in other branches of commercial interest, three artificial influences—organized labor, the trusts and federal policy—have thus been set against natural law. Deprived of appeal to the normal elements of relief the thing easily foreseen has come to pass and the trunk line presidents have been taking counsel together for a general increase of freight rates. Three anomalies of a situation have thus produced a fourth, that is to say, a proposed rise of rates in a period of industrial depression and of natural drift to a lower scale of prices. The railroads say with a good deal of logical force "we have been deprived of certain regular forms of economy and relief. We must now move in the other line of least resistance and increase rates." The plan has one conspicuous peril. Its ultimate burden rests obviously on the consumer to whom every plus in the algebra of prices is at last charged up. The consumer's other name is the general public, not just now too friendly to the railroad corporations and certain not to be made less hostile by an increase of rates. A step not attended with much, if any, risk in a period of commercial prosperity changes its nature when taken in a period of commercial stress and may afford fresh text for the demagogue and politician against whose frothy, albeit fictitious, rage the cold facts of a situation are apt to be urged in vain. And a presidential campaign is not the time when their voices are hushed.

The policy of raising freight rates under such conditions is one which must be determined by the railroad corporations themselves. A good deal depends, doubtless, on the question of change in industrial conditions and the possibility of an outlet in the direction of reduced wages and cost of material attended, perhaps, with the reduced dividends which tend to diminish the burden by dividing it with the consumer and wage earner. But just now and in the immediate case the thing to be noted is the strange and anomalous economic situation in which three forces are crossing natural law and are compelling the railroads also to cross it. The outcome of the conflict of that law with resistive expedients will be a rich theme when the completed story is written.

METAL AND REINFORCED CONCRETE TIES.

In Europe the metal tie has passed the experimental stage, the principles being generally accepted and only the details remaining to be standardized. Conditions abroad, however, are entirely different from those in this country. We have not yet come to the point where it is immediately necessary to look for a substitute for the wooden tie. Several years ago Mr. Whinery showed that, on the basis of yearly cost of the original investment, a steel tie good for 25 years' service must not cost originally over $1.85 to be as economical as an untreated wooden tie costing 62 cents in track and lasting eight years. Similarly, a reinforced concrete tie lasting 14 years must not cost over $1.05.*

Last year the Maintenance of Way Association's committee on ties made a report covering the use of concrete ties, describing a number of designs and giving results of experiments with them. It did not report on steel ties. The committee called attention to three requisites in the design of either steel or concrete ties: First, an efficient method of fastening the rail to the tie; second, a considerable amount of elasticity in the tie itself; and, finally, satisfactory insulation. Difficulty with insulation occurs in concrete as well as steel ties, as short-circuits occur between the rails and the reinforcement. Fiber insulation wears out and track circuit maintenance becomes expensive. The first two requirements are closely related. There must be a certain amount of give between the rail and the sub-grade. Part of this, with wooden ties, is in the ballast, part in the tie and part in the fastening. This cushioning is necessary for easy riding track and to prevent rail breakage, since the rail must be allowed to take its proper curve or "wave" under load. The amplitude of the wave is ⅛ in. or more. In spiking a wooden tie, some play results, and the rest of the superstructure also lifts and falls somewhat. In designs of ties other than wood the rail is usually fastened firmly to the tie, and the tie itself is rigid. Dr. Haarmann, in the paper recently published in the *Railroad Gazette*, showed designs of metal ties in use in Germany which have more elasticity. This inverted trough type has, in this country, been found too weak to stand up under the much heavier trains which we use. The National of Mexico has for a long time been using ties of this sort on narrow gage road. The average life is given as 14 years before repairs were necessary. The ties were laid 16 to the rail in burnt volcanic clay ballast, the traffic was not heavy and the speed of trains very slow. Failures were due to breakage under the rail seat where the ties are weakened by cutting and bending up part of the metal to make lugs to hold the keys. The officers of the road recommend a U-bolt instead of the key, which will not remain tight. Rock ballast cannot be used with these ties, as it makes the track too rigid, resulting in frequent rail breakage and also damaging the rolling stock. The National of Mexico has not used any steel ties on standard gage track. A trough design was tried on the Pennsylvania Lines West a few years ago. These were Seitz iron ties, 49 of which were laid in the westbound passenger track of the Pittsburgh, Ft. Wayne & Chicago, near Emsworth, Pa., in October, 1904. Part of them were on a 2 deg. 10 min. curve, and part on tangent, 16 ties being used for each 30 ft. rail. These ties broke under the rail seats, and during 1905 they were removed. The Snyder steel tie is shaped somewhat like an ordinary wooden tie, the inside being filled with a cheap grade of asphaltum containing a large proportion of gravel. The Pennsylvania Lines East have about 3,000 of these in service on unimportant sidings. They seem to be satisfactory, but the company has never felt it wise to put them in main passenger tracks.

The Carnegie tie is the only steel tie which has been made in large numbers in this country. It is an I-beam section 5½ in. high; the top is 4½ in. wide and the base 8 in. wide. Smaller sections are rolled for electric lines and industrial railways. The rail is secured to the tie by two rolled steel clips at each rail seat bolted to the tie with ¾-in. bolts. There are indentations in the base to diminish lateral motion, and in the latest design the base is also crimped to tend to prevent shifting in the direction of traffic on heavy down grades. Up to the end of 1907, 248,914 of these ties had been sold to companies outside of the United States Steel Corporation and 593,550 to the corporation and its constituent companies. The first lot were sold in 1904. The experience of the Bessemer & Lake Erie, controlled by the Steel Corporation, on which a great number of these ties have been laid, seems to show that this design is practicable under very heavy traffic as long as it moves at low speed. Under high speed trains it is criticised for its rigidity and the design of the fastenings, the clips holding the rail so tightly that the wave in the rail under the wheel is resisted. The reaction of the steel tie as it returns to position after the wheel impact is much sharper than the cushioned reaction of a wooden tie; the shock, almost undiminished, is thus transmitted from the tie through the rails to the adjacent ties, resulting in secondary stresses which modify the impact and rail wave stresses at different points. Some of the roads which have used this tie report as follows. The Buffalo Rochester & Pittsburgh, in 1906, laid 1,500 in main track at Colden, N. Y., part on tangent and part on a 3-deg. curve, and 1,500 in southbound track near Ridgway, Pa., all on a 2-deg. curve. The track is ballasted with broken stone and slag and is subject to heavy, high-speed traffic. The company has had considerable trouble in keeping the fastenings in proper condition, but little trouble in keeping track in surface and line. The price paid, including clips, etc., was $2.08 per tie. The Cleveland, Cincinnati, Chicago & St Louis has had in track, for about a year, 3,000 ties laid on a 30 min. curve. At first the fastenings loosened, but this trouble is decreasing. Some of the bolts were removed and showed but little wear. The maintenance cost, as far as surfacing, has been no more than with wooden ties. The purchase price was $2.02. The Pittsburgh & Lake Erie also has 3,000 ties in track under 90-lb. rail, 22 ties to the rail. They are laid in the main northbound freight track, subject to low-speed traffic, partly on slight curvature and partly on tangent. The track is on stone ballast. The ties are insulated for track circuit and because of the number of points of insulation there has been some trouble, but not enough to seriously interrupt signal service. The officers of the road believe that by using a heavier rail and more ties to the rail they can be properly insulated and used in fast main track service. The cost, including insulation, was $2.50. The Pittsburgh, Shawmut & Northern has had 700 in track for about nine months. They are laid in gravel ballast on both curve and tangent under 85-lb. rail, 20 ties to the 33-ft. rail. They are under very heavy traffic at low speed, a 227-ton locomotive running over this track. The opinion of the engineering department of this road is that these ties are satisfactory under the above conditions on tangent and on curves up to possibly 3 or 4 degs., but that on greater curvatures they move laterally through the ballast. On 14-deg. curves some of the bolts have been sheared, but this has not happened on 12-deg. 30-min curves in spite of the heavy locomotive mentioned. The ties cost, delivered, $2.16. The Baltimore & Ohio has had 2,860 in main line freight track east of Marriottsville, Md., for over a year. They seem to hold line and surface somewhat better than wooden ties, but the design of the clip and the difficulty of getting good bearing on ballast are objectionable features. The New York Central laid some of these ties in rock ballast on straight and curved track under heavy traffic at high speed, using 18 ties to the rail. They were all removed because they complicated the maintenance of signal track circuits and because so many rails broke on them. The Pennsylvania Lines West laid 500 ties in westbound passenger track near Emsworth in the spring of 1905. About one-fifth were placed on a 2 deg. 10 min. curve, and the rest on tangent. They were laid in stone ballast, 22 ties to a 33-ft., 85-lb. rail, and subject to heavy traffic at high speed. They were removed in July, 1907, because it was reported that they were failing. Investigation showed, however, that, while there was some deterioration, the ties should not have been taken out. The company reports that the ties held the track in good line and surface, and comments on the fact that there was less noise under passenger trains than is the case with wooden ties. The insulation at first was not efficient, but before the ties had been removed this difficulty had been mostly overcome. The ties move more readily through the ballast with the creeping of the rails than do wooden ties, and, also, it was found hard to keep them at right angles to the rail. A serious objection is that when the tie is laid in rock ballast, the stone under the bottom flange becomes pulverized so that mud is formed; this occurs no matter how well the track was ballasted and surfaced in the first place. They cost, complete, $2.62. The Pennsylvania Lines East had some in service for a little less than a year in about a mile of main passenger and freight track at Mineral Point, Pa. After the derailment of a passenger train at that point last year, all these ties were taken out. A careful investigation indicated that their use was not in any way responsible for the derailment, but the resulting damage was greater than it would have been if wooden ties had been used. These ties were more expensive to maintain than wooden ties, and did not make such an easy riding track. The company believes that if the tie were made somewhat heavier, and a better fastening used, it would give good results.

The Buhrer reinforced concrete tie consists of a piece of 65-lb. scrap rail, laid in concrete shaped somewhat like a wooden tie, with flat bearing on the ballast. From 18 to 20 ties to the rail are used. In June, 1903, 50 were laid on the Lake Shore & Michigan Southern, the Lake Erie & Western and the Chicago & North-Western. These ties are still in track in good condition. In December,

*Railroad Gazette, November 11, 1904.

1903, 21 ties were laid on the Pittsburgh, Ft. Wayne & Chicago, partly on 2 deg. 10 min. curve and partly on tangent, 16 ties to the 30-ft. rail. They were removed the next month because the concrete broke away from the reinforcement. During the following spring 300 more were put in track at the same place. They began to break soon, and by August of that year 131 of the total 321 had been removed. During the fall 200 more were laid, but they continued to break, and by December, 1906, all had been taken out. In the spring of 1903, 50 were laid in main track near Toledo, Ohio, and 50 more at the same place in April, 1904. These were in stone ballast, 16 ties to the 30-ft., 85-lb. rail, under comparatively light, medium-speed traffic. They were all removed during the latter part of 1905 because they broke. In July, 1903, 550 ties were laid on 9 and 10 deg. curves on the Lake Side & Marble Head. They are subject to heavy traffic, but the speed is not over 30 miles an hour. In 1907, 37 ties were removed because the concrete failed. In September, 1903, 77 were laid by the Ann Arbor Railroad on a 6-deg. curve around which passenger trains run at 60 miles an hour. Of these ties, 10 have been removed because the concrete failed under the inner rail. The rest are in track and in good condition. In July, 1904, 1,000 ties were laid on a 6-deg. curve on the Lake Shore. Of these, three failed and were removed in 1905. The rest were taken out in the summer of 1907 because an electric track circuit was being installed. At the same time that these were laid, 1,000 were installed in the Lake Shore main track at Millsburg, Ind. In 1905, 110 of these failed, and in 1906, 105; the rest were removed in August, 1907, when electric track circuits were installed. In October, 1904, 1,000 ties were laid on the Sandusky Pier branch of the Lake Shore, in a city street. So far there have been no failures. During the same month, 500 were put in the Lake Shore switching leads in the Englewood yards. Of these, 31 have failed and the rest are in good condition. The cause of the above removals was, in general, that the concrete split and crumbled, partly because of defects in the concrete, partly through imperfect reinforcement, and partly because of high speed. It is considered that with proper reinforcement and clean, high-grade material, properly mixed, this tie is satisfactory for slow speed and yard track, and should have a very long life. The scrap rail should have the same scrap value after 20 or 30 years as it had in the beginning. The cost of the tie is 95 cents, plus fastenings and the price put on 180 lbs. of scrap rail.

The Percival reinforced concrete tie is, roughly, a three-sided prism, the rails being laid on one face. The lower edge is comparatively sharp in the middle, but is rounded beneath the rail seat to a shape nearer that of a wooden tie. The depth is about the same throughout its length. The rail rests on an impregnated hard wood block. Threaded sockets of Babbitt metal are cast in the tie to receive screw spikes; no clips are used. The reinforcement consists of three corrugated steel bars in the upper surface of the tie and one at the bottom close to the edge; the bars are bound together with wire. The object of blunting the lower edge under the rail seats is to give the tie more bearing surface on the ballast at these points. The comparatively sharper edge at the middle of the tie does not give such a firm bearing on the ballast, so that (considering the tie as a beam with the pressure on the ballast as its load) there is less bending moment at the middle, at which point concrete ties often crack. This tie costs about $1.85; the concrete is a 2:2:7 mixture, the aggregate being screened to ¾-in. size. The reinforcement weighs about 25 lbs. In the middle of 1905, 25 ties were laid in main line track of the Galveston, Houston & Henderson, at Galveston, Texas. They were laid in sand ballast and were subject to all the traffic of the road at that point, including switching, but not to high-speed trains. One of these was removed nine months later and showed no signs of deterioration, the spikes and cushions being in good condition. In the fall of 1906, three cars loaded with rails ran off the track, breaking the ends of three ties and badly shattering the centers of one or two. The track remained true to gage, and the ties were not removed at that time. In the spring of 1906 some of these ties were laid in the Florida East Coast Railway's track at St. Augustine, Fla., in coquina, or shell, ballast, but no report has as yet been made on them. In October, 1906, a number were laid in the tracks of the Galveston, Harrisburg & San Antonio at Edgewater, Texas, in Glidden gravel. From six to eight freight trains and four passenger trains a day run over this track, at speeds from 40 to 60 miles an hour. In the following February a freight train was derailed and the cars ran over 50 of these ties, breaking off the ends of about 25 of them. The track remained true to gage and only three of them were at that time removed. The rest were taken out 11 months later. The spiking was in good condition in spite of the derailment, and the ties were not cracked in the center; they were removed only because of their appearance and because the ends of the reinforcing bars were exposed, and so would ultimately corrode. At the same time that these ties were laid on the Galveston, Harrisburg & San Antonio, some were put in the track of the Pittsburgh & Lake Erie in heavy rock ballast. Two of these cracked in the center, and a rail broke, at a joint, between a concrete tie and a wooden tie.

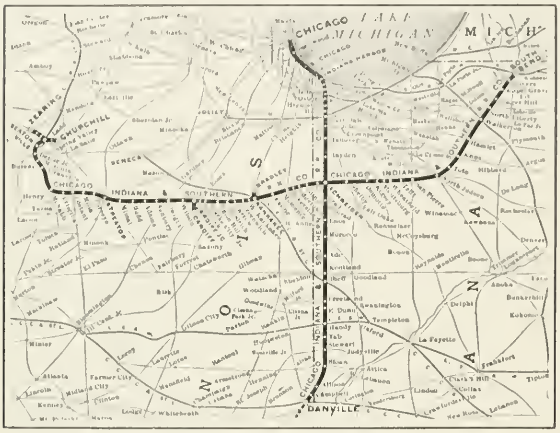
A number of designs of reinforced concrete ties have been tried on the Pennsylvania Lines West in addition to the Buhrer tie. In the summer of 1899, 30 Harrell ties were laid in the westbound main track near Harrison street, Chicago. This tie is about 8½ in. deep throughout; under the rail it is 9 in. wide, and narrows to 5 in. in the center. The reinforcement consists of a steel plate ¼ in. by 7 in., set on edge and running the length of the tie, with a number of lugs punched from it to get a grip on the concrete. These ties were put on a 6 deg. 10 min. curve, in stone ballast, 16 ties to the 30-ft., 85-lb. rail, under heavy traffic at high speed. They were all removed within a year because the fastening, a convenient device of spring steel, was too weak. Some of the ties also were badly broken. It does not appear that the design can be used for heavy traffic. The Affleck tie is 8 in. wide and 6 in deep, with I-beam reinforcement. In the fall of 1904, 100 of them were laid in the westbound passenger track west of Emsworth on tangent, 16 ties to the rail. They began to fail from the beginning, the concrete breaking and crumbling under and outside of the rail. Transverse cracks also developed at the bolts which held the rail clips. By April, 1905, they had all been removed. The Chenoweth tie is 6 in. deep by 8¼ in. wide. It is reinforced with six longitudinal ½-in. bars and with wire netting of ½-in. mesh. The rail rests on a steel tie plate, between which and the tie is a wooden plate ⅞ in. thick. The clips are held by screw spikes going entirely through the tie and engaging with a wire helix which is held in a white metal lining fitted in the hole through the concrete. In the fall of 1906, 101 were put in switching tracks in Scully Yard, Pa., on the P., C., C. & St. L. They were placed in cinder ballast, 16 ties to the 30-ft., 85-lb. rail, under heavy traffic at low speed. Up to the middle of January, 1908, four had been removed because they crumbled under the rail. There has been some trouble in keeping the bolts and clips tight. The creeping of the rail tends to turn the clips around, and in a few cases the rail has become unclamped in this way. Each of the three designs described above cost $1.50. The Keefer tie is reinforced with longitudinal twisted bars. In December, 1905, 44 of them were put in track at the same place as the Chenoweth ties. They began to break soon and were all taken out by June, 1906. On this design the rail rests on oak blocks. These did not hold the spikes firmly and the rails spread. The Bowman tie is 8 in. wide and 6 in. deep, reinforced with expanded metal near the top and on both sides. In December, 1905, five of them were put in freight track at Emsworth, under heavy, high-speed traffic. They all broke under the first train that passed over them. The designer believed that the reinforcement did not extend far enough under the base of the tie, so he furnished 25 improved ties in July, 1907, but they have not yet been put in track.

The Delaware & Hudson laid 99 reinforced concrete ties last fall on tangent in broken stone ballast under 90-lb. rail. Heavy trains are operating over this track at high speed. None of these have as yet been removed. They cost $1.80 apiece. Several designs of concrete ties have been used on the New York Central in yards, but none of them have been satisfactory. They disintegrate and their rigidity and lack of proper fastenings are also criticized.

The Buhrer cushion and insulation steel tie consists of a steel inverted T section with heavy wooden blocks set on it under the rail seats, the rails being spiked to the blocks in the ordinary way. With this design there is no more trouble with insulation than in an all-wood tie. The blocks are fastened to the steel by bolts passing through metal U straps which pass under the steel beam. This holds the fibers of the wood together and the spikes hold in the wood more solidly than in ordinary wooden ties. They cost, complete, from $2.25 to $2.50. The Lake Shore laid a hundred of these in main track at Sandusky Junction, Ohio, in the fall of 1905, and 1,400 more at the same point the following spring. They are laid in gravel ballast on a 1-deg. curve under 80-lb. and 100-lb. rail, 20 ties to the rail. All the westbound traffic of the road goes over this track at high speed. None of the ties have been removed so far.

Chicago, Indiana & Southern.

This company was formed by the consolidation of the Indiana, Illinois & Iowa, known as "the connecting link," with the Indiana Harbor. The Indiana, Illinois & Iowa could transfer through freight from eastern and western roads around the city of Chicago, so avoiding freight delays in Chicago. This road runs from Ladd, Ill., east to South Bend, Ind. The Indiana Harbor line runs from Indiana Harbor, on the lake shore 19 miles east of Chicago, south to Danville, Ill., which is the northern terminus of the Cairo division of the Big Four. It was built by New York Central interests to develop the Cairo division of the Big Four and to enable this division to compete for through traffic between New Orleans, La., and Chicago, and also to open up a new supply of bituminous coal for the western New York Central Lines. By the new Indiana Harbor-Danville line it is 389 miles from Chicago to Cairo against 365 miles by the Illinois Central. A new fast freight line, called the North & South Despatch, has been established, which handles traffic between Chicago, and New Orleans and Mobile. The Big Four runs through Sheff, Ind., on the Chicago, Indiana & Southern road, to Kankakee, Ill. From Kankakee it at present runs into Chicago over the Illinois Central tracks. It would be possible to run Big Four trains directly into Chicago by using the Chicago, Indiana & Southern's tracks and trackage rights.



Chicago, Indiana & Southern.

The second report of the Chicago, Indiana & Southern, and the first report which shows the combined roads operating as a single property for the entire year, shows gross earnings of $3,000,000, as compared with $2,300,000 in 1906, an increase of 29 per cent. Net earnings were $1,000,000 in 1907 and $500,000 in 1906, an increase of 100 per cent. Freight earnings were $2,700,000, an increase of $600,000. Passenger earnings were $200,000, an increase of $32,000, but this increase is not commensurate with the large number of passengers carried, owing to the reduction in passenger rates on intrastate business both in Indiana and in Illinois.

The cost of maintenance of way per mile operated was $1,300 in 1907 and $1,000 in 1906. This increase was mainly due to relaying the tracks of the Kankakee division with heavier rails and putting the roadbed in condition for increased traffic.

Freight earnings per mile were $8,400 in 1907 against $5,800 in 1906. Freight density was 1,850,000 tons one mile per mile of road in 1907, an increase of 750,000 tons. The trainload was 542 tons in 1907, an increase of 138 tons over 1906. The number of passengers carried one mile per mile of road in 1907 was 31,000, an increase of 6,000 over 1906. Almost all the other operating figures show increased efficiency in handling both freight and passengers.

During the past year the tonnage of bituminous coal carried by the road increased from 960,000 tons to 2,300,000 tons. The total number of tons of freight moved was 5,100,000 in 1907, an increase of 1,100,000 tons over 1906. This is less than the increase in the tonnage of bituminous coal. The only class of freight besides bituminous coal which shows any considerable increase during the year is dressed meats, which increased from 170,000 tons in 1906 to 214,000 tons in 1907.

During the year the company charged $212,000 for new equipment and $1,300,000 for new construction and improvements to property, to capital account. New yards, shops and general office buildings at Gibson, Ind., cost $779,000 and passing sidings and new construction on the Danville division cost $332,000.

The advantages of the consolidation of the Indiana, Illinois & Iowa and the Indiana Harbor line are shown by the increased traffic and the increased net earnings. The possibilities of the property seem to be good.

There have been authorized $20,000,000 fifty-year 4 per cent. bonds, of which $4,850,000 are reserved for the purpose of paying off the Indiana, Illinois & Iowa first mortgage bonds. Last week J. P. Morgan & Company offered $15,150,000 of these bonds at 91 and accrued interest. Last year's report showed $10,000,000 of these bonds outstanding. Besides the interest charge of $400,000 on these bonds, the company showed a further charge of $232,700 for interest on loans. These loans are to be paid off. The annual interest on the additional $5,150,000 will be $206,000. This is $26,700 less than the interest charges on the loans. The mortgage securing the bonds is a first lien on all property and equipment of the Chicago, Indiana & Southern, subject only to the underlying bonds of the Indiana, Illinois & Iowa

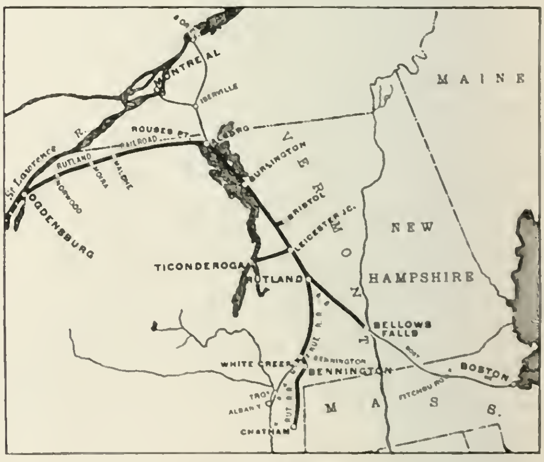
The following table summarizes the results:

	1907.	1906
Mileage worked	340	340
Passenger earnings	$206,864	$174,864
Freight earnings	2,679,876	2,080,406
Gross earnings	3,004,483	2,332,732
Maint. way and structures	443,553	348,596
Maint. of equipment	503,914	348,232
Conducting transportation	873,461	1,923,747
Operating expenses	1,943,130	1,851,808
Net earnings	1,061,353	505,780
Net income	223,180	258,304
Year's surplus	223,180	258,304

Rutland Railroad.

The Rutland Railroad has shown increased cost of operation during the last three years, since the New York Central has been in control, entirely out of proportion to its increase in earnings. The net earnings have increased only 10 per cent. during this period, while the gross earnings have increased 25 per cent. The history of the road explains this. Under the direction of Dr. Seward Webb the Rutland bought control of a number of small roads, and through ownership of the Rutland Transit Company, which operates a line of lake steamers from Ogdensburg, N. Y., to Chicago, was able to establish new through routes between Chicago and Boston. It was not able to compete successfully for through traffic, however, because these routes are neither the shortest nor the cheapest. The New York Central gained control of the Rutland through buying a majority of the preferred stock. It is said that the Central paid $100 a share, but most unwillingly.

The cost of maintenance of way and structures and maintenance of equipment have steadily increased since the Central took control, and last year maintenance of way per mile of road was $1,200, against



Rutland Railroad.

$1,000 in 1906. This is an ample but not at all excessive figure for such a road as the Rutland. About $40,000 of the sum spent for maintenance of way went toward relaying track with 80-lb. rails. The unit costs of repairs and renewals of equipment for 1907 were $2,119 per locomotive, against $1,708 in 1906; $662 per passenger car in 1907, compared with $564 in the previous year, and $51 per freight car in 1907, against $49 in 1906. These are no more than fair allowances, and they are large increases over the figures of 1904. The number of freight cars decreased by 176 last year, and the total capacity of freight cars was 3,740 tons less in 1907 than in 1906.

The policy of the New York Central has been to charge betterments and improvements to income account. In 1907 $41,000 was charged to income for new equipment, and in 1906 $29,000 for new construction. This policy has reduced the surplus, shown after the 1½ per cent. dividend, from $149,000 in 1904 to $7,000 in 1907.

Gross earnings in 1907 were $6,532 per mile of line operated, an increase of $624 per mile, while net earnings were $1,889 per mile of line operated, an increase of only about $70 per mile. In previous years passenger earnings generally increased more than freight earnings. In 1907, however, freight earnings increased 11 per cent., while passenger earnings increased only 6 per cent. In handling freight the company is making a fair showing. Freight density has increased during the three years from 417,000 to 598,000 tons one mile per mile of road. The revenue trainload increased last year from 223 to 248 tons. The average haul has increased from 95 to 108 miles. The tonnage of nearly all classes of freight increased in 1907. Bituminous coal showed an increase of 69,000 tons over 1906, but even with this increase it was less in 1907 than in 1904. The tonnage of grain increased 70,000 during the three years. The tonnage of stone, sand, etc., decreased materially in 1907.

The preferred stock of the Rutland is a 7 per cent. cumulative stock on which there is now due 171½ per cent. During the past year the minority stockholders called a meeting to protest against the policy of the directors, which charges additions and betterments to income. The proposal was made that common stock be issued to preferred stockholders to the extent of 25 per cent. of the profit and loss credit balance (which was $924,200 on December 31, 1907) and the dividend on the preferred stock be reduced to 5 per cent., the New York Central to guarantee this 5 per cent. No definite arrangements were made, but the proposal that the New York Central should guarantee anything on Rutland stock was laughed at by the railroad officers. The minority stockholders protested that the Rutland was being managed for the benefit of the New York Central system and not for its own best interests.

The principal statistics of operation, rearranged according to our usual classification, are as follows:

	1907.	1906.
*Mileage worked	415	415
Passenger earnings	$1,025,846	$967,298
Freight earnings	1,837,265	1,656,244
Gross earnings	3,058,087	2,799,209
Maint. way and structures	486,754	452,673
Maint. of equipment	428,851	380,640
Conducting transportation.	1,167,695	1,027,104
Operating expenses	2,173,978	1,948,199
Net earnings	884,109	851,011
Net income	186,492	179,625
Dividends	135,861	135,861
Year's surplus	50,628	44,761

*There are 53 additional miles operated for passenger trains only.

NEW PUBLICATIONS.

Experimental Electrical Engineering. By V. Karapetoff. New York: John Wiley & Sons. 790 pages, 6 in x 9 in.; 538 illustrations; cloth. Price, $6.00.

This book is professedly a laboratory manual for testing, adapted to the especial requiremente of students in their junior and senior years of such universities as Cornell. It presupposes a certain amount of electrical and physical knowledge on the part of the reader. But, given a familiarity with the basic principles of magnetism and the electric current there is no excuse for any one possessed of a mind of average intelligence not to comprehend every sentence contained within its covers. In his preface the author thanks certain of his associates upon the faculty of Cornell for assistance and moral support in the preparation of this book. If these associates were made familiar with the contents of the manuscript as it progressed, it is small wonder that they gave generous encouragement towards its completion, for it is a rare thing to find a writer upon a scientific or technical subject that brings to it such a mastery of the language and such a familiarity with the details coupled with the power to pick out the gist and essence of a subject and then express it in such clear and simple diction as we find in the book under consideration.

While presupposing a familiarity with the fundamentals the writer is never betrayed into an overweening confidence in that familiarity, but with the instincts of a true teacher he bases his work upon the value of line upon line and precept upon precept, advancing gradually and thoroughly until even the most casual and desultory reader would find himself steeped in the subject. And yet there are no vain repetitions. The statements are concise, remarkable for their lucidity, for their selection of the gist of the matter, and for discarding all extraneous and non-essential matter.

The book is too big to be covered by a brief review, for it takes in almost the whole wide range of electrical engineering practice as embodied in the measurement of resistances, the construction and operation of electrical instruments, electrostatic capacity, the magnetic circuit, permeability, photometry, illumination, transmission and distribution, generators and motors, transformers, converters, induction motors, windings, batteries, switchboards and controllers, railway work, heating and telephony. But it is noteworthy that the scheme upon which this is worked out is that of a division into chapters, each of which is complete and independent in itself. The book opens with an introduction intended to illustrate general principles, so that there is at once established a complete understanding between the writer and his reader as to what it is proposed to discuss. Diagrams and other illustrations are profusely used to make all things clear, and a series of experiments that are to be performed by the student in order to test the principles laid down, are included. These experiments increase in complexity and difficulty from the beginning to the end of the chapter, and thus each clusters about its own particular center. Under these circumstances the author recommends that the elementary experiments selected from nearly all the chapters be worked out first by the juniors and that the seniors follow with the others that are more complex. In each case the object of the experiment is stated, and this statement is followed by clear instructions regarding every step that is to be followed, down to the checking and the preparation of the report.

Schematically, the book is devised for student use, but broadly considered it can well find its place on the shelves of every electrical engineer, not only because of its intrinsic value as a comprehensive treatise, but because of the suggestiveness that every practical worker must find within its pages, to say nothing of the pleasure of reading an author who has so thoroughly mastered the art of expressing things.

The Engineering Index Annual for 1907. Published by the *Engineering Magazine*, Nassau street, New York.

In this volume, as in the Annual for 1906, the *Engineering Magazine* has adhered to the classified system which is followed in the monthly record of technical papers printed in the magazine. The company formerly published a five-year volume, but has found the annual volume more satisfactory from all points of view. The heartiest praise should be given to this kind of work. It cannot be an important source of profit to the publishers, but it presents an extremely valuable record for the engineer engaged in research work or desirous of obtaining all the detailed information which has recently been published about some branch of his profession.

CONTRIBUTIONS

Steam Shovel Performance.

Ottawa, Ont., April 27, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have noted the item about steam shovel performance in your issue of April 24, and was somewhat startled at Mr. Colvin's figures, until I saw that his day consisted of the full 24 hours, or two shifts of 10 hours each. I have been so long of the opinion that we held the world's champion record for small steam shovel performances that it never occurred to me we might have to defend it.

Our record was made while building the O. A. & P. S. Railway, now a portion of the Grand Trunk Railway System, and I submit the figures for one month in the summer of 1895, in sand and small gravel pit at M. P. 146.

Shovel used, Marion, Style A-1 yard dipper, served by two trains of 12 cars each. Haul, one-quarter mile to five miles. Work, filling trestles and raising dump. During 26 days of 11 hours shovel loaded a total of 65,000 yards, or an average of 2,500 yards per day. The best day's work was 3,070. To do this 307 34-ft. platform cars were put past shovel. The haul for this day was 1,000 ft. only, but I claim the world's record for this day with small shovel and platform cars.

The pit was a long one with good face, and the shovel was moved twice only in month. But the bank was not all good, and cemented sand had to be poled and blown down, while there was a spur of rock in middle of cut that gave considerable trouble. Work was in charge of Joseph Leslie, Roadmaster, and shovel was handled by George Holtby, both of Ottawa. Records kept by myself in the pit.

E. J. M'VEIGH,
Storekeeper, Grand Trunk Ry.

How Can We Get Better Conductors and Enginemen?

McCook, Neb., April 24, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Much interest is being manifested of late on the subject of railroad accidents, and while the consensus of opinion seems to be that inattention to duty and violation of rules are the prime causes, and the remedy strict discipline and the enforcement of rules, few practical theories are advanced as to the best way to secure the desired results.

The rules of the operating department are safe and cover the ground so that with sufficient thoroughness very few accidents would occur; and there are only two factors to be taken into consideration to secure the proper observance of rules, namely:

to secure officials who are strict enough disciplinarians to enforce the rules impartially upon all, and to secure a class of men who can be made to realize that not only do the tenure of their positions and perhaps their personal liberty, but also their lives and the lives of others depend upon their strict observance of rules. It is not always possible to secure officials who are able to withstand the pressure brought upon them by the intercession of grievance committees and personal friends, and it is practically impossible to make the average man submit to discipline in the proper spirit.

It seems to me that the thing to do is to have a law passed by Congress empowering the Interstate Commerce Commission to appoint in each state a commission composed of trained experts in the railroad business, preferably one or more train despatchers, conductors and engineers, a part of whose duties shall consist in passing upon the competency of all employees who have charge of handling trains in interstate traffic. Or, this commission might be appointed by the state railroad commissions. Require each conductor, despatcher and engineer to pass an examination before this commission and to secure a certificate of efficiency before being allowed to take charge of a train; and to be re-examined every three or four years. Require each railroad corporation to include in their reports to the commission covering train accidents the past records of those employees who may have been concerned in the accident, in order that they may be in a position to determine what, if any, bearing the actions of the employee in the past may have on the question at issue. . . . Empower this commission to call before it for investigation any or all employees of the railroad corporation who may be concerned in an accident, which in the opinion of the commission is serious enough to call for investigation, and give the commission power to annul, upon sufficient assurance of guilt, the permits of any conductor, engineer or despatcher. . . . A marine engineer or the master of a ship must secure a license before being permitted to act in their respective positions. The stationary engineer is required to secure a license in most states. The dentist has to pass a rigid examination before he is allowed to pull your tooth. Is it out of reason that the man at the throttle or at the key, who has your life in his charge, shall be any more exempt from proving his competency than the doctor or the dentist?

The examinations that the railroads require their employees to pass are not rigid enough. In theory they are, but not always in fact. Too often the element of personality enters into the examination and men are allowed to pass because they were good brakemen or good firemen, and the examining official trusts, because of this fact, that they will succeed in the more responsible position. Too often the official who is conducting the examination is not a practical man in the handling of trains, so far as the outside work is concerned, and for this reason is handicapped when dealing with the many little things that come up in the daily life of a trainman or engineman which make for success or failure in those positions. Too often men are allowed to pass upon the request of someone with a pull, or upon the behest of a brotherhood.

The railroads should conduct an examination of their own, but the examination before the commission should be supplemental and serve as a check upon that given by the railroad company.

A better grade of men would be attracted to the train service on account of the greater immunity from danger guaranteed by having a more careful set of men. The necessity of reporting the past record of employees who are concerned in accidents will be a check upon the official with respect to his retaining in the service any employee whose past record stamps him as a dangerous or an undesirable man.

M. H. LEARNARD.

[We are glad to print Mr. Learnard's letter, not only because he has a right to be heard, but also because his views are shared, no doubt, by many other thoughtful railroad men. The letter speaks not only for the writer but also for many others who have not put their ideas on paper. But we must remind our correspondent that the main feature of his proposal, licensing men by the federal or state government, is a remedy which very likely would prove to be worse than the disease. The first essential in an examining board is integrity—high personal character. Add to this the necessary experience, judicial temperament and ability to issue decisions that would stand the fierce criticism that they would be subjected to, and you have a set of requirements that no political appointing power would measure up to, one time in fifty. Even if the appointing of examiners could by some good fortune be kept free from the influence of unworthy political motives, the limitations of salary which the lawmakers would impose, with the obvious limitations of human nature, which, as we can see all around us, keep the standard of ability low in public offices of all kinds, constitute such serious obstacles that any hope of effecting material improvement of the personnel of the train service by state examinations would be small indeed. Admitting that the government does do some good in its activities concerning doctors and steamboat captains, the present proposition is a doubtful one. Improving conductors' and enginemen's consciences is an intricate problem.—EDITOR.]

What Are We Going to Do About Accidents?

TO THE EDITOR OF THE RAILROAD GAZETTE:

"Faith without works is dead." A few months ago the *Railroad Gazette* contained an article signed by W. L. Park, and only a few weeks ago one signed Vice-President which contain an ample number of practical suggestions to about do away with those accidents which are due to failure to respect rules, if only they were carried out. Mr. Park is a stickler for drill and inculcation of safe habits. This position is taken, not, as I have heard him remark, because he deems it absolutely necessary for an engineman to actually stop every time he explodes a torpedo on straight track in broad daylight; but, to insure that he will do so when the conditions are not so favorable, Mr. Park insists that such signal should be respected. His reason for this is obviously so sound that the same principle should be applied to all rules which are necessary to enable trains to be handled safely.

"Vice-President" says: "Appoint one or more experienced railroad men as inspectors (not detectives), who shall report to the General Manager. Require inspectors to note not only how the men obey, or disobey the rules, but how officials enforce and understand the rules." This reminds us that not only must Mr. Park's rule be carried out; in addition we must show the rank and file wherein they have failed, and must instruct officers as may be necessary concerning matters which may not be known to them, owing to their having multitudinous duties. Officers should avoid formalities, writing up only such cases as may be needed for record, or to use as examples to assist in preventing others from committing the same errors. Treat all information furnished you by employees as strictly confidential, and decline to reveal the identity of the persons who help out by giving you pointers. I have read somewhere that "all intelligent people soon grow restive over too much and too many reminders of their being subject to discipline." Some other bright man remarked that "any old scheme will figure out all right on paper." I believe these "saws" to be correct in the main, and that better results would obtain were men talked with more and shown their erroneous reasoning or conclusions instead of being reported and suspended. I do not mean, however, that men who habitually sleep on duty, or indulge in intoxicants or narcotics, should not be disciplined. I would fire that gang bodily before they got a chance to make a mistake, and perhaps kill worthy employees.

I believe it is an economical investment to have a competent inspector of transportation and plenty of trainmasters; but how can the economy be proved? Possibly the problem for the general manager to solve is how to scrape up enough money to pay the men now on the rolls. While I have no doubt each such employee would effect a saving of fully $5,000 a year in accidents, overtime, etc., I cannot prove it, and am therefore left without anything tangible upon which to base an appeal. In some instances the employment of an additional set of despatchers on a crowded division would no doubt effect a saving in the overtime account much greater than their salaries would amount to, and would increase the mileage of engines; but, again, we are confronted with the same declaration, "prove it."

Too much attention is given to deep, intricate train-order problems and too little to such so-called unimportant matters as enforcement of signal rules and such others as prescribe clearance, protection, taking siding at initial switch, keeping away from switches while they are being used by trains, calling fixed signals, reading train orders, turning switch to run the inferior train in on siding at meeting points, drunkenness and sleeping on engines and in cabooses.

In nearly every investigation of accidents which I have taken part in trainmen state that they had not forgotten the meeting order; that they were just getting ready to take the necessary steps to prevent the collision when it occurred. Perhaps if such men were touched up to the extent of from $20 to $50 for not acting they would remember to do so next time.

On many roads enginemen are allowed to whistle about as they please—may whistle out flagmen, or not, just as they think best; may acknowledge a signal to start a freight train by two short blasts, instead of two medium long, and if they happen to fail to whistle for a station nothing is done about it. Failure to whistle for a station may mislead the men in the caboose and at least give them an opportunity to escape punishment (if an accident occurs) by claiming that they had lost their bearings. I think rules should forbid a freight train from going through a station without receiving a proceed signal from the rear. If signaled to proceed, engineman should answer by two medium long blasts. If the engineman knows that he must stop to meet a train, or can get no farther to clear a superior train, he should, after whistling for the station and waiting about two seconds, sound three short blasts. Under such an arrangement a failure to whistle, or to receive a proceed signal, would cause others interested to believe that something was wrong, or had been forgotten, and there would still be time to take the necessary steps to prevent a collision. The objection to allowing enginemen to sound two short blasts to start is that that signal is also an answer to a hand-stop signal given by a flagman, and it often has caused confusion and accidents. Perhaps it would not be a bad idea to alter the code rule to conform to the above suggestions. Rule 14 (b) could easily be changed to read: "Release brakes. Answer to a signal to start, or to indicate ready to start."

H. W. FORMAN.*

American Railway Association.

The spring session of the American Railway Association was held at the Hotel Belmont, New York City, April 22. There were present 225 delegates, representing 150 members. The Executive Committee reported that the membership of the association now comprises 338 members, operating 240,770 miles; and the associate membership 44 members, operating 1,630 miles.

A special Commission on Interchange of Freight Cars has been appointed by the Executive Committee, consisting of James McCrea (Pennsylvania), Lucius Tuttle (Boston & Maine), W. W. Finley (Southern), Howard Elliott (Northern Pacific). A report was presented by a sub-committee of the Executive Committee on the subject of bringing into relation with the American Railway Association the various voluntary associations of railroad officials. It is desired to harmonize the work and increase the usefulness of these other organizations, and the committees of the American Railway Association will be rearranged so as to provide for supervision when desirable and for facilitating co-operation.

A resolution was adopted requesting the Master Car Builders' Association to harmonize the terms used in designating different classes of cars and different kinds of cars in each class, according to their physical characteristics, and to report to the association.

Certain amendments to the Articles of Organization and By-Laws were adopted, including one changing the dates of meeting from April and October to May and November.

The Committee on Car Service submitted a decision in connection with Car Service Rule 10, which was approved, as were amendments to Car Service Rules 10 and 11, and Per Diem Rule 7.

The Arbitration Committee reported decisions rendered in connection with Arbitration Cases Nos. 37, 38, 39 and 40.

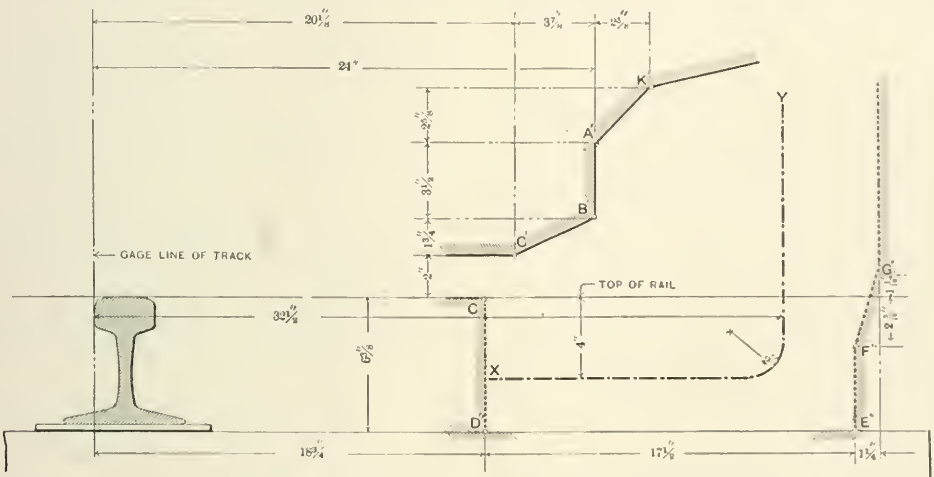
The Committee on Safety Appliances submitted a Code of Air-Brake and Train Air Signal Rules, which was adopted and made part of the Standard Code of the association.

The Committee on Accounting and Statistical Inquiry submitted a proposed classification of revenue and expense accounts, which was referred to the Executive Committee.

This committee recommends that the adoption of a system of physical statistics should be deferred, as the Interstate Commerce Commission intends to promulgate a system of classification of accounts to take effect July 1 of this year. The committee believes that the depreciation of the property may be fully covered by charges to operating expenses through the medium of "repairs," as directed by the Interstate Commerce Commission, and through "replacement." The application of measures of "depreciation" and of "renewals" as required by the Interstate Commerce Commission is at best a guess. The determination of a measure of depreciation must of necessity be based upon average life, which is impossible of accurate or even approximate determination. The relation between the equipment retired in past years and that in existence to-day, or that may be subsequently acquired, is too vague and too indefinite to admit of the application of the law of averages for the determination of measures of charges to operating expenses in anticipation of future requirements.

The committee approves the classification of operating expense accounts as promulgated by the Interstate Commerce Commission, with the following exceptions: The text for "loss and damage, freight" should read "including company's material." The text for the several renewal and depreciation accounts applicable to equipment should be abrogated and appropriate texts inserted under "replacement." There should be a provision for revenues from outside operations, so that the revenues from the operation of water lines, etc., may be included in the gross revenue of the company; and the committee recommends a separate primary account for this purpose.

On the subject of depreciation of equipment the committee does not approve the rule promulgated by the Interstate Commerce Commission; but it recognizes the fact that while that rule is in effect it is necessary for the depreciation charge to be made. If that rule be continued this committee recommends that, by reason of the fact that there is and will be under any rule of depreciation a duplicate charge made to operating expenses, railroad companies be permitted to charge against the depreciation reserve a proportion of the cost of repairs to equipment. The committee further recommends, if the depreciation rule is to be continued, the elimination of the accounts, equipment borrowed, debtor and equipment loaned, creditor, for the reason that through the medium of these accounts arbitrary charges and credits to operating expenses are made which are not justified. The net debit or credit through these two accounts is too small to justify the expense of keeping the accounts.



Recommended Clearances for Rolling Equipment and Structures; American Railway Association.

The Committee on Car Efficiency reported that its work in collecting and publishing statistics had been continued. There has been a more general compliance with the requests of the Committee for information, but there is still opportunity for improvement, especially in the line of promptness. The reports now regularly cover about 160 roads, including practically all the more important ones.

The reports concerning car shortages and surpluses have excited a general interest through the country, indicating as they do the present unfortunate railroad situation in a striking and concrete way. The figures showing the surplus cars have been widely reprinted, not only in the periodical press, but in government publications. It is pleasant to record the fact that the surplus has decreased since its high-water mark on February 5, but unfortunately, this decrease appears to be largely influenced by arrangements which have been made to hold large numbers of cars under load, which possibly should be counted as surplus.

Progress is being made in the more equal enforcement of car demurrage through the country, which will undoubtedly have a favorable effect on car efficiency, when business again increases. The committee has maintained relations with various government commissions, national and state, and has collected considerable information in regard to railroad legislation. The committees formed

*Author of "Rights of Trains on Single Track."

to supervise demurrage on coal at tidewater and on the lakes have continued their meetings and somewhat broadened their scope, and a committee is considering demurrage on and storage of export freight at the principal Atlantic ports. Meetings have also been held at certain points to determine proper switching reclaims.

Owing to the desirability of economy the work of the committee has been cut down to its lowest basis, and since the shortage of cars disappeared most of the railroads which were interested in the record feature of the Clearing House have discontinued this work which was done at their expense.

The clearing feature, however, under which Per Diem and mileage balances between railroads are handled, has shown a gradual and gratifying increase, and there are now 10 railroads using it in clearing their car service balances. This work is done at cost to the subscribers, and it is found that this cost is so inconsiderable that the plan has advantages both of convenience and economy. The committee will be glad to see further growth in this direction.

The Code of Car Demurrage Rules, which was adopted at the last meeting of the American Railway Association, has been under consideration by most of the Car Service Associations in different parts of the country. Some of the associations have already adopted, almost in their entirety, the rules as recommended, with exceptions to suit local conditions. Many of the associations have adopted the suggestion made to change their designation from "Car Service Association" to "Car Demurrage Bureau" or "Demurrage Bureau."

The committee has on file at its Chicago office the rules of all the Car Service Associations and Demurrage Bureaus in the United States, as well as those included in state laws and promulgated by state commissions. The committee also is collecting the Car Demurrage Rules of the railroads which have recently dropped out of Car Demurrage Bureaus. It is, therefore, ready to give full information in regard to the Car Demurrage situation throughout the country.

The matter of storage is still having the attention of the committee. Wherever storage is handled by car demurrage bureaus by the transportation departments of railroads and in accord with state laws or state commission rulings, the committee endeavors to keep itself fully informed on the subject.

The rules on export freight at the different Atlantic seaboard points are still unsatisfactory, but gratifying progress is being made toward harmonizing them. The rules governing bituminous coal at tidewater points have, at some points, been extended to cover anthracite coal, and these rules are working very satisfactorily, the equipment being released much more promptly than formerly. The rules which were in effect on bituminous coal transshipped by lake have now been in effect for a season, and results have proved them to be extremely beneficial. A new set of rules, including certain amendments, has been formulated to cover the current year.

In the last report mention was made of the great decrease in the delay to cars on account of the rule adopted by the Trunk Line Freight Association and the Central Traffic Association, imposing a charge for reconsignment. Since that time, the Western Trunk Line Association has adopted a rule in regard to a charge for reconsignment more stringent than the rule of the eastern roads. This has caused great relief in the yards, particularly at large centers, and in the coal traffic; one road reporting the saving of four switching engines at one point from this cause.

Your committee is endeavoring to keep in close touch with all national legislation and has made arrangements to be furnished with all bills introduced into Congress in any way affecting railroad interests. The progress of these bills is being closely watched. A synopsis of these bills is made and copies can be procured from the Secretary of the association at a nominal charge. Your committee is also endavoring to keep in close touch with the Railroad Commissioners of the different states, and has been in active correspondence with them.

On the Pacific coast the free time for unloading freight cars has been reduced to 48 hours on all articles except lumber, on which 72 hours is allowed.

The Committee on Transportation of Explosives urged all members to become members of the Bureau of Explosives. The membership of the bureau now comprises 94 companies, operating 149,669 miles of road. The committee submitted a revision of the Regulations for the Transportation of Explosives, and a set of Regulations for the Transportation of Inflammable Articles and Acids, both of which were adopted by the association.

The Committee on Standard Location for Third Rail Working Conductors has issued a circular giving suggested clearance diagrams for third rail working conductors, and the association adopted the following resolutions: (1) That the diagrams showing lines of clearance as presented in the report be approved and made the standard of the association. * * * (2) That in designs of new rolling equipment which is to be used in interchange, the clearance line K'A'B'C", including such horizontal and vertical variations which may in any reasonable probability occur in combination at one time, should not be exceeded. In determining this, the position of the equipment on a 20-deg. curve should be considered, making allowance for the side-throw of the bolster and the consequent effect on the location of such portions of the equipment that are attached to the car body. Variations in equipment should be allowed for as follows: Horizontal, 2½ in. in all; vertical, 4 in. in all. (3) That in design of new bridges, trestles, tunnels and platforms, no part that is continuous for more than 7 ft. should come within the space for third-rail structures,† and should preferably clear this line by at least 1 in., as is shown by the line C", D", E", F", G", but that structures which are not continuous for more than 7 ft. may be allowed to come to the line XY.

The report of the Rail Committee will be found under another head.

F. A. Delano, President of the Wabash, was elected President, and W. A. Gardner, Vice-President of the Chicago & North-western, was elected Second Vice-President of the association for the ensuing year.

The association decided to hold its next session at Chicago November 18.

Report on Standard Rails.

At the meeting of the American Railway Association in New York City April 22 the Committee on Standard Rail and Wheel Sections submitted a complete report including a series of rail sections of two types, and specifications for Bessemer and Open Hearth steel rails, which were adopted by the association as recommended practice. On the recommendation of the committee, the association adopted resolutions providing that gage of track be measured between the heads of rails, at right angles thereto, at a point ⅝ in. below the top of the rail; and that the standard distance between the main rail and guard rail and in the throat of all frogs be 1¾ in., measured at the gage line, for all tracks of standard gage. A resolution was also adopted by the association, providing that the two types of section and the specifications for the standard rail be referred to the American Railway Engineering and Maintenance of Way Association, with the request that that association study the question of drop tests, observe and record behavior of rails of the proposed sections, compare results from the two sections and submit to the American Railway Association a single standard for adoption.

The standard sections now adopted by the association are the same as those (Type A and Type B) recommended by the committee last October, and shown in the *Railroad Gazette* of Nov. 22, 1907, page 627 The specifications differ from those before reported (*Railroad Gazette*, Dec. 20, 1907) in the clauses covering discard and chemistry. These clauses, as now reported, are:

There shall be sheared from the end of the bloom formed from the top of the ingot, sufficient "discard" to insure sound rails. (All metal from the top of the ingot, whether cut from the bloom or the rail, is the "top discard.")

The chemical composition of the steel shall be within the following limits

Bessemer Steel Rails.

	60 lbs.	70 lbs.	80 lbs.	90 lbs.	100 lbs.
Carbon	0.37 to 0.47	0.40 to 0.50	0.43 to 0.53	0.45 to 0.55	0.46 to 0.56
Manganese	0.80 " 1.10	0.80 " 1.10	0.80 " 1.10	0.85 " 1.15	0.90 1.20
Silicon	0.10 " 0.20	0.10 " 0.20	0.10 " 0.20	0.10 " 0.20	0.10 " 0.20
Phosphorus* ..	0.10	0.10	0.10	0.10	0.10
Sulphur*	0.075	0.075	0.075	0.075	0.075

(When lower phosphorus can be secured, a proper proportionate increase in carbon should be made.)

Open Hearth Steel Rails.

	60 lbs.	70 lbs.	80 lbs.	90 lbs.	100 lbs.
Carbon	0.50 to 0.60	0.55 to 0.65	0.60 to 0.70	0.65 to 0.75	0.70 to 0.80
Manganese	0.75 " 1.00	0.75 " 1.00	0.75 " 1.00	0.75 " 1.00	0.75 " 1.00
Silicon	0.10 " 0.20	0.10 " 0.20	0.10 " 0.20	0.10 " 0.20	0.10 " 0.20
Phosphorus* ..	0.04	0.04	0.04	0.04	0.04
Sulphur*	0.06	0.06	0.06	0.06	0.06

(When higher phosphorus is used, a proper proportionate reduction in carbon should be made.)

*Not to exceed.

All rails are to be branded with the name of the maker, the weight of the rail, and the month and year; and the number of the heat and a letter indicating the portion of the ingot from which the rail was made, shall be plainly stamped on the web of each rail, where it will not be covered by the splice bars. Rails to be lettered consecutively "A," "B," "C,", etc., the rail from the top of the ingot being "A." In case of a top discard of 20 or more per cent., letter "A" will be omitted. All rails marked "A" shall be kept separate and be shipped in separate cars. All open hearth rails shall be marked o h; and the specifications for open hearth stipulate that the manufacturer shall, before the rails are shipped, furnish the inspector with a complete chemical determination for each heat.

In its report the committee says:

With regard to the discard question, the committee has always held that it would be preferable to test the finished product rather than specify as to details of mill manufacture, and the committee arranged for a trial lot of rails to be rolled from the ingot without any discard whatever except such as was necessary to enable the

†This space was indicated in diagrams showing the practice of the New York Central, the West Jersey & Seashore and the Long Island, printed, with the Committee's previous report, in the *Railroad Gazette* of Nov. 8, 1907, p. 559.

bloom to enter the rolls, and after these rails had been cut into small pieces, they were broken under the hammer and the fracture examined. This test proved to the satisfaction of the committee that if "pipes" or other physical defects were present they could be detected by this means. The test also proved quite conclusively that it is possible to so conduct the process of manufacture that the "pipes" or other physical defects will be reduced to a minimum, and that these defects may not occur at all, even in rails rolled from the top portion of the ingot.

In order to avoid an unnecessary waste of good material, the committee set about to devise means by which the rejection of defective material could be insured without requiring an arbitrary and definite percentage of discard in every case, and a committee of the Pennsylvania Railroad pursuing the same line of investigation, adopted a tentative specification which provided for a physical test of this nature, and which further provided that when physical defects were discovered, all top rails of the heat should be rejected. * * * A trial lot of rails, of a section corresponding to "Type B" submitted with the committee's report of last October, was recently rolled under this specification as to discard, and the results convinced the committee that a development of this idea would prove the best solution of the discard problem.

Some of the advocates of a fixed and arbitrary discard have argued that the mere provision of a discard to insure the elimination of "piped" rails, or rails containing physical defects, was not sufficient, and urged the rejection of a fixed percentage from the top of the ingot, because of the well known fact that segregation occurs in the upper portion. This question of segregation was given careful consideration by the committee, and while it is a fact that, due to the rearrangement of the constituent parts of the metal during the process of cooling and solidifying in the ingot mold, an analysis of the metal in the finished rail will often show a wide departure from the analysis required by the specifications, it is also true that an analysis of the metal taken from the different parts of the finished rail will frequently show similar wide variation. This discrepancy is due to the fact that the test ingot referred to in the specifications, and upon which the chemistry specification is based, is taken from the ladle before the metal is poured into the ingot mold, and consequently before the segregation takes place.

It has been assumed that, because of this variation from the standard composition of the metal in the finished rail, the rejection of all segregated metal would be warranted. But, on this assumption, it would be necessary to discard more than a third of the upper part of the ingot to be on the safe side, as the segregation frequently extends that far, and while our knowledge of the subject is not as complete as we could wish it to be, we have a great deal of evidence that rails of good physical condition can be made from the upper portion of the ingot.

Furthermore, the analyses of a large number of rails taken after years of service indicate that these wide variations in chemical composition may occur without apparently affecting the safety or wearing quality of the rail, and since it is impossible to check the analysis of the finished rail with that of the test ingot, the question arises as to what limits should be placed on the variation which will be permissible. None of the experts consulted are ready to say what this limit should be, and all admit that no facts are available as the result of actual experience which would warrant the adoption of any fixed limit to govern the rejection of material. The provision in the new specifications for stamping the rails to show their position in the ingot will enable us to obtain more definite information on this point in the future.

The committee conferred with a number of disinterested experts on both the discard and phosphorus questions, and among the principal authorities consulted were William Metcalf, of Pittsburgh; Robert Forsyth, of Chicago, and Professor Henry M. Howe of Columbia University. These gentlemen all agreed that it would be preferable to test the finished product rather than specify a fixed percentage of discard, and they also agreed that it would be unreasonable to require less than .10 phosphorus in a specification for Bessemer rails intended to cover purchases for all American railroads.

In the matter of rail sections, the committee, after considering criticisms and suggestions, and after visiting the mills and witnessing the rolling of rails of both the new types of section, are confirmed in their opinion that a change from the A. S. C. E. section is necessary in order to obtain the best results in manufacture. * * * So far as stability is concerned the recommended sections are well within the limits of safety, and with respect to the cutting of the ties it was felt that the increasing wheel loads of modern traffic necessitate the use of tie plates on curves and on soft wood ties in any event.

* * * Recently some important lines have shown a disposition to drop the 85-lb. standard; but as the committee has again been urgently importuned by the manufacturers to hold the rail roads in line on this matter, in order to prevent the multiplication of sections, your committee has determined to hold to its original recommendation (five weights), and trusts that the members will see the importance of subordinating personal preferences to the general good.

The committee feels that the main objects of the investigation have been accomplished, and that members are now in a position to secure the best rails which can be manufactured in the present state of the art. The adoption of the new and better balanced sections will enable the manufacturers to roll the rails at lower temperatures, thus ensuring a finer grain and better wearing quality, as well as reducing the internal stresses. The nearest approach to a single standard type has been arrived at consistent with present engineering knowledge and opinion. Provision has been made for the rejection of all rails containing dangerous physical defects, and means have been provided for keeping accurate records of the rails rolled from different parts of the ingot, and for uniform reports of rail failures, so that accurate information as to the cause of failure will be available in the future.

It will be noted that no reference is made in the specifications submitted, to the deflection under drop test, as definite figures can only be inserted after the new sections have been actually rolled and tested. * * * The committee has recommended the adoption of a new standard type of anvil which is very much heavier than those used heretofore, and a further revision of the drop test specification may be found necessary after observing the results of a sufficient number of tests under the conditions resulting from this change. * * *

In connection with the investigation of the cause of the excessive wear of rails in the London "tubes" since the installation of electric traction, certain experiments have been made in England, both on electric and steam lines, with the high-silicon rails advocated by Mr. C. Peter Sandberg. The results of these experiments seems to be quite favorable, and the subject should be followed up by the Committee of the American Railway Engineering and Maintenance of Way Association.

The experiments with canted rails, referred to in the report of April, 1907, have not been carried on long enough to enable your committee to arrive at any definite conclusion, but a recent inspection of these experimental rails indicates that the canting will cause a tendency to tighten up the gage, and it is also observed that on curves the metal of the top of the head "flows" to the inside of the low rail, instead of to the outside as in usual practice. This latter tendency will have to be reckoned with in considering the effect on flange wear.

Colonel Yorke on the Shrewsbury Derailment.

The British Board of Trade has issued its report, prepared by Lieut. Col. H. A. Yorke, on the disastrous derailment which occurred at Shrewsbury, Oct. 15, 1907, when 11 passengers and seven trainmen and mail clerks were killed. In this case, as in the Salisbury and Grantham accidents, the train was derailed by running at high speed through a curve at which safety required very low speed. The accident occurred on a Tuesday at 2:08 a. m. and the engineman, 52 years old, had been in the service of the company 37 years, and an engineman 10 years. He was not a teetotaler, but was described as a sober man. The record showed 13 entries against him, four for running past stations at which he was booked to stop, two for passing signals at danger, five for being absent without leave, two for losing time or allowing his engine to emit clouds of black smoke at a station. All these faults occurred between the years 1896 and 1905. After an exhaustive study, Colonel Yorke holds it extremely improbable that the disaster was due to any defect in the engine or the roadway, and he believes that the engineman had fallen asleep. The runner had been on duty all of Sunday night and from 8.15 p.m. on Monday, and though he had been in bed on Monday, the inspector could find no satisfactory evidence as to how much he slept. The inspector finds that the fireman, who had had to attend actively to his fire probably was not asleep (although he may have been so) but was unaware that the engineman was not wide awake. The fireman was 22 years younger than the engineman. The engineman and fireman were both killed. The body of the engineman was examined by a government physician and no traces of alcohol or malt liquor were found in the stomach.

Having found sleepiness as the most probable cause of this disaster, Colonel Yorke goes on to consider possible remedies. First, he suggests that the duties of drivers and firemen should be so arranged that they shall not be on duty during the whole of two consecutive nights. The proposal to have three men on the engine is condemned, but speed recorders are favored, although no such apparatus would have done any good in this case. Colonel Yorke hears that the French government is going to make the use of speed recorders compulsory. The report discusses cab signals and automatic stops, but the inspector contents himself with saying that the question of their desirability is not yet settled. "Pending the introduction of cab signals, or automatic train stops," Colonel Yorke recommends that the signal which was overrun in this case be moved back about 1,500 ft. (the block section is very short), and that signal boxes on descending grades approaching junctions or important stations be equipped with apparatus by which the signal man could put a torpedo on the track. Many signal boxes now have apparatus of this kind, but it is not used except in times of fog or falling snow.

As it is always difficult to get reliable testimony as to whether brakes have been tested when trains are made up, Colonel Yorke suggests that the testing should be witnessed by the station master in every case, who should sign a certificate, to be given to the man in charge of the train. It is also suggested that when enginemen sign for important notices or other documents their signatures should be witnessed, not by an engine wiper, as is the general practice, but by a responsible officer.

Westinghouse Horizontal Double-Acting Gas Engine.

The type of large gas engine described herewith is the result of about ten years' development of various sizes and types at East Pittsburgh. During this time orders for 1,054 engines have been taken, averaging a little over 140 h.p. Some of those now in operation are used for 25-cycle single-phase interurban railways, 60-cycle central stations, 25-cycle and 40-cycle industrial plants, all operating in electrical parallel, and there are also many direct-current plants.

While most of the engines are running on natural gas, the largest plants use some form of manufactured gas. By-product coke oven gas promises an excellent field for development, although little has been done as yet. Pooled coke oven gas averages above 50 per cent. hydrogen and often reaches 66 per cent. By-products from the stills in oil refineries consist almost entirely of the higher hydrocarbon gases, and are extremely rich, even double that of natural gas, 1,200 to 2,000 b.t.u. per cubic foot. For the leaner gases cylinder diameters are slightly increased, as well as compressions. Within the past year very material progress has been made in the application of producer gas to all classes of service, and it is probably true that the future of gas power rests with the corresponding development of the producer.

Parallel operation, except at excessive frequencies, is no longer a difficulty. Although spring couplings are used in the vertical type single-acting engine, they are unnecessary in the horizontal engine, except for special cases. Although a double or triple set of igniters is provided to insure positive ignition, the actual cyclical variation, due to the impressed crank effort, is but a fraction of that allowed in steam practice. In other words, the factor of safety in amplitude of cyclical variation is large enough in Westinghouse engines to provide for the contingency arising in case of displacement of one complete set of igniters. The governing system, as described later, makes accurate speed regulation possible.

Westinghouse gas engines are rated at 10 per cent. below the maximum load that the engine will sustain for a considerable period. Allowance is made for fluctuation in the heat value of gas, so an engine rated on 125 b.t.u. producer gas can sustain full load on gas as low as perhaps 100 b.t.u. A 200 or 300 h.p. engine is nearly as efficient in heat consumption as an engine of 1,000 or more horse-power. The efficiency is largely independent of the kind of gas used, because leaner gases will stand higher compression. A horizontal gas engine can make long, continuous runs. In the mills of the Iola Portland Cement Co. the record of eleven months shows actual operation 93.2 per cent. for the horizontals and 97 per cent. for the verticals.

The Westinghouse engines are four-cycle and the tandem cylinder arrangement is standard for all sizes, whether single or double crank. The former gives two power strokes per revolution, the latter four power strokes per revolution, with cranks at 90 deg. A solid concrete block extends the full length of the housing and some feet in front, but a clear space is left between the piers to allow access to the exhaust valves. By removing the inlet valve of a cylinder a man may enter to inspect the cylinder. One piston may be removed through each end of the engine without disturbing the other head or the engine alinement.

The main frame is of heavy box girder construction, with internal ribs to withstand transverse stresses arising from the side-crank construction. The smaller shafts are solid and the larger are bored hollow. On engines under 1,000 h.p. a three-part bearing is used and on larger sizes a four-part bearing.

The cylinders of the small engines are symmetrical, one-piece castings, with openings closed by split jacket bands with joints of flexible packing to allow the cylinders to expand independently of the jackets. The water spaces are easily accessible for cleaning. Cylinders of the large engines are cast in halves to insure sound castings with the best metal where most needed. The cylinder is supported at the ends only, and the weight of the pistons and piston-rods is carried by the front, center and rear crossheads.

The valves are in a vertical line at the center of the cylinder, so that heating and dilution of the incoming mixture is avoided. Exhaust gases discharge straight downward without encountering any pockets for the accumulation of foreign matter. Compression spaces of volumes suitable for the various qualities of gas can be arranged without changing the design of pistons or cylinders or the location of the valves.

Westinghouse Horizontal Double-Acting Gas Engine.

The pistons are cast in one piece, symmetrical in design, without internal ribs or sharp corners, and without the use of chaplets or other methods of core support. They are permanently mounted on the rod. Rods are made in two parts so as to be removed through front and rear housing. They are bored hollow for cooling water, except at the center of the piston where the ducts connect. The pistons float free from the cylinder walls, the rods not being cambered but designed stiff enough to support the weight without undue deflection. Pistons are kept tight by sectional rings with keepers and springs. For the rods, sectional metallic packing is used, consisting of a number of segments mounted in series along the rod, with two solid rings next to the cylinder. These segments are supported by springs to relieve the rods of their weight.

Instead of a single governor valve, gas is governed and mixed directly by each inlet valve. Only one eccentric is used to operate both inlet and exhaust valves. In the lay shaft drive, "hunting tooth" gears are used, the intermediate lay shaft running at an odd number of revolutions per minute. This distributes the wear evenly over all the gear teeth. Hollow water-cooled exhaust valves, of either cast iron or steel, are used in all sizes, or a combination valve with cast iron head and steel stem. Stems are lubricated about the middle of the bushing. To remove the valves it is only necessary to drop out the entire cage with the assistance of a rope swing. By means of an oil-pressure relay system the regulator is entirely relieved of the actual work of moving the heavy valves. The regulator is driven direct from the engine shaft and connected by means of reach rods to the various inlet valves. Oil pressure for the relay is supplied at about 50 lbs. pressure by a small pump driven from the engine lay shaft. If the governor is disabled, a safety device shuts down the engine by cutting off the ignition. A spring-balanced plunger in the rim of the fly wheel is projected by centrifugal force at a predetermined speed, and trips a pawl. In some plants an additional safety stop acts if the water supply to the jacket fails.

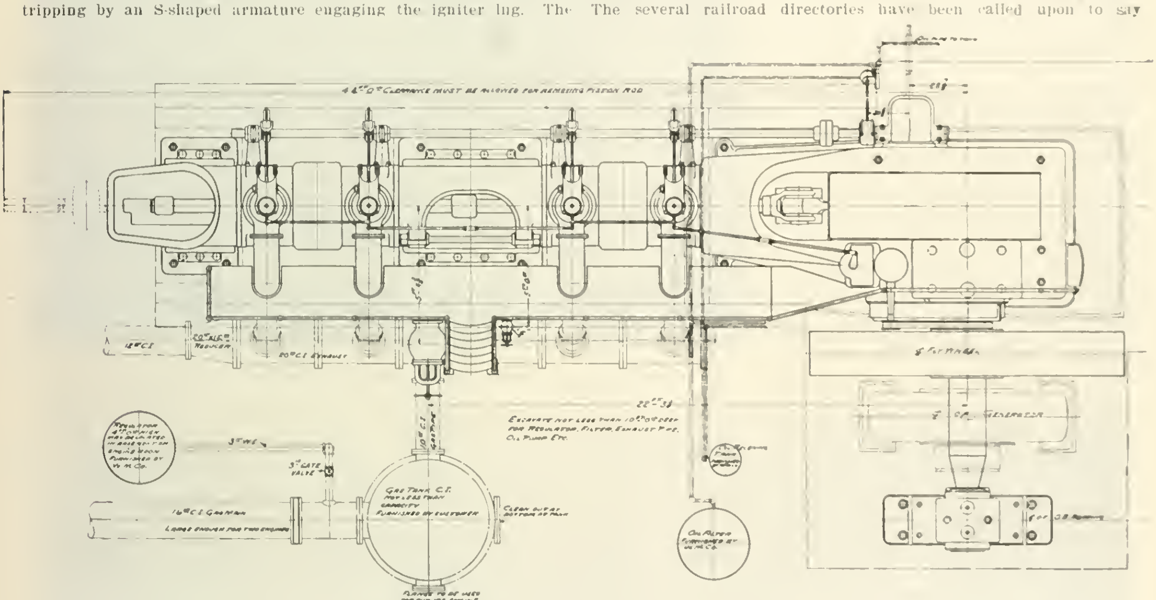
Make and break ignition with high voltage and low current furnished by a small motor-generator is used. Cast iron or special bronze points are used on the moving contacts, and the fixed terminals are steel. Both sides of the igniter circuit are insulated, making a double-ground necessary to put an igniter out of commission. In the event of a serious ground, the igniter on that circuit is immediately insulated by a fuse blowing out. Igniters can be removed while the engine is in operation by shutting off gas from the cylinder and relieving the compression by blocking open the exhaust valve. There are two or more igniters for each combustion chamber; in the larger sizes there are three, located at corners of an equilateral triangle. These make combustion more rapid and perfect. Two types of gears operate the igniters; the electro-magnetic, and the mechanical cut-off. The former consists of an electro-magnet connected in series with the igniter terminals, and tripping by an S-shaped armature engaging the igniter lug. The field coils furnish the inductance ordinarily provided by spark coils. The mechanical device carries the usual knock-off cams geared to the lay shaft.

For the cylinders, force-feed lubricators are used. The oil is accurately timed so as to reach the piston just at the close of the power stroke when it is covering the oil ports. In a number of 500-h.p. plants, cylinder oil consumption is as low as from three to five gallons per week, ten-hour day. These lubricators serve cylinders, packing glands, and exhaust valve stems. Engine oil is fed by a gravity system, including pump, filter and elevated reservoir with individual sight-feeds, all controlled by a single valve, so that individual adjustments, once set, need not be changed.

Particular attention has been given to reducing the quantity of water required for the engine. A series system of cooling has been used to some extent. Each cylinder, piston and exhaust valve have separate discharges. Water enters the piston through telescopic connections at the center crosshead, discharging front and rear into chambers cored out of front and rear housing. A water pressure of 25 lbs. is all that is required for supplying all parts, and, in some plants with exceptionally pure water, a 25-ft. static head is sufficient.

The engines are started by compressed air. With ignition on, the engine starts itself after opening compressed air and gas valves. As each cylinder picks up its ignition (after one or two revolutions) the compressed air supply is automatically cut off by a check valve held to its seat by the combustion pressure.

There is an automatic regulator in the gas supply line to maintain at the inlet valves the proper mixture. This is a butterfly disc valve, the position of which is controlled by a small gasometer connecting with the main on the engine side. The movement of the gasometer and the butterfly follows instantly upon the varying demand for gas by the engine. In some cases it is also desirable to install a receiving tank to further take care of the fluctuation in pressure.



Westinghouse Gas Engine.

Foreign Railroad Notes.

The Prussian State Railroad authorities direct that those in charge of workshops encourage the participation of apprentices in athletic exercises.

Mr. Zemp, since 1891 at the head of the Railroad Department of the Swiss Federal Council, has been chosen Vice-President of the Confederation for 1908.

The Italian railroads have let a contract for 165 passenger cars, costing more than $1,300,000, to works in Riga, Russia, which is perhaps the first time that Russia has exported rolling stock.

The Prussian State Railroads some time ago had a number of pressed steel coal cars built to carry 22 tons on four wheels. They had sides 6 ft. high, with two double doors on each side. The several railroad directories have been called upon to say whether more of this kind should be ordered. Most of them say no; the sides are so high that it is difficult to load them where there is no loading machinery, and the coal, etc., is liable to be much broken by falling so far. Moreover, the cars when loaded have so great a weight per wheel that they are not allowed on the Austrian and on some of the Saxon railroads.

The Austrian State Railroads, in view of the high rents in Vienna, have bought a piece of ground near one of the stations and built thereon nine three-story buildings containing in the aggregate 114 tenements, each of two rooms and closet, which are let to trainmen at low rents. The whole cost was $180,000, which is $1,250 per tenement. Gardens and playgrounds are attached.

The German engineer Frahm, who was for several years technical attaché of the German embassy in London, in a recent communication says that in England the advocacy of large cars of the American design, carrying 50 tons or so, which was much in evidence some seven years ago, has quite subsided. It came chiefly from men unfamiliar with the practical requirements in England, where the railroad officers themselves had already investigated the subject, and knew what they could do. They are now generally convinced that 20 tons is the limit, but a great many 12 and 15-ton cars have been built.

The Austrian Railroad Ministry has established a sanitary department. It will have charge of the administration of the sanitary service, will co-operate in determining all questions involving railroad hygiene, such as clothing of employees, provision for their meals when on the road away from home, hours of work and rest, and time of vacations; will criticize from a sanitary point of view all plans of buildings, and will give its opinions on signaling, the furnishing, lighting, heating, cleaning and disinfection of cars, the ventilation of tunnels and of railroad restaurants; and will keep the statistics of sickness and death in the state railroad service.

Bergen Hill Tunnels of the Pennsylvania.

The south tunnel of the two tunnels which the Pennsylvania is driving under Bergen Hill, west from Hoboken, N. J., was driven through on April 11. It is expected that excavation on the other will be finished next month. These tunnels are each 5,920 ft. long; they connect at the Weehawken shaft with the two tubes running under the North river. At this point the floor of the tunnel is about 75 ft. below the surface and about 60 ft. below mean high water. Under the crest of Bergen Hill, the floor is about 220 ft. below the surface. No unusual difficulties have been encountered in the work on these tunnels, but the progress has been slow because about 4,000 ft. had to be cut through Palisade trap rock. This is so hard that steam drills could not drill more than 1 ft. an hour. Work has been under way for about three years. About 260,000 cu. yds. of rock have been taken from the two tunnels, and over 680,000 lbs. of dynamite have been used.

One of the accompanying photographs shows the interior of the tunnel near the Hackensack, or western, portal, and the other shows the portal itself. From this point the tracks are to be carried on trestles and fills across the Jersey meadows to connect with the main line near Harrison.

Tunnel Interior near Hackensack Portal, Showing Use of Cross Section Rod.

Hackensack Portal of Bergen Hill Tunnels, Looking East and Showing Arches of Cut-and-Cover Section; Pennsylvania Railroad.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XVII.

Trans-Atlantic Freight Rates and Their Control.—II The Lines Between America and the Continent.

The independent, competitive and chaotic condition existing among the lines connecting the United Kingdom and the United States is in very marked contrast to the relationship of the Continental-American carriers with each other. There are but two German trans-Atlantic lines of importance—and there is but one interest, the North German Lloyd-Hamburg-American. They represent the culmination of a series of consolidations that ended competition in their respective ports. They never actually wage war on one another, and where their pockets are affected they are astonishingly agile in getting the best results for both, while standing together to prevent encroachment by any new concern. With their close traffic understanding and pooling arrangements, with their alliances with the International Mercantile Marine Company's Red Star Line and the French Line, and with the joint control of the Holland-America Line a remarkable front is presented by these five dominant companies in the continental freight and passenger business.

The Hamburg-American Company alone may really be considered as a vast and strong conference, the only difference being that it is all owned by one firm rather than managed by a conference of owners and its solidity is therefore absolute. It dominates the German and Scandinavian trade with America, having its own lines to all ports of importance from Montreal to Galveston, and transshipping at Hamburg to Baltic and Scandinavian ports. Any small lines that from time to time go to Hamburg do so by its consent. In its earlier days it competed, fought, won and consolidated until at present its competition is well nigh irresistible. The great force of its competition arises from the fact that having 57 services in nearly all parts of the world, it is in the identical position of an American trust which kills a small rival by doing business at a loss in his small territory while it is making profit in the other 95 or 98 per cent. of its own territory, and with this profit can pay dividends and also maintain a strangulation fund.

These two German companies in guarding their territory from competition have not only driven and kept rivals away from their own ports; but, for the last 10 years, the establishment of services to Scandinavia has been regarded as an undue and unpermissible encroachment; because it might carry directly the goods now handled by transshipment through Hamburg and Bremen, especially Hamburg.

The most recent of these episodes is the attempt of a Philadelphia firm to start a line from that city to Copenhagen. As soon as the service was begun they were advised by the Hamburg-American Company representatives to withdraw or take the consequences, and having maintained the service, very severe and damaging competition followed by both lines and by new ones especially created by them for the purpose. The American firm, one of the oldest and most reliable in the business, filed a complaint* before the Interstate Commerce Commission which may be taken as an excellent exhibit of rate and traffic control by an ocean carrier. It states that more than a decade ago the Hamburg Company established such a system of rebates that through its financial penalties * * *

shippers were not permitted to ship goods, whether they were interested directly or indirectly, either as owners of the goods or as agents, except by the lines of the Hamburg-American Packet Company, or by such lines as it might direct. This contract, when made with a German forwarding agent, covered whatever merchandise he might handle for any or all of his foreign or domestic principals, no matter by what route or routes he may have been instructed by the bona fide owners of said merchandise to forward their goods to ultimate destinations in the United States.

In other words, the Hamburg American Packet Company not only secured the right absolutely to fix freight rates from Hamburg to the United States North Atlantic ports of Boston, New York, Philadelphia, Baltimore, Norfolk, and Newport News, but, in like manner, peremptorily demanded as well the right to name the steamship lines by which the shipper should forward freight from Bremen or Rotterdam to the said United States North Atlantic ports, thereby preventing the shipper from sending his merchandise by any other lines than those specifically designated by the Hamburg American Packet Company.

If the goods were destined beyond the American seaboard, this arbitrary selection of trans-Atlantic lines frequently involved the determination by the Hamburg American Packet Company of the United States inland carrier by which the goods should be forwarded from the seaboard to their final destination, and a consequent restraint of trade within the United States.

This rebate contract first issued in 1895 has been withdrawn and a modified form issued. "Under this modified form of contract, the Hamburg-American Packet Company agrees to carry all the goods of the merchant at a certain rate, provided he will ship goods to the six United States North Atlantic ports only by lines of the Hamburg-American Packet Company, or such other steamship lines as that company may designate."

"This contract covers all shipments that may be routed via German or Dutch ports, the routing of which can in any way be controlled by the merchant. Both the goods of the merchant and those which may be ordered through him or transshipped under his direction are included in the contract. Though the principal may have goods to forward from different ports, the agent must submit to the Hamburg-American Packet Company the determination of the lines by which the goods in question are to be transported from the respective ports. The merchant in an interior distributing center of the United States, ordering goods through his German representative, who is under contract with the Hamburg-American Packet Company, must submit to have all his goods shipped via such lines as the Hamburg-American Packet Company may dictate.

"Thus the Hamburg-American Packet Company not only fixes the rates from Hamburg, but it controls the selection of the steamship lines by which shippers may transport their goods from Bremen and Rotterdam to the United States North Atlantic ports."

"The Hamburg-American Packet Company, after years of aggressive tactics, stands to-day the absolute dictator of the German-American trade. No steamship company in the United States, or elsewhere, dares to question its lofty supremacy; such temerity would be followed immediately by attempted extermination.

"Thus a company, foreign in its control, dictates the rates, the line, the manner, the method, the routes and every other condition of trade and traffic to which the United States producer, manufacturer or shipper must humbly submit if he aspires to introduce his goods to the foreign consumers *via* the three most northern important Continental ports."

The complaint then goes on to state that in addition to this contract control there is a further dominance through a pooling agreement which the strong hand of Hamburg also controls.

"We desire especially to make complaint against the eastbound or export Baltic pool dominated by the Hamburg-American Packet Company, and maintained and manipulated by them in New York, in conjunction with the North German Lloyd, Scandinavian-American Line and Wilson (Hull) Line. The Baltic pool comprises the eastbound merchandise traffic through the United States North Atlantic ports of Boston, New York, Philadelphia, Baltimore, Norfolk and Newport News destined to ports or places in the kingdoms of Denmark, Sweden and Norway, the province of Finland and the German ports on the Baltic. This pool arbitrarily determines the ultimate rates for forwarding merchandise on through and on local bills of lading from the cities of Chicago, St. Louis, Kansas City, Omaha, Minneapolis, Duluth, Cleveland and other manufacturing centers of the United States via the United States North Atlantic ports, either direct to the Baltic or via Hamburg, Germany; Bremen, Germany, or Hull, England."

The pool divisions were described as follows: "Routes to Baltic direct, and those via other nations, by which Baltic traffic is forced by the pool to travel, and percentages allotted each route:

The Hamburg-American Packet Company, via Germany	56 per cent
The North German Lloyd, via Germany	17½ "
The Wilson (Hull) Lines, via England	2½ "
	76 per cent
The Scandinavian American Line—direct to Denmark	24 "
	100 per cent

"To make easier and more certain the percentage division of the traffic, the field has been parceled out to members of the pool. The Hamburg-American Packet Company maintains a service to Hamburg from each of the six United States North Atlantic ports of Boston, New York, Philadelphia, Baltimore, Norfolk and Newport News. The North German Lloyd maintains a service to Bremen from New York and from Baltimore. The Scandinavian-American Line maintains a service to Copenhagen from Boston and from New York.

"The practical working of this pool was illustrated recently when one of the largest exporting concerns was approached and without solicitation advised as to what their ocean rate of freight would be for their output for the ensuing season. They were also informed that later they would be advised (1) over what trunk line their shipments should be made, (2) to what ports their shipments should be forwarded; (3) what volume would be assigned to each of the export centers. This is clearly a case where the pool undertook to control, direct and divert as best suited the interest of its members the output of the establishment.

"When a member of the pool is doing more than its apportioned share of the business, shippers are instructed to send their goods to ports from whence other lines make their sailings. A further balance is maintained by the Hamburg-American Packet Company for its own benefit. It orders the shipper to send his goods first to one and then to another of the six United States North Atlantic ports to which it maintains regular lines. Freight shipments are thus manipulated so that the services of the Hamburg-American Packet Company shall not be depleted at one port or overburdened at another."

These are the statements of a comparatively small but old and

*"Statement of Peter Wright & Sons in the matter of the complaint against the Hamburg American Packet Co. for pooling and maintaining monopolies in restraint of trade." June 19, 1907.

very reliable firm which the Hamburg-American Company is now attempting to beat off of the Baltic service. The statements contained in the complaint are common knowledge, although most of them have not been determined in a court of law. Nor were they in any way disproved by the rebuttal of the Hamburg Company's attorneys. The Interstate Commerce Commission did nothing to question or determine their correctness because the complaint was dismissed in March, 1908, on the grounds of lack of jurisdiction to control the ocean lines in any alleged restraint of trade.

The Hamburg Company is therefore allowed to go on undisturbed in its steady accretion of services and virtual control of rates. Unquestionably it has the strongest position and organization to be found among the world's great shipping companies. A virtual witness of this is its ten-fold increase of tonnage in 20 years and its prosperous financial condition.

The evidences of the strength of its position and that of its allies need not be drawn wholly from complaints before the Interstate Commerce Commission.

A freight classification in the ocean-carrying trade is a sign of great stability. The shipowner in the Liverpool-New York trade hardly knows what freight classifications are. His life is a turmoil and a scramble for freight. He cannot make a classification because the exigencies of his competitive business would make him break class *i* before he had completed class *vi*, so he does not classify. But the Germans do. The North German Lloyd and its partners just mentioned have a westbound freight classification of six classes. That for 1906 was printed and distributed in New York in November, 1905, so great is their fore knowledge. It divides freight into six classes and it is currently reported in shipping circles that the rates are maintained as announced.

The character of the goods has a profound influence on rate making and classifying as is shown by the different practices of the Germans in the east and westbound trade. They can maintain a rate going west but do not attempt to do so on eastbound traffic. The difference is largely due to the character of the freight. The trade to the west is largely valuable manufactures which pay high prices. It is in these goods that the classification holds. The six classes do not provide for all articles. Heavy freight is almost excluded from the classification and reserved for special arrangements which are estimated to cover at least 25 per cent. of the traffic of one of these lines. As the eastbound freight is nearly all heavy freight, it is all reserved for special arrangements. This is necessary because goods of this character cannot bear high freight charges and would go to their destination by transshipment from British, Dutch, Belgian or French ports if the German lines were not free to make some adjustment to the current rates. The freight rates on westbound goods, though high per ton, are really low in percentage of value of the goods. This high value makes it unprofitable for much of this class of freight to lose any time in following slower, more devious, but cheaper routes. Hence it becomes the easy prey of the carriers with agreements and classifications.

The London carriers are unique among British-American carriers in that they have a freight classification. It has seven classes and was formed in 1901 by crystalizing the results of long practice. It is instructive to note that it is in a trade controlled by few and strong hands, and that only an estimated 10 per cent. of the traffic is classified—the higher class manufactures. On the other 90 per cent. the agreeing London carriers feel that they must be free to meet the market, which sets the rate for all freight moving in great quantities.

Why do the ocean carriers from Germany to America agree so completely while those from Great Britain compete so constantly? There are at least three reasons that may be cited in partial explanation. The first is the much smaller size of German maritime operations and the shorter shore-line this commerce serves. In Germany there are but two ports engaged in Atlantic foreign trade and as these are almost twin ports, agreement is geographically simple. In England there are three different coasts and at least six ports of the first magnitude and many smaller ones, each striving to get a larger share of the national commerce. The second reason may be found in the national characteristics. The Englishman loves his independence and will undergo financial privations to have it. The German has submitted to the national will, has received military drill, has obeyed orders and has moved in companies and masses. He is thereby trained to common action. The third reason is the influence of the German government. The great German steamship companies are probably more nearly a part of the government than are any other important lines in the world. They receive direct or indirect government aid and are benefited by the great desire of Germany to be a sea power. A part of the subsidy is in the form of special railroad rates on export goods on the government railroads. The personal side of this government relation, the lively interest of the German Emperor, who uses the great force of his personal and social prestige to uphold this branch of German sea power, is also important.

The lines to the southern countries of Europe carry an important part of our trade with the continent, but it is not necessary to give any full account of the rate problems of the lines between the United States and the Mediterranean for the reason that while a complex array of incidents might be marshalled, they show no new principles. The long shore line, the several nations, the many ports combine to destroy any idea of homogeneity. Five jealous peoples have their outlet on the Mediterranean—the French, Spanish, Italians, Austrians and Hungarians, and to add to the variegated aspect the German and English companies have been important factors in the carrying trade to America, which now has at least 15 line services to the North Atlantic ports.

Their history this past 15 years has been as checkered as is the cosmopolitanism of the carriers, wars, agreements, pools—more wars, more readjustments—but nothing different in principle or practice from that which has been narrated in the previous numbers of this series.

(To be concluded.)

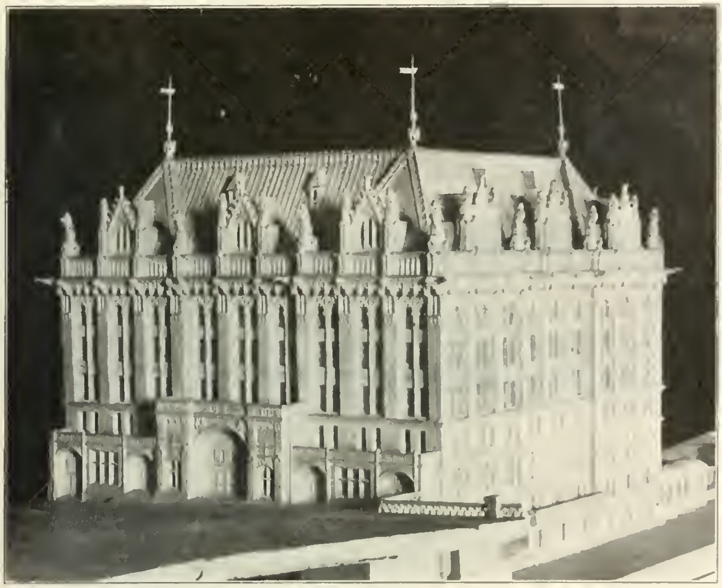
Ottawa Union Passenger Station.

The union passenger station at Ottawa, Ont., is being built by the Grand Trunk, to be used by that road, the Canadian Pacific, and the New York & Ottawa. As shown in the accompanying plan, the station will face the new plaza to be formed at the intersection of Dufferin and Sapper's bridges with Rideau street. In connection with the building of the station, a hotel will be erected, on the other side of the plaza, at the southwest corner of Major's Hill Park. This hotel is to be known as the Chateau Laurier.

View of Ottawa Union Station and Chateau Laurier, Looking Across Rideau Canal.

The present Canadian Pacific tracks, as well as those of an electric railway which runs to Hull and outlying points, run between the site of the new station and Rideau canal. The Canadian Pacific line is eventually to be double tracked. It will continue parallel to the canal, running under the plaza formed by roofing over the space between the two converging bridges over the canal. From this point, the line continues along the canal and to the Alexandra bridge across the Ottawa river, over which the through Canadian Pacific trains and the electric cars will operate. The terminus of the electric railway will be under the plaza. The original idea was to make the station a head on instead of a through station;

that is, to put the station at the end of a Y over which all trains would back in from the east and west. This would have made a shorter run to Hull station than the route across the Alexandra bridge, but as the government required that the bridge continue to be used the present plan was adopted. The tracks come into the station from the south, leaving the Canadian Pacific tracks about

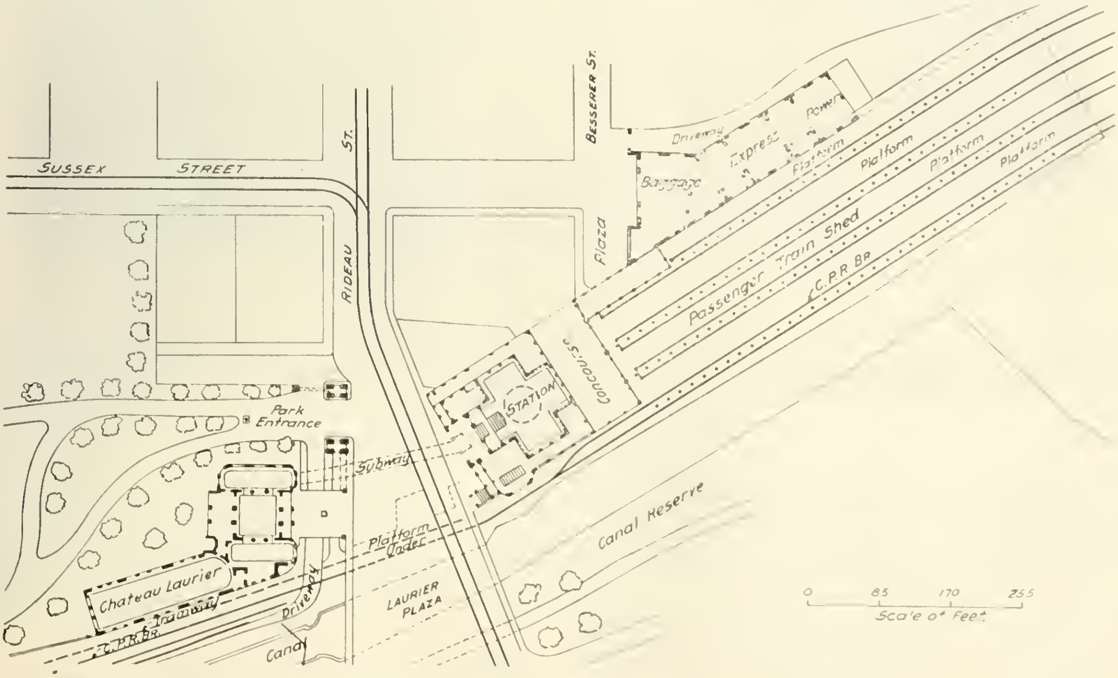


View of Station from Laurier Plaza.

2,000 ft. below the station. There will be nine station tracks, served by platforms 20 ft. wide. East of the train-shed is the baggage and express annex, about 350 ft. long, with separate tracks and platforms. This takes care of in and outbound baggage, express and mail. Adjoining it is the power plant and space for coal storage, also second class waiting rooms, the conductors' and trainmen's rooms, customs offices, etc. The ground area of this annex is about 28,000 sq. ft. At the north end of the annex there will be another new plaza at the intersection of Sussex and Besserer streets, wide enough to easily take care of carriage service and baggage wagons, while express and mail wagons are provided for in the driveway east of the annex.

Between the train shed and the station building is a concourse 170 ft. x 50 ft. This is at track level; it communicates on the east with the plaza just mentioned, and on the north it leads into the general waiting room, at the same level. The first four stories of the station building proper are used for the passenger station, while the upper stories will be railroad offices. These upper stories are built around a well, the bottom of which is the central dome over the waiting room. From the main waiting room open alcoves and rooms for the ticket office, sleeping car office, information bureau, parcel room, lunch room, etc. At the north end of the waiting room is a broad stairway leading up to the Laurier plaza, which is 22 ft. above the track level. The main waiting room is 52 ft. square, with wide wings each 50 ft. square and 40 ft. high. The women's room 52 ft. x 30 ft., is north of the main stairway, being under the entrance to the plaza, and is well lighted from open areas on each side of the entrance. The smoking room is 32 ft. square; the ticket office, 52 ft. square; the lunch room 52 ft. x 35 ft., and the sleeping car office, telegraph office and information bureau, each 15 ft. x 20 ft. On the mezzanine floor will be the offices of the train despatcher and the station master, and other rooms.

One of the accompanying photographs of models shows the main entrance of the station fronting on the plaza. A smaller entrance leads to a suite of private waiting rooms for the use of government officials and distinguished visitors. Another view of the model shows the station building and also the Chateau Laurier. The ground area of the hotel is about 25,000 sq. ft. The main entrance is from the plaza and the service entrance is underneath from the level of the roadway to the canal. There is also a large passenger subway connecting it with the station. The hotel will have over 300 outside rooms and connecting baths, aside from the ballroom, public and private banquet and dining-rooms, cafe, etc. Heat and electric current for light



Location of Ottawa Union Passenger Terminal.

will be furnished from the power plant in the baggage annex.

These buildings have been designed to harmonize with the adjacent parliament building and the proposed governmental buildings east of Major's Hill Park. The architecture is French Gothic with a predominating Norman motif. This style lends itself particularly to the construction of the station building, in which the vertical lines of the steel frame have been made prominent. The outside of the buildings will be of stone, and the detail of the upper stories will be in faience. The roofs are to be copper. The entire framework will be steel, and the floors and partitions of concrete or tile.

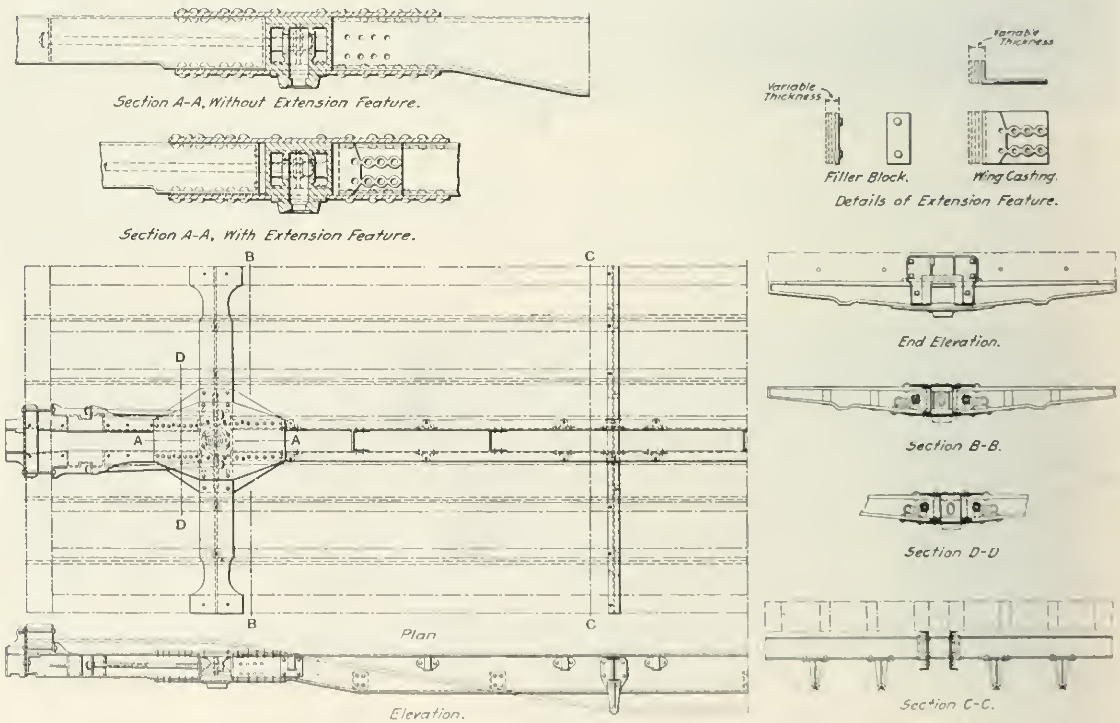
It used to be customary in working out plans for a terminal of this kind for the railroad's engineering department to prepare the general layout, deciding what areas should be used for station, baggage room and other purposes, and have the architect design the structure within these limits. More recently, better results have been obtained by submitting the problem to the architect, leaving it to him to work out the best layout for handling traffic; the details as to tracks, switches and connections being subject to the approval of the operating and engineering departments of the railroad. The Ottawa Terminal and the Chateau Laurier were designed in this way by Bradford L. Gilbert.

On the Austrian railroads, the rule since 1876 has been for trains to run on the left hand track, and signals, switches, etc., have been placed accordingly. Meanwhile, in the adjacent countries, Germany, Italy and even Hungary, the trains kept to the right. Now the Austrian authorities have determined to do as their neighbors do and new second tracks, etc., are to be constructed accordingly, and old lines are to be changed as occasion offers, but it must be many years before the change is completed. Running to the right was the rule on the first Austrian railroads; a change to the left was made in 1844, when there was not much to change, in 1851 there was a change back to the right, to be changed again as aforesaid.

Metal Draft Frame for Wooden Cars.

All-wood freight cars are subjected to treatment which greatly increases the cost of maintenance because of the use of high-capacity all-steel and steel underframe cars, heavy locomotives, hump switching yards, etc. To strengthen them so that they are better fitted to withstand these stresses, W. E. Sharp, Superintendent of the Armour Car Lines, Chicago, has designed a steel underframe to be applied to wooden cars now in service, which will give a continuous draft system, and which can be put on at low cost. Since cars of the same class, made at different times, may vary appreciably in such essential dimensions as the distance from end sill to body bolster or distance between truck centers, it was necessary that this frame be so designed that it could be applied without boring new holes and thus further weakening the wooden members of the car, and, also, that the original height of the car floor be left unchanged. Furthermore, it was desired to avoid cutting away the body bolster in making continuous center sills, it being considered that a large number of the failures of such bolsters in service are due to the weakness thus caused.

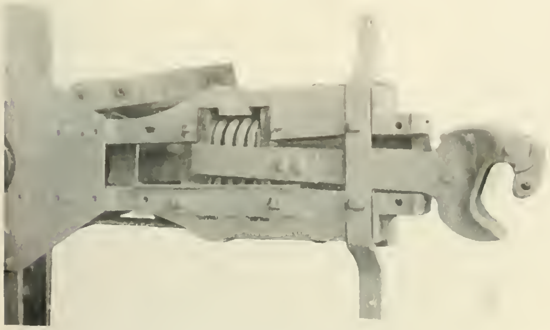
Detail drawings and photographs are shown herewith. Th



Sharp's Steel Center Sill and Draft Sills for Wooden Cars.

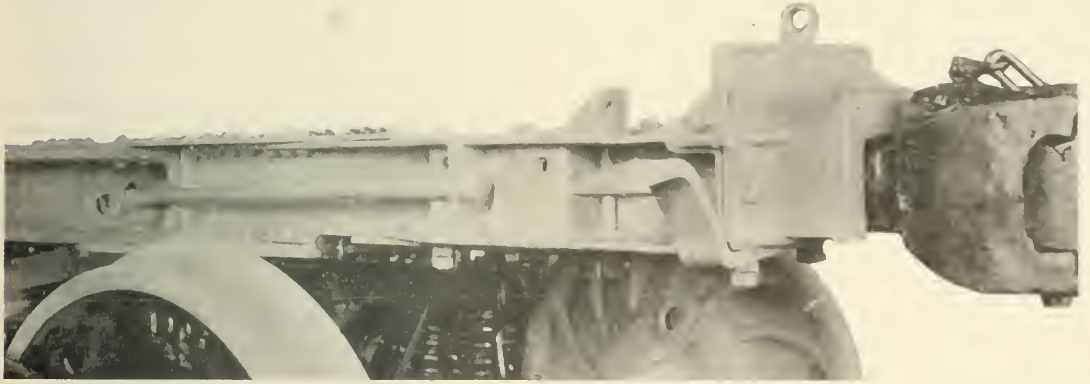
draft sills and the dead block are steel or malleable iron. The latter is bolted to the forward ends of the draft sills and extends up the outside face of the end sill. A bracket is cast on the top for the uncoupling lever. Each draft sill has a stop against which the inner face of the end sill bears, with a hole for bolting through the end sill to the dead block. The illustrations show draft sills designed for twin draft springs; they can, however, be made for any design of spring or friction gear.

The lengths of the draft sills and of the center sills are standard, the variations in essential dimensions noted above being met by



Bottom View of Draft Sills.

an extension feature, which is shown in detail in the drawings. To lengthen the distance between bolster and end sill, a filler block is put between each draft sill and the body bolster. To increase the distance between truck centers, a wing casting is riveted to each center sill, with its short arm fitting between the end of the sill and the bolster. The thickness of this wing casting arm and that of the filler blocks vary according to requirements. The filler blocks have lugs which fit into holes in the ends of the draft sills to hold them in place before the frame is riveted up. The draft sills and the center sill are made continuous by two plates passing



Side View of Draft Sills, Showing Buffer Block.

over the top and under bottom of the bolster and securely riveted to the different members. The lower plate is cut out for the top center plate, which is cast integral with the bolster. Each draft sill is strengthened by a rod passing through the body bolster and through a lug cast on the side of the draft sill.

Refrigerator cars of the Armour Car Lines have been equipped with this underframe for a year and no weakness has developed.

Foreign Railroad Notes.

The Austrian authorities have made a special rate on crude petroleum to be used as fuel, coming from the wells in Galicia. This rate is the same per pound as the coal rate. As oil has a fuel value equal to about 1¾ its weight of coal, and as the oil tank cars can take no return freight, the coal producers have an excuse for calling this unfair.

The contract has been made between the Chinese government and German and English capitalists for a railroad from Tientsin, the port of Pekin, south by east to the Yang-tse-Kiang river opposite Nankin, the distance in an air line being about 530 miles. The Chinese are to build and own the railroad themselves, under the observation and inspection of engineers and accountants selected by the Europeans, who are to provide £5,000,000 towards the cost. About 175 miles south of Tientsin the line will connect at Tsinan-fu with the German Shantung Railroad.

The railroad around the shoals of the Congo from Stanleyville to Ponthierville, 79 miles, has been completed and steamboats no longer ply on that part of the stream, there called the Lualaba. Stanleyville is about a thousand miles above Stanley Pool, the upper terminus of the old Congo Railroad, and between them steamboats of considerable tonnage ply. Above Ponthierville the Lualaba is navigated to Kindu, about 200 miles further up (south). Thence to Kongolo, 200 miles, south by east, another railroad is to be built, to reach a stretch of river which with a little improvement is said to be navigable for about 400 miles, to the falls of Kalengwe.

Effects of the 16-Hour Law on Trainmen.

From replies received in response to inquiries sent to the principal railroads, it appears that the most important result of the United States law limiting the working hours of trainmen, which went into effect on March 4, has been to equalize the rest periods of those crews who formerly took a long rest at the home end of their runs and a short one at the other end, and to reduce the average income of freight trainmen in numerous cases where the rearrangement of runs has necessitated the employment of additional crews. In a number of cases a run of, say, 160 miles, has been divided so as to leave 120 miles to be operated the same as before, while the other 40 miles is operated by having a crew go out and come back the same day. This arrangement as well as most of the other changes which have been made, makes some increase in the total time spent at terminals, and in this way makes necessary the employment of additional crews; and the payment for the time spent in this added terminal work has in a few cases increased the expense per train-mile to the companies.

Large numbers of roads have reported that no important change was found necessary on their lines; and in the cases of the few roads on which considerable expenditures have been made for new terminal buildings and tracks, we are informed that the changes had been planned before the passage of the law. Information received from roads on which changes have been made is given below.

Atchison, Topeka & Santa Fe.—The lengths of the divisions are quite uniform, so that probably the law will result in no serious changes; but crews that have heretofore made their runs in the direction of home after a rest of six or eight hours, will now have to make this rest-period longer.

Atlanta, Birmingham & Atlantic.—A few additional crews put on; only a small part of the whole force is affected by the change.

Baltimore & Ohio.—About 21 crews will have to take longer rest-periods at that end of their run which is farthest away from home. It was expected that not over a dozen men would have to change residence.

Central of New Jersey.—Some crews which have run out and back the same day will now be run farther and be required to take a rest, as required by law, at the far end.

Chicago, Burlington & Quincy.—A number of runs have been rearranged and additional freight crews are required.

Chicago & North-Western.—A few crews will have to take rest away from home who formerly made round trips.

Delaware & Hudson.—Heretofore freight trains have been running from Binghamton to Oneonta (61 miles) and return, total 122 miles; Albany to Oneonta (83 miles) and return, total 166 miles; Oneonta to Mohawk (72 miles) and return, total 144 miles; Oneonta to Mechanicsville (87 miles) and return, total 174 miles. Under the new arrangement the runs are from Oneonta to Saratoga, 92 miles; Binghamton to Mechanicville, 149 miles; Binghamton to Albany, 143 miles.

The number of crews who thus have their runs changed from round trip to straight away is 32. The company probably will have to provide new buildings at two points, costing $2,500, and about 100 men with families will change their residences.

Delaware, Lackawanna & Western.—On one division where traffic is dense the freight trains have been made lighter so as to insure the completion of trips within 16 hours. In numerous cases runs of 100 miles and less, formerly doubled in 15 to 20 hours, are no longer doubled.

Great Northern.—Business is now so light that no changes have been necessary, but, with the road working to its full capacity, some runs will have to be shortened. A number of passenger runs have been changed so that the rest periods of the crews will be more nearly equalized as between the two ends of the run.

International & Great Northern.—Changes were made some time ago to comply with the law of the state of Texas, in which the limit is 14 hours instead of 16, as in the federal law, but only a few changes were found necessary. One Y track had to be put in to be used for turning engines.

Illinois Central (freight runs).—

Old Arrangement.	*New Arrangement.*
Memphis to Mounds.......173 miles	Memphis to Fulton.... ...123 miles Fulton to Mounds ... . 50 "
Memphis to Paducah......169 miles	Memphis to Fulton ... .123 " Fulton to Paducah .... 46 "
Louisville to Paducah .....225 miles	Louisville to Central City..125 miles Central City to Paducah....100 "
Princeton to Nashville and return ....232 miles	Princeton to Nashville ....116 miles Nashville to Princeton.....116 "
Memphis to Gwin..........161 miles	Memphis to Tutwiler...... 92 miles Tutwiler to Gwin.......... 69 "
Vicksburg to New Orleans..228 miles	Vicksburg to Wilson ......113 miles Wilson to New Orleans....115 "

About 150 men are affected by these changes, about half of whom will change their residences.

Passenger Runs.—

Old Arrangement.	*New Arrangement.*
Evansville to Nashville....217 miles	Evansville to Princeton....101 miles Princeton to Nashville ....116 "

Kansas City, Mexico & Orient.—One new passenger crew had to be employed.

Kansas City Southern.—The run between Mena and Shreveport (178 miles) has been changed so that now the men will run from Mena to Texarkana, 107 miles; and from Texarkana to Shreveport, 71 miles (round trip, 142 miles). The line from Shreveport to De Quincy (161 miles) will be divided at Hornbeck, 94 miles from Shreveport, and the balance of 67 miles will be covered by a round trip (134 miles). Eighteen crews are affected by these changes. The buildings and tracks required at the new terminals cost $105,000, and about 50 men with families have changed their residences, or will change. The additional time paid to crews in consequence of the new arrangement is estimated at $105 a month. Six passenger crews have had to change the place of their principal away from home terminal.

Louisville & Nashville.—Few crews will have to change residence.

Michigan Central.—One freight run has been changed so that three crews will be required where formerly two handled the trains. Three passenger crews on the main line have been changed, but their aggregate mileage is the same. On the Bay City line a passenger run of 237 miles is divided so as to make one of 147 miles and another of 90 miles.

Oregon Railroad & Navigation Co.—The runs of the local freight trains between Starbuck, Wash., and Spokane, 156 miles, have heretofore been divided at Tekoa, 108 miles from Starbuck, but now are divided at Colfax, 69 miles from Starbuck. The fast freights between Starbuck and Spokane have heretofore run through (146 miles), but now the runs are divided at Tekoa. About 35 men have to change their residences.

Oregon Short Line.—No changes have been made in runs, but about $55,000 is being spent for new passing tracks, with a view to preventing delays in the movement of freight trains.

Philadelphia & Reading.—This company began some years ago to equalize the runs of trainmen so as to avoid the necessity of excessive hours, and 100 miles is now the maximum for practically all freight and coal trains. In connection with the changes decided on (before the law was passed) the company built two rest houses costing together about $10,000, one at Bridgeport and one at East Penn Junction. About 1,500 men now have to take rest away from home, though formerly in many cases they made a round trip in 16 hours.

Southern Railway.—On this company's lines many of the divisions are from 150 to 170 miles long, but it was found that to change the terminals would cost about $2,000,000, a sum which, on account of the business depression, was not available. It was decided, therefore, to have the crew which starts out with a train take it about 120 to 125 miles, and then have a relief crew take it the remaining third of the distance and make the round trip. While this crew is at work the other one has time to rest. The engines and cabooses are not changed at these temporary changing places.

Texas & Pacific.—Trains that heretofore ran from New Orleans to Boyce, 208 miles, now end their trips at Baton Rouge Junction, 89 miles.

Union Pacific.—Between Denver and North Platte, 277 miles, the line is to be divided at Sterling, exactly one-half, but this change was decided on before the passage of the 16-hour law. One freight run of 164 miles is divided into two, one 117 miles long and the other 47 miles. Some of the trainmen will earn 25 per cent. less than before. The headquarters of three passenger crews has been changed.

The Purchasing Department and Common Standards.*

This is a brief description of the present practice and policy of the purchasing department of the Union Pacific and the Southern Pacific and of the co-operation of other departments of the service, which has made its methods practicable and effective.

COMMON STANDARDS.

To obtain the most efficient, economical and satisfactory results for all the lines of these systems, comprising about 18,000 miles, the management realized several years ago the importance of selecting definite uniform standards of the best practicable designs for many articles used in large quantities by the different departments of the service.

In numerous conferences, which are held periodically, the chief

COMMON STANDARD FREIGHT CARS.

Kind of car.	Capacity Pounds.	Capacity Cu. Ft.	Inside Length.	Inside Width.	Inside Height.	Light Wt in lbs.	Light Wt pr ct of carrying capacity.	Light Wt in lbs. per 1,000 cu. ft. capacity, level full.	Remarks.
Box	100,000	2730	40 ft.	8 ft. 6 in.	8 ft. ¼ in.	40,803	40.8	14,946	Steel underframe.
*Box	80,000	2730	40 ft	8 ft. 6 in.	8 ft. ¼ in.	37,870	47.3	13,872	Steel underframe.
Flat	100,000		40 ft. 10 in.	9 ft. 4½ in.		33,100	33.1		Steel underframe Decking 2⅝ in. thick
Flat, with wooden removable sides and ends......	100,000	1640	38 ft. 2 in.	9 ft. 2½ in.	4 ft. 8 in.	38,217	38.2	23,303	Decking 2⅝ in. thick
*Flat	80,000		40 ft. 10 in.	9 ft. 1½ in.		30,644	38.3		Decking 2⅝ in. thick.
*Flat, with wooden removable sides and ends......	80,000	1405	38 ft. 2 in.	9 ft. 2½ in.	4 ft.	34,806	43.5	24,773	Decking 2⅝ in. thick.
Stock	80,000	2596	36 ft. 6 in.	8 ft. 5⅜ in.	8 ft. ¼ in.	34,978	43.7	13,474	Steel underframe.
†Furniture	60,000	3629	40 ft	9 ft. ⅝ in.	10 ft ¼ in.				Steel underframe.
Refrigerator	60,000	2494	39 ft. 10¾ in.	8 ft. 2¾ in.	7 ft. 7 in.	44,416	74.0		Steel underframe.
(between ice tanks)....		2057	32 ft. 11¾ in.	8 ft. 2¾ in.	7 ft. 7 in.			21,593	
Gondola	100,000	‡1783	40 ft. 4 in.	9 ft. 4⅞ in.	4 ft. 6 in.	39,834	39.8	22,341	All steel with 8 drop bottom doors.
Hopper bottom	100,000	‡1650	30 ft. ¼ in.	9 ft 6 in.	5 ft 9¼ in.	38,751	38.8	23,487	All steel.
Oil	100,000 12,500 gal.	‡1700				48,300	48.3	28,412	All steel
Work, convertible as gondola car	100,000	1040	40 ft.	8 ft. 8 in.	3 ft.	42,000	42.0	40,385	Steel underframe.
Hopper bottom car....		‡ 928	30 ft.	8 ft. 8 in.	3 ft.			45,259	Steel underframe.
Caboose, 8 wheel			29 ft. 7 in.	9 ft. 1 in.	7 ft. ¾ in.	33,606			Wooden car, steel platform.

*Since 1903 it has not been considered advisable to purchase any 80,000 lbs. capacity box or flat cars, as the cost of these is only about $60 per car less than the cost of similar 100,000 lbs. capacity cars.

†No 60,000 lbs. capacity furniture cars have yet been purchased. ‡Level full.

*Abstract of a paper read before the New York Railroad Club on Feb. 21, 1908, by W. V. S. Thorne, Director of Purchases of the Union Pacific System and the Southern Pacific Company.

officials of each department concerned of the various associated companies have recommended exactly what many of these standards should be. Decisions have been made after considering the advantages from a mechanical and practical as well as from a commercial point of view and after opportunity has been given for argument or suggestions from many experienced and technical men, who have used or manufactured the devices or material in question. Later most of these recommended standards have been favorably passed on by a majority of the general managers of the companies concerned, and when formally approved by the Director of Maintenance and Operation of the associated systems have thus been adopted as common standards for all the associated lines. Where practicable and desirable, detailed and definite specifications and drawings have been prepared, describing and illustrating clearly each common standard.

When formally adopted, any article remains a common standard until it has been formally canceled or superseded by another device, which the officials concerned have voted to be preferable, either on account of greater efficiency, safety, economy, simplicity or other good and sufficient reason. This method has been found to work most satisfactorily in practice and without too much red tape to be objectionable.

When common standards were first considered, it was impracticable to adopt the then existing standards of any one company as common standards for the associated lines, as the various railroads had been under separate management and had different standards of their own. No one line had any design of freight car or passenger train car or locomotive, or more than a few maintenance of way department standards, that could not be greatly improved by suggestions from officials of the other associated lines, from car builders, locomotive builders or other manufacturers, to whom various parts of proposed common standard plans and specifications were submitted for criticisms and suggestions. It was found, however, that certain parts of cars or locomotives, heretofore used as standards by some of the lines, were entirely suitable as common standards, and these were accordingly adopted. Each common standard was therefore adopted strictly on its merits.

ADVANTAGES OF THIS SYSTEM IN MAKING PURCHASES.

Some advantages of this system to the purchasing department are as follows: The variety of similar articles to be purchased is reduced to a minimum. Many standards for all the associated lines being uniform, stocks of material carried on hand at different points are interchangeable to a much greater extent than formerly, and, in case of emergency, material can be drawn with little delay from other than the usual storehouses, thereby avoiding the necessity of carrying as much on hand as formerly.

Common Standard Wooden Passenger Train Cars.

Kind of car.	Length over end sills.	Seating capacity.	Light weight, car complete.
‡Coach	60 ft.	70	88,000
†Coach	*69 ft.	82	* .....
‡Chair	60 ft.	58	88,000
†Chair	*67 ft. 1 in.	66	* .....
‡Baggage	60 ft.	..	85,400
†Baggage	*69 ft.	..	*103,000
†Postal	60 ft.	..	101,500
†Baggage and postal	69 ft.	..	101,000
†Diner	72 ft. 6 in.	..	125,000
†Observation-smoker	72 ft. 6 in.	..	.....

*None of these yet built.
†6 Wheel all steel trucks. ‡4 Wheel all steel trucks.

**Common Standard All Steel Passenger Train Cars.*

Kind of car.	Length over end sills.	Seating capacity.	Light weight, car complete.
‡Coach	60 ft.	70	95,700
‡Baggage	60 ft.	..	90,000
†Postal	60 ft.	..	108,000
†Postal storage	60 ft.	..	106,000

*Up to the present time sample all steel passenger train cars only have been built, but it is probable such cars will be ordered exclusively in future and that some slight reduction can be made in weights shown.
†6-Wheel all steel trucks. ‡4 Wheel all steel trucks.

The light weights given above for common standard all-steel passenger train cars complete include the weights of an axle lighting device and storage batteries which amount to about 6,390 lbs. for each car. These axle lighting devices are to be given a trial, but none has yet been adopted as a common standard.

The weight complete in running order of each four-wheel all steel truck is about 14,400 lbs. and of each all steel six wheel truck about 20,000 lbs., not including the weight of any axle lighting device.

Many purchasing agents spend half their time trying to secure further definite information than is ordinarily furnished at first in regard to supplies they are asked to buy. They do this in order to have some specifications, even though crude, as a fair basis on which to compare bids and place orders, which will insure to some extent the railroad company's receiving the quality, sizes and kinds of supplies best suited for its requirements. If, therefore, a purchasing agent is supplied with definite and complete specifications and drawings prepared by experts, covering many of the most important articles purchased, the result is certainly a great relief to the purchasing department. It simplifies the work there, not only at the time purchases are made, but later also in lessening the amount of correspondence complaining about defective devices or inferior workmanship or material.

When competing manufacturers are furnished with carefully prepared specifications, and if necessary, drawings also, showing exactly what is wanted, they are then able to figure the closest prices they can afford to name without having to make any allowances for uncertainties. When definite specifications or drawings establish a fair and exact basis for comparing the relative merits of bids, manufacturers will ordinarily submit lower prices for material of the quality specified than they would otherwise. If a manufacturer feels that certain railroad companies will repeatedly purchase from him in large quantities articles of exactly the same kind, and will not change their standards without excellent reason, he will ordinarily quote very low figures hoping thereby to secure such business continuously. By concentrating orders for the same devices or materials with one, or in a few cases with two, well equipped and reliable manufacturers, more uniformity can be secured, and the ordering, inspection and forwarding of shipments are facilitated and accomplished with greater economy. Another great advantage in having intelligent and definite specifications and drawings is that it facilitates a fair inspection, and, when articles are furnished in accordance with definite conditions, there is far less uncertainty as to results that will be obtained by their use.

INSPECTION BUREAU.

An inspection bureau well equipped with mechanical and chemical testing laboratories and with a corps of experienced inspectors has proved most useful and necessary. To this department copies of many orders placed by purchasing agents are sent so that proper attention may be given to inspection of quality of workmanship and material of supplies and equipment furnished, and so that weights and conformity to standards, etc., may be properly checked. This department has also rendered much assistance in the preparation and revision of specifications and drawings.

The following examples will illustrate to what extent many of the articles purchased for the Union and Southern Pacific lines have been standardized by the operating and motive power departments.

ROLLING STOCK EQUIPMENT.

As all rolling stock is likely to be transferred from one line to another, and as new cars and locomotives and repair parts for such equipment form the largest items purchased by railroad companies, it was considered most important to have these of as uniform and good designs as possible for all the associated lines.

After several conferences, the officials concerned decided to have definite specifications and detailed drawings of what has been called

COMMON STANDARD LOCOMOTIVES.

	Passenger Locomotives			Freight Locomotives		
	Atlantic.	Pacific	*Ten Wheel.	Consolidation.	Mogul	Switch
Class	A 81 20 28 105	P 77 22 28 141	T 63 22 28-160	C 57 22 30 187	M 63 20 28 140	S 51 19 26 140
Cylinders ... inches	20x28	22x28	22x28	22x30	20x28	19x26
Diameter of driving wheels ... "	81	77	63	57	63	51
" " truck wheels ... "	33½	33½	30½	30½	30½	..
" " trailing wheels ... "	51	45	...	....	.	
Boiler pressure ... lbs.	200	200	200	200	200	175
Boiler dia. of 1st course, outside ... inches	70	70	72	80	70	65
Total weight on drivers ... lbs.	105,000	141,000	160,000	187,000	140,000	140,000
" " of engine ... "	196,000	222,000	203,000	208,000	162,000	140,000
" heating surface ... sq. ft.	2649	3018	2994	3403	2102	1557
Firebox ... inches	108x66	108x66	121x37¼	108x66	108x66	108x40¼
Grate area ... sq. ft.	49.5	49.5	32.1	49.5	49.5	30.2
Heating surface to grate area	53.5	61.6	93.3	70.0	42.0	51.0
Tractive power (M. E. P. considered 85 per cent. of boiler pressure ... lbs.	23,506	29,920	36,570	43,305	30,222	27,[illegible]76
Adhesive weight to tractive effort	4.47	4.71	4.38	4.32	4.63	5.11

*For mountain service.
The above weights and dimensions, etc., are for coal burning locomotives. Common standard oil burning locomotives are identical except that grates are omitted, and ash pan is modified, and oil burning apparatus and connections and fire brick are added without materially affecting weights.

common standard cars and locomotives as shown in the accompanying table. It was thought that these would include practically all of the different types of such equipment which it might be advisable to purchase in the near future for ordinary use on any of the lines.

Common Standard Locomotive Tenders.

	Shape of Tank			
	Cylindrical.	Cylindrical.	Rectangular	Sloping Rectangular
Water capacity . . . . gal.	7,000	9,000	9,000	4,000
Coal capacity . . . net tons	11	11	10	6
*Weight empty . . . . . . lbs.	48,720	53,980	63,000	39,770
*Wt. with coal and water. "	135,850	156,980	178,000	85,100
Fuel oil capacity of these tenders when fitted for use with oil burning locomotives . . . . . . gal.	2,910	2,940	2,850	1,020
Additional weight of such tenders empty, is in lbs. about	6,130	6,130	8,400	3,780

*For passenger service tenders are equipped with vestibule, which adds about 4,660 lbs. to the weight of cylindrical tenders, and about 3,240 lbs. to the weight of rectangular tenders.

Common standard tenders for oil burning locomotives are identical with those for coal burning locomotives, except that tank for fuel oil is placed in coal box, and piping connections to locomotive firebox are added. Having determined the general types of cars and locomotives to be purchased in future the question of detailed plans and specifications for each and every part, no matter how small, of all such equipment was then given the most careful consideration, and care was taken to follow M. C. B. or M. M. adopted or recommended standards.

UNIFORMITY OF PARTS.

In designing all types of common standard freight cars the principle was strictly adhered to of using identically the same parts in different types of cars wherever suitable, in order to minimize variety and to have as many parts as possible interchangeable. The same practice was also followed in designing common standard locomotives and passenger train cars.

This plan not only proves of great advantage to the railroad companies from a maintenance point of view, in facilitating the making of repairs without delay, but it also lessens the variety, amount and value of material necessary to carry in stock. Uniformity of parts, wherever practicable, is also of value to car and locomotive builders, as it reduces considerably the variety of patterns, dies, templets and blue-prints, which they would otherwise have to make if building more than one type of car or locomotive, thereby enabling them to make slightly lower prices.

SPECIALTIES FURNISHED BY THE RAILROAD COMPANY.

In making common standard plans and specifications for equipment, it was naturally found that there were numerous parts of cars or locomotives, among them many patented devices, which car or locomotive builders had no special facilities for making or could not make. These specialties the railroad companies could purchase direct from the manufacturer at lower prices and with better assurance of prompt deliveries than the car or locomotive builders could obtain, particularly if the railroad companies signified their willingness to adopt such specialties as their standards until they found something better, or just as good, and enough cheaper to justify a change. Another inducement to manufacturers to name low prices has been that if specialties made by them were used as common standard by any large railroad system, it would advertise their wares and assist them in getting business from other companies.

Therefore, in buying new equipment, the Union and Southern Pacific systems have found it advantageous to furnish free of charge to the car or locomotive builders the following specialties:

For Common Standard Freight Cars.

Air brake equipment
Bearings, journal
Bolsters, body, cast steel
Brake Adjuster equipments.
Brake beams
Door insulation for refrig. cars
Draft rigging
Journal boxes, M. C. B.
Refrigerator air syphons
Refrigerator car lining
Roofs, metal
Side bearings, truck
Brake shoes
Couplers, M. C. B.
Door bolt keepers for refrig. cars
Door fasteners
Door fixtures
Springs, truck and draft
Steel platforms for cabooses
Truck bolster, truck center plates and dead lever anchors
Truck side frames, cast steel
Wheels, rolled steel (in special cases only).

For Common Standard Passenger Train Cars.

Air brake equipment
Air signal equipment
Bag racks for postal cars
Bearings, journal
Brake adjuster equipments
Basket racks, metal
Body bolsters, cast steel
Brake beams
Brake handles
Brake shoes
Car couplers
Cinder guards for postal cars
Closets, Duner for observation and dining cars
Coffee urns for dining cars
Curtain and rollers, vestibule
Diaphragms and attachments, vestibule
Draft gear
Electric fans for dining and observation cars
Lid, bolt and spring for journal boxes
Lighting equipment
Mail catchers for postal cars
Ranges for dining cars
Refrigerators for dining cars
Steel platforms
Seats
Side bearings, truck
Springs, truck and draft
Steam heating system equipment
Trap door fixtures
Truck steel castings
Vestibule parts
Wash stands
Water coolers
Water heaters for dining cars
Water filters for dining cars
Wheels, rolled steel

For Common Standard Locomotives and Tenders.

Acetylene gas generators
Air brake equipment
Air signal equipment
Bearings, axle
Bell ringers
Brake adjuster equipment
Brake beams
Brake shoes
Couplers, M. C. B.
Draft rigging
Feed pipe strainers
Hose, tank
Headlights, acetylene and electric, and apparatus for the same
Injectors
Journal boxes, M. C. B.
Lubricators
Packing for piston rods
Packing for valve stems
Safety valves
Sanders
Side bearings, truck
Springs
Staybolts, flexible
Steam chest valves for [illegible] engines
Steam gages
Steam and air conduits
Steam heat equipment
Steam heat gages
Steam heat reducing valves
Throttle valves
Tires for driving and trailing wheels
Truck bolsters, truck center plates and dead lever anchors
Truck side frames, cast steel
Vestibule diaphragms and attachments for passenger locomotive tenders
Water gages
Wheels, rolled steel, engine and tender truck
Whistles

The cost of these specialties furnished by the railroad for new common standard freight cars is from 20 to 30 per cent. of the total cost of the car complete. For new common standard passenger train cars it averages from 30 to 40 per cent. of the cost of the car complete, and for new common standard locomotives it is approximately from 12 to 15 per cent. of the cost of the locomotive complete. This leaves to the car or locomotive builders only plain and regular work to figure on when requested to submit bids. As they should be well equipped to perform such work, they should be able to quote closer figures than if also required to secure quotations on short notice from other manufacturers, on the specialties referred to above, the close prices of which they are not always familiar with, and could not in many cases easily obtain.

FORM OF SPECIFICATIONS FOR CARS AND LOCOMOTIVES.

The Union Pacific and Southern Pacific have found it desirable to have all specifications for common standard cars and locomotives printed on pages M. C. B. size 8¼ in. by 10¾ in., to secure uniformity, correctness and compactness. It has been found convenient and desirable to bind under separate covers specifications for the following:

Approximate Number of Printed Pages in Each.

Each different type of freight car. . . .	14 to 21
Each different type of passenger train car body	23 to 38
Four wheel passenger train car trucks. .	5
Six wheel passenger train car trucks. . .	5
Each different type of locomotive.	15 to 18
Each different type of tender.	8 to 9

SCHEDULES.

As a part of common standard freight car specifications, separate schedules have been made describing in full detail each of the different kinds and parts of specialties furnished by the railroad f.o.b. the car builders' works. On each schedule is shown the name and address of the manufacturer of the article referred to and a list of the different types of common standard freight cars on which such specialties are used. The schedules also show on what common standard drawings the devices or parts thereof are illustrated, and with what common standard material specifications (if any) or with what other specifications the material furnished must comply. Information in regard to the weight of the device and the kinds of material and parts of which it is made, etc., is also indicated where desirable. By reference to these schedules officials of the railroad companies and car builders can see exactly what material the railroad is to furnish, and, when these specialties are ordered, if reference is made to schedule number and date and to the number of cars of specified types for which the material is wanted, manufacturers and inspectors will be fully informed as to what should be furnished.

NUMBERING OF SCHEDULES.

For purposes of easy reference, schedules are numbered consecutively and in alphabetical order.

PREFIXES TO SCHEDULE NUMBERS.

To designate the kind of equipment to which the schedules apply, the following prefixes are used in front of their numbers: P, for passenger train cars; L, for locomotives and tenders, for freight cars no prefix letter is used.

SUFFIXES TO SCHEDULE NUMBERS.

Where two or more schedules are necessary to clearly describe different varieties of the same kind of specialties, which may be furnished for different types of the same kind of equipment, the same schedule number is used, but the letter a, b or c, etc., is suffixed to the number for the purpose of identifying each variety of schedule. Thus, the schedule, describing air-brake equipment for freight cars weighing light more than 35,000 lbs. where combined air cylinder and reservoir is used, is numbered 1a. Schedule 1b describes air-brake equipment furnished for freight cars weighing light more than 35,000 lbs., where a detached air cylinder and reservoir are used. Schedule 1c describes air-brake equipment furnished for freight cars and cabooses weighing less than 35,000 lbs. light.

SCHEDULES BOUND UNDER SEPARATE COVER.

All of the 36 schedules applying to common standard freight cars, consisting of about 50 printed pages, are bound with an index under separate cover. As they apply to all or some types of common standard freight cars, this avoids the necessity of inserting and repeating this information in detail in the specifications of each different type of freight car. As the car builder does not furnish the specialties described in the schedules and is not responsible for them—only applying them to the cars—it is more convenient for him as well as for the officials of the railroad companies to have the schedules separated from that part of the specifications for which the car builder is responsible. Likewise, as a part of common standard passenger train car and locomotive and tender specifications, schedules describing specialties furnished by the railroad for such equipment are made and are bound with an index under separate cover for the same reasons. The 65 schedules for passenger train cars, consist of about 91 printed pages, and the 49 schedules for locomotives and tenders, of about 84 pages.

MATERIAL SPECIFICATIONS.

As a part of common standard specifications, the material specifications mentioned below have been printed, describing quality, workmanship or test requirements, etc., of each of the materials named. As these material specifications apply to all different types of cars or locomotives they are bound with an index in alphabetical order under separate covers to avoid the necessity of repeating this detailed information in specifications for each different type of car or locomotive.

	Frt. Cars.	Pass. Train Cars.	Locomotives.
Axles, steel for cars and tenders	x	x	x
Bearing metals, babbit and bell metal	x	x	x
Castings, malleable iron	x	x	x
Castings, steel	x	x	x
Chain	x	x	x
Couplers, M. C. B., automatic	x	x	x
Forgings, steel and blooms for same	..	..	x
Hose, rubber	x	x	x
Iron, merchant bar, double refined	x	x	x
Staybolt and boiler brace iron	..	.	x
Lumber	x	x	..
Oil, linseed	x	x	..
Paint	x	x	x
Pipe, steam, gas and water (black and galvanized)	x	x	x
Pipe, copper and brass	..	..	x
Pipe, wrought iron dry pipes	.	..	x
Plates, steel for steel cars	x	x	..
Plates, steel, for boiler, firebox and tank	..	..	x
Rivets	x	x	x
Spring steel and springs, elliptical and coil	x	x	x
Structural steel shapes	x	x	x
Tires, steel for locomotive driving and trailing wheels	.	..	x
Tubes, boiler	..		x
Turpentine	x	x	x
Waste, cotton and wool	x	x	x
Wheels, rolled steel, for engine and tender trucks and passenger train cars	..	x	x
Wheels, chilled cast iron	x		x

Material specifications for freight cars consist of about 40 printed pages, for passenger train cars of about 39 pages and for locomotives of 40 pages.

DRAWINGS.

To illustrate fully all details of different types of common standard equipment referred to above, the following number of working drawings have been found necessary:

For freight cars	about	1,300
For wood passenger train cars	"	800
For steel passenger train cars	"	625
For locomotives and tenders	"	1,100

These drawings are made of the following common standard outside dimensions, including border, so that they may be folded conveniently with correspondence. In the case of locomotive drawings the standard sizes used by the Baldwin Locomotive Works are followed:

For Freight Cars.	For Passenger Train Cars.	For Locomotives.
11 in. x 15 in.	11 in. x 15 in.	13¼ in. x 16¼ in.
15 in. x 20 in.	15 in. x 20 in.	16¼ in. x 22½ in.
23 in. x 30 in.	23 in. x 30 in.	19¼ in. x 23⅜ in.
	29½ in. x 41 in.	

In addition there are a few special sizes for drawings illustrating general designs, underframes and brake arrangements.

It is customary to show on each common standard car or locomotive drawing, in the upper right-hand corner, a list of each different type of car, locomotive or tender on which the device illustrated is used, and, in the upper left-hand corner of each drawing, the latest date of revision is indicated. The title and drawing number are shown in the lower right-hand corner. All common standard freight car drawings bear the prefix letter "C" in front of the number, locomotive drawings have the prefix "CA," and passenger train car drawings, the prefix "CB," for the purpose of indicating that they are common standard drawings and to what type of equipment they refer. Drawings illustrating articles referred to in any schedule bear a note referring to such schedule number. Notes are also placed on drawings, where advisable, referring to numbers of material specifications concerned.

PREFIXES TO PATTERN NUMBERS.

The following prefixes to common standard pattern numbers have been adopted and are shown on drawings illustrating articles concerned, and on patterns to designate the type of equipment on which castings referred to are used and the material of which castings are made.

Castings of	Frt. Cars	Passenger Train Cars.	Locomotives.	Maint. of Way Dept.
Cast iron	C	CB	CA	M.W.
Malleable iron	CM	CBM	CAM	M.W.M.
Steel	CS	CBS	CAS	M.W.S.
Brass	CF	CBF	CA[illegible]	M.W.F.

INDEXES OF COMMON STANDARD DRAWINGS FOR CARS OR LOCOMOTIVES.

The following are also a part of common standard specifications and are each bound under separate cover

Alphabetical index of freight car drawings	about	56	pages
Numerical index of freight car drawings	"	26	"
Alphabetical index of wood passenger train car drawings	"	79	"
Alphabetical index of [illegible] passenger train car drawings	"	51	"
Numerical index of wood passenger train car drawings	"	23	"
Numerical index of all steel passenger train car drawings	"	18	"
Alphabetical index of locomotive drawings	"	78	"
Numerical index of locomotive drawings	"	34	"

In the numerical and in the alphabetical index of common standard freight car drawings a separate vertical column is provided for each different type of car, and opposite each drawing number and title an "X" is placed in the respective vertical column or columns to indicate on which type or types of cars the details illustrated on each drawing referred to are used. In this way it is easy to see at a glance on how many and on which types of cars the articles illustrated on each drawing are required. A similar practice is followed in the case of indexes of drawings of common standard passenger train cars and locomotives. Numerical indexes of drawings also show the latest date of revision of each drawing.

SUPPLEMENTS TO SPECIFICATIONS AND REVISED DRAWINGS.

As it becomes advisable from time to time to revise specifications, material specifications, schedules or indexes of drawings, supplements thereto numbered and dated are issued, and when such supplements become too voluminous, the entire specifications, etc., are reprinted to include all corrections and additions and are given a new date. New or revised drawings are likewise made and distributed whenever changes or revisions are authorized.

DISTRIBUTION OF MECHANICAL DEPARTMENT DRAWINGS, SPECIFICATIONS, ETC.

Copies of common standard specifications and drawings of cars and locomotives, or any supplements or revisions of same, when issued, are distributed to the Director of Maintenance and Operation of the Union Pacific and Southern Pacific, to the general manager and superintendent of motive power of each associated line; and to the inspection bureau. Sufficient copies are also sent to the Director of Purchases for distribution at the same time to car or locomotive builders who may be asked in future to submit bids, so that when it is desired to order new equipment, prices can be obtained, orders placed and construction work commenced with the least possible delay.

In distributing such drawings it is customary to send negative prints to each superintendent of motive power and to the car or locomotive builders who may be successful bidders, to enable them to reprint from these negatives whatever additional white or blue prints may be needed by officials of their company or in their shops. The manufacturers of any common standard specialties are supplied with copies of schedules and negative prints of each common standard drawing referred to in the schedules describing the articles to be furnished by them, so that from these they may easily provide such additional copies as are needed by their employees, for reference in connection with orders or correspondence. Local purchasing agents are also furnished with copies of these schedules and drawings referred to therein, so that they have this information for reference in placing orders under agreements made with the manufacturers by the Director of Purchases.

OTHER ADVANTAGES OF DEFINITE SPECIFICATIONS FOR CARS AND LOCOMOTIVES.

In having definite and detailed specifications for cars and locomotives, which do not change very much from year to year, there are two other important advantages. One of these is that where a car or locomotive builder has once built equipment to these specifications he will have on hand most of the necessary dies, templets, patterns, etc., for use in duplicating such equipment, without incurring as much additional expense or delay as would be involved if entirely different designs of cars or locomotives were ordered from year to year. The other advantage is that having bought cars and locomotives under similar specifications for several years it is not difficult at any time for the railroad's representative to determine at what price it is fair to ask builders to furnish similar cars or locomotives, considering general conditions.

COMMON STANDARD PARTS USED WHERE PRACTICABLE IN REPAIRING OLD EQUIPMENT.

Wherever possible, common standard parts are used in making repairs to old equipment which was not originally built in accordance with common standard specifications. If this is not practicable, of course whatever is necessary must be purchased.

COMMON STANDARD CARS, LOCOMOTIVES AND RAILS PURCHASED.

Since the adoption of common standard specifications 1,140 locomotives, 459 passenger train cars and 31,845 freight cars have been built in accordance therewith and 860,000 gross tons of rails have been purchased.

MAINTENANCE OF WAY DEPARTMENT STANDARDS.

The following examples will illustrate how some of the articles purchased for the Union Pacific and Southern Pacific have in like manner been standardized by the maintenance of way and operating departments.

Common standard specifications have been prepared for

Angle bars	Steel rails
Battery material	Screw spikes
Chloride of zinc	Storage batteries
Creosote	Ties
Frogs, switches and crossings	Track bolts and nuts
Nut locks	Track spikes
Paint	Tie plates, rolled steel
Steel railway structures	Wire, rubber insulated copper signal

Common standard drawings have been prepared to illustrate fully all details of the following, which are supposed to include sufficient varieties of sizes and kinds of the articles mentioned to meet the requirements for new work in the near future of any of the associated lines, or for maintenance, where such standards are applicable:

Brackets, pins, cross arms and glass insulators for signal installations.
Bridges, single track:
  Deck girders, 20 ft. long.
  Deck plate girders, 30, 40, 50, 60, 70, 80, 90 and 100 ft. long.
  Through plate girders, 30, 40, 50, 60, 70, 80, 90 and 100 ft. long.
  Through riveted spans, 100, 110, 125, 140 and 150 ft. long.
  Through pin connected spans, 150, 160, 180 and 200 ft. long.
Bridges, double track:
  Through plate girders, 50, 60, 70, 80 and 90 ft. long.
  Through riveted spans, 100, 110, 125 and 140 ft. long.
  Through pin connected spans, 150, 160, 180 and 200 ft. long.
Steel deck turntable, 80 ft. long.
Frogs:
  Rigid frogs, No. 6 — 9 ft. long.
    No. 7 — 10 "
    No. 9 — 12 "
    No. 14 — 18 "
  Spring rail frogs, No. 10 — 15 ft. long.
    No. 12 — 16 ft. 6 in. long.
  Crossing frogs, when angle of crossing is less than 27 deg.
    when angle of crossing is 27 deg. or larger.
Guard rail with adjustable clamp.
Nut locks.
Rails:
  Common standard section steel rail, weighing 90 lbs. per yd.
  Common standard section steel rail, weighing 75 lbs. per yd.
Rail joints:
  Continuous rail joints, 27 in. long, with 4 bolt holes, weighing 86 lbs. per pair for 90-lb. rail.
  Continuous rail joints, 27 in. long, with 4 bolt holes, weighing 76 lbs. per pair for 75-lb. rail.
  Insulated continuous rail joints, 26 in. long, with 4 bolt holes, weighing 86 lbs. per joint for 90-lb. rail.
  Insulated continuous rail joints, 26 in. long, with 4 bolt holes, weighing 75 lbs. per joint for 75-lb. rail.
Split switches:
  10 ft. long, not insulated and insulated.
  15 ft. long, not insulated and insulated.
  24 ft. long, not insulated and insulated.
  20 ft. long, Wharton switch.
Steel water tanks and supports:
  65,000 gal. capacity for cold climates.
  65,000 gal. capacity for mild climates.
Screw spikes, $^{11}/_{16}$ in. x $5\frac{1}{8}$ in.
Semaphores:
  High semaphore with signal.
  Station semaphore signal.
Switch stands, high and low.
Track bolts and nuts, $\frac{3}{4}$ in. x $4\frac{1}{2}$ in. and $\frac{7}{8}$ in. x $4^{5}/_{16}$ in.
Track spikes, $^{9}/_{16}$ in. x $5\frac{3}{8}$ in.
Tie plates.
  Flat bottom, rolled steel, $^{7}/_{16}$ in. x 8 in. x $8\frac{3}{4}$ in., weighing 6.6 lbs. each, for use with 90-lb. rail.
  Flat bottom, rolled steel, $^{7}/_{16}$ in. x 8 in. x $8\frac{1}{2}$ in., weighing 6.4 lbs. each, for use with 75-lb. rail.
Taper rails, for connecting heavy with lighter rails.

DISTRIBUTION OF MAINTENANCE OF WAY DEPARTMENT DRAWINGS AND SPECIFICATIONS.

Copies of maintenance of way department common standard drawings and specifications, or any supplements or revisions thereof, are distributed to the Director of Maintenance and Operation; to the general manager, chief engineer and local purchasing agent of each associated line, and to the inspection bureau. Copies are also sent to the Director of Purchases for distribution to manufacturers who may be asked to submit bids in regard to furnishing the devices referred to. In distributing such drawings it is customary to send negative prints to each chief engineer and to each manufacturer, with whom the associated lines may have an agreement in regard to furnishing the articles illustrated on such drawings. This enables them to print whatever additional white or blue prints are needed by officials of their company or in their shops.

COMMON STANDARDS ADOPTED ON MANUFACTURERS RECOMMENDATIONS.

Besides the common standards already referred to, for which the railroads have prepared their own specifications and drawings, a number of other articles have been adopted as common standard by accepting the specifications, descriptions, drawings or illustrations offered by some manufacturer, and making an agreement with him to furnish such of these as the associated lines require or may desire to purchase. In such agreements the manufacturer recommends, in a manner satisfactory to the railroad's representative, what he thinks will be most suitable for use as common standards for all ordinary requirements and conditions, bearing in mind the advisability of having as few varieties of sizes and kinds as is consistent with good practice.

The following are examples of some of these articles:

Car seals and ratchet seal presses	Replacers, car and engine
Electric lamps, incandescent	Rubber bands,
Erasers, rubber and steel	Safes and vault doors
Fusees and torpedoes	Scales
Hand cars, push cars and track velocipedes	Soap
Inks and adhesives	Soda ash
Jacks	Signal material, mechanical interlocking
Lamps, engine and coach tail	Signal material, automatic block
Lamps, switch and semaphore	Storage cells for signal work, gravity zincs and coppers for same, battery connectors and lightning arresters.
Lanterns, hand	Telegraph and telephone line material and pole equipment
Mail cranes	Track tools
Nut and bolt fasteners	Tracing cloth, blue print paper, profile and drawing paper, etc.
Oil, illuminating, signal, lubricating, fuel, gasolene, etc.	Trucks, warehouse and baggage
Padlocks and keys for signal work	Typewriters, covers, ribbons, etc.
Padlocks and keys for switches	Wire rope
Pantasote	Wire, barbed and plain, and telegraph, telephone and signal pulling
Pens	
Penholders	
Pencils and pencil point protectors, timber crayons, etc.	

STATIONERY FORMS.

By conferences between representatives of the department concerned of each of the associated lines a very large number of stationery blanks, envelopes, blank books, etc., have been standardized as to quality, weight and size of paper and as to printed matter thereon. Thus the variety of these forms and papers heretofore used by all the associated lines has been greatly reduced and the arrangement of the blanks, quality of paper, etc., have been more intelligently suited to their purpose. Samples of each of these blanks as finally adopted with estimates of quantities of each required annually have been furnished to a number of the largest printing establishments for the purpose of securing bids.

Based on the most favorable propositions received, agreements have been made with certain printers covering specified blanks, whereby similar forms used by the associated lines are purchased from the same printer. Most of these agreements for stationery forms, etc., have been made to continue without expiration until a certain number of months notice by either party to the other, with the understanding that if the railroad companies cancel the agreement or change any of the forms referred to, they will take off the printer's hands all stock of such forms as he may have at the time, up to a maximum of one year's estimated requirements. This enables the printer to print forms in large quantities, and therefore economically. It is stipulated that when the printer's stock of any particular form becomes low he shall receive proper authority from the General Stationer of the associated lines as to what changes, if any, are to be made before the next supply of such forms is printed. If changes which involve increased or decreased cost are ordered in any forms, and these cannot be adjusted to mutual satisfaction, new bids on such revised forms are asked for, and new agreements or supplements to existing agreements are made accordingly.

These stationery forms, etc., are divided into three classes: Common standard forms, of which there are now about 600 different kinds, which are identical for all of the associated lines; standard forms, of which there are now about 500 different forms or 2,000 blanks, which are identical for all the associated lines, except as regards the name of the railroad company or titles of officials, etc.; and local forms, which are used by one line only, to meet local conditions.

PURCHASING AGENCIES.

The lines composing the Union Pacific and Southern Pacific systems have a Director of Purchases located at New York City, and seven local purchasing agents at different important points on the systems.

AGREEMENTS MADE BY DIRECTOR OF PURCHASES.

New cars, locomotives, miscellaneous equipment, rails and a few other supplies of importance are ordered by the Director of Purchases direct from the builders or manufacturers after securing competitive bids in each case, and copies of all such orders placed are sent to the various officials concerned. Continuing agreements with manufacturers, on behalf of all the associated lines are made by the Director of Purchases, covering the purchase of many articles, especially those heretofore mentioned, for which common standard specifications or drawings have been adopted. Copies of all such agreements are forwarded to the Director of Maintenance and Operation, to each general manager, local purchasing agent, and to the head of the department concerned of each associated line. Based on these agreements, the local purchasing agents may send their orders direct to the manufacturer, as soon as they receive requisitions, without having to waste further time or labor in correspondence regarding specifications, prices, etc.

Much labor can be saved and better results can usually be obtained by having one central agency negotiate such agreements, which can be used by all of the associated lines, rather than by obliging each local purchasing agent, who is not so well equipped or so well located for the purpose and has not so large a volume of business to offer, to act independently.

SUPPLEMENTS TO AGREEMENTS.

In case it is necessary from time to time to revise existing agreements, supplements to these are made and distributed to all concerned. Each agreement is given a different number and each supplement is numbered in numerical order for purposes of reference.

SLIDING SCALE AGREEMENTS.

In making agreements with manufacturers it has been found most satisfactory, where practicable, to have the price of the finished articles purchased based on the average price of the raw material from which such articles are produced, as quoted say every three months in the most reliable trade journal, with the understanding that when the price of any finished article has once been agreed to, such price will thereafter automatically fluctuate in some fair proportion with the price of the raw material:

For instance:

The price to be charged for the following articles on orders placed by the Railroad Companies with the manufacturer during each quarter of any calendar year during the term of the agreement.	May be based with proper differentials on the average price of the raw material mentioned below, as quoted in the most reliable trade journal during the month or quarter immediately preceding the quarter of the calendar year in which the finished material is ordered.
Boiler tubes, dry pipes, safe ends, water grates and arch pipes. Firebox steel. Castings, steel and malleable iron. Castings, gray iron. Steel or iron forgings, for locomotives, rough or finished. Rail joints. Stay bolt and boiler brace iron. Screw spikes. Track spikes. Track bolts and nuts. Wheels, rolled steel.	Average price per gross ton of Bessemer pig iron at Pittsburgh, Pa.
Brake-beams. Truck bolsters, if made of rolled steel.	Average price per 100 lbs. of beams and channels at Pittsburgh, Pa.
Axles, steel, for cars or locomotives.	Average price per net ton of steel forging-billets at Pittsburgh, Pa.
Tie-plates, rolled steel.	Average price per gross ton of Bessemer steel billets at Pittsburgh, Pa.
Steel plates, merchant steel bars, steel angles, tees, channels and beams.	Average price per 100 lbs. of steel plates, merchant steel bars, steel angles, channels and beams at Pittsburgh, Pa.
Switches, frogs and crossings frogs, and repair parts for same.	Price of steel rails per gross ton f. o. b. Chicago, as quoted by the Illinois Steel Co., and price per 100 lbs. of steel bars at Pittsburgh, Pa.
Guard rails with adjustable clamp. Taper rails.	Price of steel rails, as above.
New cast-iron car wheels and credit to be allowed for scrap wheels.	Average price per net ton of scrap cast iron car wheels f. o. b. Chicago.
Springs, elliptic and coil.	Average price per net ton of spring steel in 1,000 ton lots at Pittsburgh, Pa., as quoted by the Carnegie Steel Co.
Steel wire nails.	Average price per pound of steel wire nails f. o. b. Pittsburgh, Pa.
Wire: Barbed and plain; telegraph.	Average price per pound of plain fence wire f. o. b. Pittsburgh, Pa.
Box car metal roofs.	Average price per pound of galvanized iron sheets f. o. b. Pittsburgh, Pa.
White lead and red lead.	Average price per pound of refined corroding pig lead, in 50 ton lots at St. Louis, Mo., as quoted by the American Smelting & Refining Co.
Babbit metal. Car seals.	Average price per pound of desilverized refined pig lead in 50 ton lots at New York, as quoted by the American Smelting & Refining Co.
Journal bearings and brass castings and credit to be allowed for scrap brass, etc. Safety valves. Locomotive whistles.	Average price per pound of casting copper f. o. b. New York, as quoted on the New York Metal Exchange.
Gravity coppers.	Average price per pound of Lake copper at New York.
Gravity zincs.	Average price per pound of spelter at St. Louis, Mo.
Rubber insulated copper wire.	Average price per pound of Lake bar copper in 25 ton lots f. o. b. New York, and average price per pound of up-river fine Para new rubber, f. o. b. New York
Manilla rope.	Average price per pound at New York of current spot manilla hemp and good current spot manilla hemp.
Creosote.	Average price of creosote as quoted in London, England.

[illegible]aples show how it is often practicable to make agreem[illegible]n large consumers and producers, so that when mutual[illegible]ory prices have once been agreed to, some fair auto[illegible]thod can be used whereby prices will adjust themselves [illegible]re conditions with as little unnecessary labor and friction possible. Such a sliding scale basis mutually protects the purchasers and sellers, and in agreements extending over long periods avoids disputes and arguments as to how prices should be fairly adjusted when general conditions change. For the protection of the railroads a clause is embodied in nearly all such agreements, stating that in case the manufacturer at any time quotes lower prices on similar articles to any of his other customers he will likewise reduce prices to the railroads mentioned as regards orders they may place with him during the months in which he may have made lower prices to any of his other customers.

About one-quarter of all the continuing agreements thus far made by the Director of Purchases have had prices based on a sliding scale.

AGREEMENTS BASED ON FIXED PRICES.

In many cases, especially those in which labor is very much the largest item of expense, it may not be practicable to base prices on any sliding scale. In such instances agreements are made with the manufacturers at the lowest fixed prices that can be arranged, and the clause referred to above is inserted whereby the manufacturer agrees that, should he quote lower prices to other customers, he will reduce his price correspondingly to the railroads mentioned.

CONTINUING AGREEMENTS.

In order to avoid unnecessary labor, the agreements have been made, in nearly all cases, to continue without expiring until a certain number of months' notice by the railroads to the manufacturer or until two or there or more times as much notice to the contrary from the manufacturer to the railroads. In agreements covering patented devices, clauses have been inserted to protect the railroads as regards adverse claims that may be made on account of patents or royalties. As a rule, the railroads make such agreements to extend as long as they desire to use such patented devices as standard, reserving the right to cancel them by giving reasonable notice and to adopt other standards, if articles of sufficiently greater merit are offered to justify a change.

COMPANIES INCLUDED IN AGREEMENTS

In making agreements between manufacturers and the Union Pacific, Oregon Short Line, Oregon Railroad & Navigation Company, and Southern Pacific Company, it has been customary to arrange so that any of the present or future associated or proprietary companies of any of the railroad corporations named may be considered a party to these agreements if so desired.

AGREEMENTS WHICH ARE PRACTICALLY QUOTATIONS FROM MANUFACTURERS.

At times large manufacturers have made propositions to the Director of Purchases, quoting very favorable prices and other terms at which they would be willing to furnish certain materials to any of the associated lines until six months or one year's notice from the manufacturer to the representative of the railroads to the contrary. In submitting these quotations, the manufacturers have fully described and illustrated, if necessary, exactly what they proposed to furnish. Where the Director of Purchases has felt it advisable he has accepted these propositions on behalf of the associated lines, with the understanding that such agreements do not in any way obligate the railroads, except as regards orders they may choose to place with the manufacturer. Copies of these propositions have then been forwarded to officials concerned for their information and files. It is customary to have only one such proposition, covering the same kind of material, in effect at the same time.

Some examples of articles covered by such agreements are:

Asbestos pipe covering, magnesia, lagging, etc.
Carbon paper
Carriage and machine bolts, nuts and lag screws.
Glass.
Paint brushes.
Paper, roofing and building
Patented flange unions, ells, tees and other fittings.
Rivets, nuts and washers.
Tools, pneumatic; air compressors, air hoists, etc
Varnish.

ARTICLES WHICH CAN BE PURCHASED LOCALLY TO JUST AS GOOD OR BETTER ADVANTAGE THAN BY A CENTRAL PURCHASING AGENCY.

Besides those above-mentioned, there is, of course, an immense variety of staple or miscellaneous materials and supplies purchased by the railroads for distribution to many different points, some of which articles it may not be especially important to describe by definite specifications, or to illustrate by detailed drawings. Such supplies are, for instance, groceries, hardware, pipe and fittings, machinery and tools, drugs, dry goods and a great many other kinds of miscellaneous material.

Many of these supplies are carried in stock by local jobbers, who buy them from the manufacturers in larger lots than the railroads would buy, and, therefore, often to better advantage, and who can obtain the benefit of carload rates of freight from point of manufacture, which the railroads might not receive. On bids received from time to time from local jobbers, who can usually ship promptly out of stock, such articles can ordinarily be purchased by local purchasing agents to as good or better advantage than a central purchasing agency could buy them direct from the manufacturers in small quantities. Where such conditions exist, it is, of course, preferable for the railroads to stimulate local business by favoring the local jobbers who probably ship freight over their lines.

Such supplies as fuel lumber, timber, ties, fence posts telegraph poles, piling brick, lime cement etc., which form very large items of a railroad's consumption, can ordinarily be purchased by Local Purchasing Agents, or their representatives, from local sources to better advantage than they could be bought by any central purchasing agency for several different lines of railroad, if spread over a wide range of territory.

SUMMARY.

The examples previously mentioned refer to some of the different articles which have been adopted as common standard by the various lines of the Union Pacific and Southern Pacific systems, the purchase of which has been covered by agreements made by one central purchasing agency. Based on these agreements, the local purchasing agents of each of the associated lines may place orders direct with manufacturers. As fast as the officials of the mechanical, maintenance of way or operating departments adopt additional articles as common standards, and prepare the necessary specifications and drawings, new agreements covering the purchase of these articles are made in the same way.

The most important items, have, no doubt, already been standardized and covered by such agreements, but this policy has proved so successful and satisfactory to all concerned that the list of common standards will constantly increase, and new agreements in regard to the purchase of these articles by the various lines will continue to be made, as long as the associated lines are allowed to co-operate in such matters. Such methods of intelligent co-operation benefit not only the railroads, but also the general public because they tend to establish more efficient, safer and more economical standards of railroad practice throughout the world.

The following remarks by I. O. Rhoades, General Purchasing Agent at San Francisco, of the Southern Pacific Company, Pacific System, indicate the methods which may be used by an individual railroad in ordering, receiving and disbursing material purchased in accordance with agreements and standards referred to above, and some further benefits derived from such practice:

"When copies of these agreements are received in the office of the local purchasing agent, an abstract of such information as it is desirable to furnish, including references, if necessary, to common standard schedules, material specifications and drawings, is sent to the heads of the departments ordering, receiving and using the articles in question. This information is then forwarded by the general storekeeper to each division storekeeper concerned, and by the latter to the foreman in charge of such material. These officials are thus advised in regard to proper description of the standards adopted.

"For the purpose of facilitating the ordering, receiving, storing and shipping of different materials, they have been classified under the following 21 headings, and instructions have been given that separate requisitions must be made when materials from different sections are asked for."

Sectional Arrangement of Material in Storehouses.

Section.	Description of Material.
1.	Maintenance of way material, steam shovel parts, hand car, motor car and velocipede parts.
2.	Bolts, nuts, rivets, lag screws, washers, etc
3.	Sheet iron, brass, copper, zinc, lead, Eng. bars, springs, tubing, chain, wire rope, jack screws.
4	Boiler and firebox steel, steel tank ends, flues, pipe, bar iron, bar steel, piston rods.
5	Boiler lagging, pipe covering, nails, carbide, shovels, rope, building paper, wire staples, handles, etc.
6.	Finished and rough brass, pig metals, etc (Except journal bearings.)
7.	Air brakes, lubricators, injectors, automatic sanders, steam heat equipment, Pintsch and acetylene gas material, electric head light parts.
8.	Car trimmings and fixtures, shelf and building hardware, small tools, metal piston and valve stem packing
9.	Water service material, pipe fittings, globe, angle and gate valves, etc.
10.	Upholstering material, etc.
11.	Glass, brushes, painters' supplies, paints in packages
12.	Belting, hose, packing, rubber and leather goods
13.	Station and train supplies, lamps, lanterns, chairs, glassware, tin ware, etc
14.	Castings (rough iron and steel), except car castings.
15.	Car castings and forgings, journal bearings, bolsters, brake beams, car trucks, car bolts, couplers and parts, train chains, stoves and parts.
16.	Wheels and axles (mounted and unmounted) tires, centers, front ends, cylinders, etc
17.	Lumber, all kinds (rough and finished)
18.	Fire clay, brick, cement, coke, charcoal, Smithing and Blossburg coal.
19.	Oils, waste, grease, varnishes, candles, etc
20.	Signal, telegraph, telephone, interlocking and electrical material.
21.	Scrap, all kinds.

"A foreman is placed in charge of each section of material. When he orders, receives, cares for and issues material for his particular section, he becomes more of an expert on that class of material than if he, with others, attended to a greater variety of supplies.

"In order to have duplicate stocks at as few points as necessary for economy and convenience, it has been arranged to carry some classes of material only at certain stores. For example, track tools, signal, lighting and electrical material, piling, ties, lumber for track and bridges are carried on hand at West Oakland, Cal., for territory north of Tehachapi, and at Los Angeles for territory south and east of Tehachapi, instead of at every store on the Southern Pacific system. This systematizes and classifies the business, saves double hauling, handling and expense. A printed pamphlet has been distributed showing what divisions and what shops each store supplies, and to which storekeeper requisitions for certain kinds of material should be sent. This pamphlet also contains a list of about 1,000 different articles or kinds of material which may be asked for from time to time and shows what information should be furnished in ordering each of these, and whether they should be ordered by the pound, foot, ton, gallon, number, etc., and to what section of material, referred to above, they belong. A list of standard catalogues, to which frequent reference may be made on requisitions, is also given. In this manner much necessary detailed information is supplied to persons ordering receiving and using material. This enables them to know how it should be described on requisitions, what names and references should be given and how it should be properly checked when received.

"Under the old system material was ordered in many different ways: Wire by the foot, pound, miles, bundles, coils, tons, etc. Other material would sometimes be ordered by feet, number of pieces, carloads; or again by gallons, pints, barrels, cans, etc. Nearly all material is now ordered in one way by the individual making the original requisition, and by the store and purchasing departments. Heretofore, there was not so much uniformity of names for the same articles as at present. One man would make a requisition giving a thing a certain name, while someone in another department would call it something else. In this way a large amount of time, labor, expense and correspondence was consumed by the store or purchasing department in endeavoring to ascertain exact details. Even after all this trouble, occasionally the wrong article would be shipped, only to be returned to the store department and the work repeated. Much of this was due to the fact that often no reference was given to a drawing or schedule, or to the exact type of car, engine or other device, for which the article was required. There were also so many different kinds of brake-beams, hand-cars, lubricators, car trimmings, switch lamps, tail lights, lanterns, bolsters, forgings of all kinds, etc., that there was frequent liability of error and often great delay in obtaining definite information for requisitions.

"Under the present system of adopting and maintaining definite standards, this labor is being reduced. The foreman in charge of each section of material, and others who handle requisitions know not only what the common standards are, but also how to order them properly and check them when received. Although the saving in labor and expense by such practice cannot be expressed in dollars and cents, it is easily apparent to those who handle the material in question.

"One of the greatest objections to constant changing or unnecessary varieties of standards on a railroad, is the fact that for nearly every standard introduced, more or less special extra parts must ordinarily be carried in stock for purposes of repairs. Thus, if a railroad has three or four different makes of hand-cars in service it will be necessary for them to carry in stock repair parts worth two or three times as much as though they followed the policy of ordering only one make of hand-car in accordance with definite plans and specifications. It would be possible to cite many other similar examples of how the expense of maintaining many articles during their existence exceeded several times their original cost. The use of unnecessary varieties adds enormously to the amount of repair parts to be carried in stock at many points, and to the time such equipment or devices are apt to be out of use undergoing repairs.

"Before the adoption of common standards on the present extensive scale, foremen of different departments, following their own ideas or experiences, ordered many more classes and kinds of material than they do now. While one man would think a certain article was better than all others, another would think just the opposite; whereas, if a certain article is better on one division, all things considered, it should in most cases be entirely satisfactory and suitable elsewhere. For instance, at one time there were about 65 different kinds of packing furnished. This has now been reduced to 12. The indiscriminate purchase of many different kinds of equipment and other devices and supplies and the excessive amount of labor and expense involved in maintaining unsuitable and poorly chosen standards, is a matter to which most railroads could well afford to pay more attention than they have done heretofore.

"Many railroads find that they are constantly accumulating a large amount of material, which soon becomes obsolete and valueless except as scrap, although for some time they may carry it on their books at cost price. If more care is taken to maintain intelligent and definite standards, especially for articles purchased in large quantities, with the understanding that they will only be changed for good and sufficient reason, railroad companies will find that the accumulation of this obsolete material thereafter will be insignificant. At least such has been the experience of the Union Pacific and Southern Pacific."

GENERAL NEWS SECTION

NOTES.

The Chicago & North-Western has a gasolene motor car, leased from the Union Pacific, and is running it between Beloit, Wis., and Janesville, 14 miles.

The Pennsylvania Railroad announces that its Fifth avenue ticket office in New York City will henceforth be kept open until 10 p.m., including Sundays.

At White Plains, N. Y., last Monday, a jury brought in a verdict of $32,400 in favor of a woman who was injured in the derailment of the New York Central at Williams Bridge, in February, 1907.

A summary of 1,258 surprise tests on the Union Pacific and Southern Pacific for the month of March shows an efficiency percentage of 98.8 for the enginemen. The violations were not of a kind that would have caused serious accidents.

President Roosevelt has signed the Employers' Liability bill, which was passed by congress, April 9 (*Railroad Gazette*, April 17, page 552). Attorney-General Bonaparte advised the President that the bill was a sound one, having decided that it does not contain unconstitutional features, as had been asserted.

The Duluth, Rainy Lake & Winnipeg is to establish a through freight route between Duluth and Winnipeg. It will be over the Duluth, Missabe & Northern to Virginia, from that point to Ranier, over the Duluth, Rainy Lake & Winnipeg and from the Canadian boundary to Winnipeg, over the Canadian Northern. The bridge at Ranier, over the Rainy river, is about finished.

The New York State Court of Appeals has decided in favor of the New York City Railway a suit in which that company was prosecuted for a penalty for refusing to give a free transfer to a passenger who had paid a five-cent fare. The law requires the company to carry, for a single fare, to any point on its line, every passenger who boards its cars; but in this case the passenger rode south on Third avenue, westward on Chambers street, and then north on West Broadway; and the court sustains the company in limiting the transfer privilege to a continuous trip in one general direction.

By the extension of the Manhattan (New York) subway to Flatbush avenue, Brooklyn, the opening of which is announced for May 1, Jamaica, N. Y.; Garden City, Hempstead and other towns in that vicinity are brought within 35 to 45 minutes of Trinity Church—that is to say, of the corner of Broadway and Wall street, Manhattan. The extension of the subway under the East river, from Bowling Green to the Brooklyn Borough Hall, which has been in operation for the last four months, is now finished about three-quarters of a mile further to a connection with the Long Island Railroad, and is to be opened as before stated. Between the Flatbush avenue terminal and Jamaica, 10 miles, the Long Island Railroad is a four-track electric line, traversed by frequent trains, and by May 15 it is expected that the electric service will be extended to Hempstead, 10 miles beyond Jamaica.

Place Names on the North-Western Line.

A history of the origin of names of places in the states through which the Chicago & North-Western and the Chicago, St. Paul, Minneapolis & Omaha pass has been compiled by one "who for more than 34 years has been an officer in the employ of this company." Great pains have been taken to get all the information that the oldest inhabitants had in regard to the origin of names of the towns and cities, but the compiler has, as he tells us, ruthlessly disregarded local legends and travelers' stories. "While it is true that the investigations of the writer have shattered many pretty romances, it is not unlikely that others have escaped his notice and may yet be handed down as history." The most interesting feature in the history of place names, especially those with Indian origin, is the evolution of the spelling. Wyoming is a corruption of the Delaware Indian word Maugh-wa-wa-ma, meaning large plains. Chicago has been spelled Tzschago, Psceschaggo and Tschakka. It is thought to have meant river of garlic. Wherever possible the writer has given a short account of places historically interesting.

Control of Coal Mines in Oklahoma, Utah and Wyoming.

The Interstate Commerce Commission has reported to the Senate, pursuant to a joint resolution adopted on March 7, 1906, on alleged discrimination and monopolies in coal and oil. The report is the third on this subject. It affirms that the coal supply of Oklahoma, Utah and Wyoming is almost entirely in the control of a somewhat complex monopoly, consisting primarily of the Pleasant Valley Coal Company, which is owned by the Utah Fuel Company, a New Jersey corporation, with a capital of $10,000,000, this being owned in turn by the Rio Grande Western Railway, which is itself owned by the Denver & Rio Grande. All these roads are part of the Gould system.

The report charges that extensive frauds have been perpetrated by the Pleasant Valley Coal Company to acquire coal lands, which have been entered upon by "dummy" entrymen, and that the company has thus obtained all the coal lands worth having in its vicinity. Of 109 coal land leases in Oklahoma, 58 were controlled by railroads, and it is declared that the railroads, through the manipulation of cars and other methods, forced all the owners of leases into a combination known as the McAlester Fuel Company. As a result of this combination the price of coal in Oklahoma City, 120 miles from the mines, was forced up to $7 and $7.50 a ton. It does not appear that the officers of the Union Pacific Railroad have ever been personally interested in the development of any coal property, or that they have ever benefited from operations in coal along the line of that road, but the Union Pacific Railroad Company does absolutely dominate the mining, transportation and selling of coal along its line.

Chicago Agreement Under the 16-Hour Law.

Following is the agreement made at Chicago, April 19, between the general managers of thirty-two western railroads and representatives of the brotherhoods in the matter of interpreting the 16-hour law. The roads entering into the agreement are all those leading west from Chicago (except the Chicago Great Western and the Wisconsin Central) and the Illinois Central, the Missouri Pacific, the Northern Pacific, the Union Pacific, the Texas & Pacific and those allied with these.

Article 1. Under the laws limiting the hours on duty, crews in road service will not be tied up unless it is apparent that the trip cannot be completed within the lawful time, and not then, until after the expiration of 14 hours on duty under the Federal law, or within two hours of the time limit provided by state laws, if state laws govern.

Art. 2. If road crews are tied up in a less number of hours than provided in the preceding paragraph, they shall not be regarded as having been tied up under the law, and their services will be paid for under the individual schedules of the different roads.

Art. 3. When the road crews are tied up between terminals under the law, they shall again be considered on duty and under pay immediately upon the expiration of the minimum legal period off duty applicable to the crew, provided, the longest period of rest required by any member of the crew, either eight or ten hours, shall be the period of rest for the entire crew.

Art. 4. A continuous trip will cover movement straightaway or turn around, from initial point to the destination train is making when ordered to tie up. If any change is made in the destination after the crew is released for rest, a new trip will commence when the crew resumes duty.

Art. 5. Road crews tied up under the law will be paid the time or mileage of their schedules from initial point to tieup point. When such crew resume duty on a continuous trip they will be paid miles, or hours, which ever is the greater, from the tieup point to the next tieup point or to the terminal. It is understood that this article does not permit crews to be run through terminals unless such practice is permitted under their schedules.

Art. 6. Road crews tied up for rest under the law and then towed or deadheaded into terminal, with or without engine or caboose, will be paid therefor, as per Art. 5, the same as if they had run the train to such terminal.

Art. 7. If any service is required of an engine crew, or if held responsible for the engine during the tieup under the law, they will be paid for all such service.

Art. 8. The foregoing articles constitute an agreement for the above named campanies and their conductors, trainmen, engineers and firemen as to runs that are tied up in conformity with the law, and become a part of the schedules or agreements of these roads and subject to their provisions as to amendment by mutual consent. Nothing herein contained shall be construed to amend or annul any rule in the various agreements with individual roads.

Disastrous Collision at Maltrata, Mex.

Press despatches of April 25 report a butting collision between a freight train and an excursion passenger train, on the 24th, on the Mexican Railway, near Maltrata, Mex., in which 28 persons were killed and 15 seriously injured.

Passenger Earnings Under Two-Cent Fares.

The annual report of the Cincinnati & Muskingum Valley for the year ended December 31, 1907, just issued, makes the following statement in regard to passenger earnings for that year.

"The passenger earnings were $184,876, an increase of $2,546, or 1.40 per cent. The number of passengers carried decreased 17,181, or 2.95 per cent., with an increased passenger mileage of 242,615 miles, or 2.82 per cent., and a decrease in passenger train mileage of 1.15 per cent. The earnings per passenger mile were 2.05c., caused by an increase in the mileage of passengers carried under the two-cent maximum rate, as compared with the previous year, the new law being in effect only during the last nine months of 1906. The expenses per passenger per mile were 2.92c., an increase of .03c., due to increased rate of pay and increased cost of materials. There was a consequent loss per passenger per mile of .87c., an increase of .05c."

This should be compared with a similar statement for the Grand Rapids & Indiana, which was published in the *Railroad Gazette* of April 17 page 527.

Shaw Wrecking Crane.

The 100-ton steam wrecking crane shown in the accompanying photograph was recently built by the Shaw Electric Crane Co., Muskegon, Mich., and sold through Manning, Maxwell & Moore, New York, to the Illinois Central. An important feature in the design is the location of the engine, the cylinders being placed well back toward the rear, instead of toward the front of the crane. The piping is thus short and direct and is out of the way of the machinery and the engineer. The steam pipe branches at the throttle, the pipes passing down at each side, just in front of the coal bin and the water tank, to the engine cylinders. The exhaust pipes go back underneath and then up to the separator on the back of the boiler, from which the exhaust steam passes to the stack through tubes inside of the boiler. These pipes are thus entirely out of the way and are protected from shocks that may cause deflection, and from the vibration of that part of the frame carrying the boiler. This position of the engine makes it possible to put the side frames farther apart and keep the machinery low, so that the center of gravity is lower; also, the engineer can get a good view of the work without being in a dangerous position. The passage for the engineer to and from the cab on both sides is unobstructed.

In addition to the usual hand brakes on the main and auxiliary hoists, steam brakes are also used on them. The auxiliary hoist has 20 tons capacity using a single line, and 40 tons with one sheave. Parts of the main and auxiliary hoists are interchangeable; these include: clutches, all brake parts, gears, shafts, drums and ropes. The design of the jib is different from past practice. The combination of bending and compression strains is avoided and the structure is lighter and stiffer. The engines are provided with the Walschaerts valve gear. Features of the steam generator are: forced draft, telescoping stack, shaking and dumping grates and dumping ash pan. The boiler tubes are so arranged that the crown sheet may be easily cleaned. There is a dry pipe, and particular attention has been paid to getting dry steam under the worst conditions.

Steam Wrecking Crane; Shaw Electric Crane Company.

The crane is self-propelling, one axle of each truck being driven by gears in such a way as not to interfere with the free movement of the truck. There is friction drive in the gearing to compensate for unequal diameters of wheels. The center and side bearings are self-lubricating, so that the crane can take sharp curves without the danger of derailment which is common on self-propelling cranes when there are rigid pedestals carried by the car body. Since the car is driven from both trucks, it travels equally well with the load suspended at either end. The car is equipped with both automatic and straight air brakes, the pipe connections from crane to car being permanent. The machine is mostly steel, very little cast iron being used.

Atlanta, Birmingham & Atlantic.

The Atlanta, Birmingham & Atlantic is carrying on important improvement work at Brunswick, Ga., where it is building and equipping freight and steamer terminals. The land for the steamer terminals it has reclaimed from the marshes, and these terminals are said to be unequaled on the South Atlantic coast for modernness and facility of loading and unloading vessels. The railroad controls the Brunswick Steamship Company, which has recently put into commission five new freight steamers running between Brunswick and New York. These steamers are built of steel and designed especially for the trade, with their engines aft to facilitate lumber loading. The Atlanta, Birmingham & Atlantic is now said to have the largest lumber business of any road in the South, and it also touches the heart of the cotton country and owns important coal and iron mines. H. M. Atkinson is president both of the railroad company and of the steamship company.

Thor No. 9 Close-Quarter Air Drill.

The "Thor" No. 8 close-quarter piston air drill, made by the Independent Pneumatic Tool Co., Chicago, was described in the *Railroad Gazette* of Jan. 25, 1907. This drill, which can work within 1½ in. of a corner, can drill up to 2 in. in diameter and can ream and tap up to 1¼ in. in diameter. To meet a demand for a similar machine for heavier work, a No. 9 machine has been produced, with dimensions as follows:

Distance, throttle connection to outside of spindle case	15⅜ in.
Distance, point of feed screw to end of socket	8⅞ "
Radius from center of feed screw to outside of case	1 5/32"
Width of case at cylinder flanges	5 3/16"
Width of case at spindle	6¼ "
Weight	31 lbs.
Speed	122 r p m.

The spindle is at one end of the tool and the motor at the other. The motor consists of two parallel cylinders at right angles to the spindle, with their center line on the center of the spindle. The pistons are double-acting and work a two-throw crank. The eccentrics are between the crank arms, the whole being one forging. The eccentrics drive balanced cylindrical piston valves, having a reciprocating motion. The air is taken in centrally between the cylinders, and the clearance between valves and cylinders is the least practicable. Geared to the crank shaft is another two-throw crank, diametrically opposed. This crank works two oscillating levers centered on the drill spindle, with their bearings around the same. These levers are provided with pawls, of about the full thickness of the lever, which work on ratchet teeth sunk in the spindle. The outer circumference, or points of teeth, leaves ample stock for the bearings of the levers. The lever-moving crank has its power stroke on the part of the revolution farthest away from the spindle. This causes a more uniform speed of the lever, with a forward pull considerably more than half a revolution, and a quick return to action. The crank being opposed, the motion of the drill spindle is practically continuous. The engine crank is not on the usual 90 deg. angle, having instead an angle of 135 deg., thus allowing both pistons to pull when the position of the levers requires the greatest power. The drill is thus partly self-regulating, with a tendency to still further govern the speed of the full revolution of the spindle. The drill has a reversible-ratchet feed mechanism, working within the width of the body of the drill. The speed and power are controlled by a poppet-valve throttle, which also acts as a handle.

INTERSTATE COMMERCE COMMISSION RULINGS.

Through Routes and Joint Rates.

Cardiff Coal Co. v. Chicago & North-Western et al. Opinion by Commissioner Harlan.

A state of facts similar to that in the case of Cardiff Coal Co. v. Chicago, Milwaukee & St. Paul et al. (see below) appeared, and the Commission declared that complainant is entitled to an order establishing through routes and joint rates to all strictly local points on the line of the Chicago & North-Western to which no through routes now exist from Cardiff.

Cannel and Bituminous Coal.

Goff-Kirby Coal Co. v. Bessemer & Lake Erie and Butts Cannel Coal Co. v. the same carrier. Opinion by Commissioner Prouty.

It was held that where the carrier has a rate on bituminous coal it should apply that rate to cannel coal. The Commission said that there is nothing in the physical attributes of cannel coal to distinguish it from bituminous coal proper; indeed, it appeared that one mine on the line of the defendant had been shipping cannel coal as bituminous without the knowledge of the defendant. The questions of reparation raised in these cases are reserved, but the Commission declared that it does not follow that because a rate is reduced for the future, damages will be allowed in all cases where that rate has been exceeded in the past.

Differentials to Wichita.

Johnston & Larimer Dry Goods Co. and Cox-Blodgett Dry Goods Co. v. Atchison, Topeka & Santa Fe and 187 other carriers. Opinion by Commissioner Prouty.

It was held that rates on cotton piece goods from Atlantic seaboard territory to Wichita, Kan., via Galveston, Tex., should not exceed $1.25 per 100 lbs. This recognizes a differential of 32 cents against Wichita, which under normal conditions and on the present basis of rates ought not to be exceeded. The Commission further held that the present rate on knit goods from Atlantic seaboard territory to Wichita via Galveston of $1.64½, producing a differential against Wichita of 26½ cents, is not unjust nor unreasonable. The order in this case was issued against only those defendants which operate via Galveston.

Jurisdiction Within Oklahoma.

Chandler Cotton Oil Co. v. Fort Smith & Western. Opinion by Commissioner Clark.

The complaint involved reasonableness of rates on shipments of cotton seed over defendant's line from Prague, Okla., to Warwick, but it was dismissed for want of jurisdiction, following the decision of the Commission in the Hussey case.

The Commission said that in all controversies before it if there is lack of jurisdiction, either from the absence of essential facts or through want of power in the statute, it is the duty of the Commission, on its own motion, to deny jurisdiction. The provision of the Act to regulate commerce applying to carriers transporting property "from one place in a territory to another place in the same territory," so far as it related to the territory of Oklahoma, expired by its own force on November 16, 1907, when Oklahoma was admitted as a state.

Rates on Live Stock from the Southwest to Chicago.

Cattle Raisers' Association of Texas v. Missouri, Kansas & Texas and 57 other carriers. Opinion by Commissioner Prouty.

The conclusions announced by the Commission in its opinion of August 16, 1905, in this case are affirmed, and the rates therein pronounced excessive are held to be still excessive and unreasonable. The rates on live stock prescribed to Chicago from the southwest are held to be sufficient to carry a delivery at the Union Stock Yards, and the imposition of any terminal charge in excess of $1 is declared unreasonable; but reparation was allowed only from August 29, 1906, when the complainant presented its petition for further proceeding under the amended Rate Law.

These advances were made during the year 1903 and were generally 3 cents per 100 lbs. In a few cases they were as high as 5 cents and as low as ½ cent. It is evident that in such instances it was the purpose of the carriers to change the relation in rates. Presumably the old relation was wrong in the opinion of the carriers and the present relation is right. If the Commission were simply to order a reduction to the original basis the present relation would be disturbed in these instances, and yet the Commission cannot well make any different order since these rates have not been specifically referred to. The better way seems, therefore, to be to allow the carriers sufficient time within which to put in rates in substantial accord with this report, and the making of an order will be postponed until July 1, 1908. The questions as to reparation are reserved and will be dealt with as specific claims are presented.

Chairman Knapp filed a dissenting opinion in this case.

The Statute of Limitations.

Missouri & Kansas Shippers' Association v. Atchison, Topeka & Santa Fe, Missouri Pacific (two cases) and Kansas City Belt. Opinion by Commissioner Harlan.

The four complaints were dismissed. The findings of the Commission were:

"A complaint by a voluntary association demanding reparation under general averments which do not name the members on whose behalf it is filed and do not with reasonable particularity specify and describe the shipments as to which the complaint is made, does not operate to stop the running of the period of limitation provided in the law; and does not give the members of the association the opportunity subsequently to come in and take advantage of the complaint by proving up their shipments, which would be barred of relief upon separate and individual complaints if then filed by themselves.

"A statute of limitations is a wise method of forcing claimants either to assert their rights against others or definitely abandon them. Persons against whom claims may be made are fairly entitled to repose at some definite point of time, and this is especially true in connection with matters of transportation. Waybills and other papers accumulate in vast numbers in the course of a few months, and carriers are entitled, if claims are to be made, to have them made with reasonable promptness.

"The universal rule in the courts, also applicable to the Commission, seems to be that, under a system of pleading which permits a proceeding for damages to be instituted by filing a complaint, the statute of limitations does not cease to run against the demand until the complaint has been filed setting up the claim with sufficient particularity to make an issue. Until a definite cause of action has been pleaded there is nothing to arrest the running of the statute. All the elements fairly necessary to present the cause of action must be pleaded in a complaint filed with the Commission.

"Under Section 13 of the Rate Law a carrier has a definite *locus penitentiae* in order to determine whether it will yield to the demand made or contest it; and the carrier has the right to have the complaint so stated as to afford it the necessary information to enable it to determine whether to request the authority of the Commission to satisfy the demand or to make a formal answer. When the demand is made on behalf of unnamed shippers and on shipments that are not specified with reasonable particularity, this opportunity is not open to the carrier."

Distribution of Coal Cars Where Carrier's Coal Is Involved.

In the cases of Royal Coal & Coke Company, Tennessee Coal Company and Minersville Coal Company against the Southern Railway, rendered by Commissioner Cockrell, the Commission held that the only regulation in respect to the transportation of coal from mines that is just, fair and reasonable is to allow to each mine its fair and just proportion of the coal cars, estimated upon its justly ascertained capacity, and without regard to whether the mine furnished partly fuel coal for the carrier and partly commercial coal, or commercial coal only.

The Commission further decided that the carrier should publish or post for convenient inspection, at frequent and regular intervals, the rating of the various mines and the car tonnage received by them within the period covered by the report. In cases where commercial mines have received more or less than their equitable pro rata of the car tonnage during any particular period, the overplus or shortage for such mines should be adjusted, as far as possible, within the period next succeeding and such correction should be shown in the subsequent reports. The carrier must be free to contract for the total output of the mine, if it so desires, or it may contract for any part thereof less than the whole; and it is entitled to get its fuel first. If, however, a mine contracts to furnish only a part of its output to the carrier for fuel, and if the filling of its contract with the carrier calls for its full pro rata of cars or more, then it should receive no other cars for commercial shipments. If such a mine in filling its contract to supply fuel coal does not exhaust its equitable pro rata of cars, then cars should be given to it for commercial shipments sufficient to complete its full pro rata share of all available cars.

In the case of Traer, receiver of the Illinois Colliery Company against the Chicago & Alton, the same complainant against the Chicago, Peoria & St. Louis, and the same complainant against the Illinois Central, rendered by Commissioner Clark, the defendants claim that the necessity for fuel with which to operate their lines gives them the right to make private contracts therefor, and that the failure to count against the mines the cars furnished for such fuel supply permits them to make advantageous contracts and to get their coal at a lower price, and that if they counted their own fuel cars in the distribution they would not only have to pay a higher price for their coal, but might not be able to contract for it at all.

The Commission held that fuel is necessary and essential to the operation of a railroad, and the right of a carrier to contract for the purchase of its fuel supply with one mine or with a number of mines must be conceded; but if a carrier and a mine owner make a contract for the fuel supply of the carrier which does violence to the act to regulate commerce or to the decisions of the court or is opposed to public policy they are in no better position than the parties to any other contract which violates the legal principles relating thereto. A carrier cannot inject illegalities in such contract and have it upheld on the ground of compelling necessity.

In these cases the Commission is of the opinion that as to the privately owned or leased cars and the foreign railroad fuel cars the rule laid down by the Commission in the Railroad Commission of Ohio case should apply, and that cars used by defendants upon their own lines for transportation of their own necessary fuel supply may be given in any numbers to the mine or mines from which such fuel supply is received, but if such mine or mines also ship commercial coal the fuel cars so supplied must be counted against the mine or mines.

Right to Through Routes and Joint Rates.

Cardiff Coal Co. v. Chicago, Milwaukee & St. Paul et al. Opinion by Commissioner Harlan.

The complainant formerly was allowed through routes and joint rates from its mines to certain interstate points, but subsequently this privilege was withdrawn. Complainant's daily capacity is in excess of the requirements of the local markets, and the complaint is filed for the purpose of securing a wider market. While such through routes and joint rates were in force, complainant was able to sell coal to the interstate territory in question, but since such withdrawal the greater part of this trade has been lost. While denying to complainant such an outlet from its mines, through routes and joint rates are maintained to such interstate points from other nearby mines. On petition of complainant for an order re-establishing the through routes and joint rates, the Commission held that the routes over other lines referred to in the opinion are not reasonable or satisfactory; that complainant should again be accorded the through routes and joint rates, and that the refusal to establish through routes and joint rates from complainant's mines is an unlawful discrimination.

The Commission further held that an interstate carrier, in order to build up enterprises of the same character on its own line and to prevent the trade of its local industries from being displaced by the competition of manufacturers of the same commodities on connecting lines, cannot deny to industries on the lines of such connections the benefit of through routes and joint rates; nor is the fact that the revenues of the carrier may be reduced by establishing such through routes and joint rates a material consideration. It may be laid down as a general rule admitting of no qualification that a manufacturer or merchant who has traffic to move and is ready to pay a reasonable rate has the right to have it moved and to have reasonable rates established, regardless of the fact that the revenues of the carrier may be reduced by reason of his competition with other shippers in the distant markets; and he has the right also to have the benefit of through routes and joint rates to such distant markets if no "reasonable or satisfactory" through routes already exist.

Express Rates Between Denver and Missouri River.

George J. Kindel v. Adams Express Co. et al. Opinion by Commissioner Prouty.

The complaint alleges that express rates from New York, St. Louis and Omaha to Denver are unreasonable; that the rates between Denver and San Francisco and Salt Lake City are unreasonable; that the rates to Denver made by combination on the Missouri river from eastern points work unjust discrimination against Denver; and that the graduate scale of rates is unscientific and inconsistent. The Commission held that the base rates of $4 per 100 lbs. from Omaha to Denver and of $4.25 per 100 lbs. from Denver to Ogden should not exceed $3.50 and $4 respectively. Further, that the rates made by express companies on small packages in competition with the United States mail are not to be taken as standards by which to determine the reasonableness of their rates on larger packages. In making express rates, a base rate of so much per 100 lbs. was fixed, and to that is applied what is termed a "graduate" scale, giving the rates on smaller packages for a given base rate. All the defendants use the same scale, which was attacked by the complainant as "illogical and inconsistent." The only objection pointed out was that rates on small packages did not correspond with those on larger ones, which is due to competition with the mail in carrying small packages. The scale must be assumed to be a reasonable one in this proceeding, and the only inquiry as to the reasonableness of rates involved should be directed to the reasonableness of the base rate. The fact that express rates in and out of a particular business locality are higher than those in and out of a competing locality from a common source of supply is not of the same importance as in the case of freight rates, since the wholesaler ordinarily brings his merchandise in by freight and also distributes it by freight.

Within certain limits express rates and freight rates compete and to that extent express rates should be established with reference to freight rates. The main object of an express service is expedition, and express rates should not be so low as to attract business which might properly go by freight and thereby congest and interfere with the service by express. In determining the reasonableness of express rates little reference can be had to the value of the property employed, since the connection between the value of the service and the cost of the property employed in rendering it is slight. This is qually true of the capitalization of the defendants, which bears no relation whatever to the actual investment necessary to conduct the business. In determining whether the present charges of the defendants are reasonable, inquiry must be had into the character of the business, the amount of capital required for its conduct, the hazard involved, and especially the profits which these companies are now making under the rates attacked.

Since no reliable information as to results of operations of these defendants under existing rates was presented, no opinion was expressed as to the reasonableness of their rates in general. The inquiry is confined to rates in territory west of the Missouri river to and from Denver. A comparison of express rates in one locality with those in another is of a much greater value than a similar comparison between freight rates, since the character of the business and the conditions under which it is transacted are more nearly the same. Rates from eastern destinations to Denver are made by adding together rates to the Missouri river and from the Missouri river, and applying to the resulting base rate the graduate scale. The rate on small packages thus obtained is much less than the sum of the locals on the same package to and from the Missouri river and is somewhat less on packages up to 50 lbs. in weight. The great majority of packages handled are under 50 lbs. This method of making through rates is not unlawful, for while the rate on packages weighing 50 lbs. and over may be somewhat high, the total result is reasonable.

The practice of making rates from or to an exclusive office by combination of the full local rates through some junction point seems to be objectionable, but since there is not evidence in this case from which the effect of an order requiring the establishment of a through base rate and the application of the graduate scale to that rate can be determined, the Commission declines to interfere with the present practice at this time. The fact that under the postal regulations of England a package can be sent from London to Denver for 50 cents is no reason for pronouncing an express rate of 70 cents on a package of the same size from Denver to London unreasonable.

TRADE CATALOGUES.

Wire Rope, Insulated Wire and Cables.—Two pamphlets, 156 pages together, issued by the Hazard Manufacturing Co., Wilkes-barre, Pa., deal with wire rope and insulated wire. Section 1 gives sizes, weights, strength and prices of iron, steel and galvanized wire rope, wires and appliances connected with the use of wire rope. This is illustrated with a large number of photographs, showing the different styles of rope and cable, and of buildings, conveying and hoisting machinery, inclined planes, etc. The pamphlet gives tables and other information on such points as: tension on rope under varying loads and on inclined planes of different degrees, proper working loads on cables, amount of power transmitted by wire rope under different conditions, etc. Section 2 gives correspondingly full information concerning insulated and uninsulated wires and cables.

Chains.—Catalogue No. 75, of the Link-Belt Co., Philadelphia, Pa., fully illustrates, with brief descriptions, the Ewart detachable link belt, showing sizes, weights, strength and prices with various attachments. It also describes pintle chains, or chains whose links are connected with pins or rivets. These include chains of many styles for different uses. Roller chains, mono-bar chains, and the Renold silent chain gear are also described, as well as sprocket wheels and spiral gears, bevel gears, angle gears, worm gears, equalizing gears and clutches for use on sprockets. Catalogue 78 of the same company is a small pamphlet telling how and why to use the Ewart link belt. It is illustrated with line drawings showing the points involved.

The Maine Woods.—The Bangor & Aroostook has issued the 1908 edition of In the Maine Woods, a "vacationist's guide." This is a volume 9 x 6 in., with 128 pages of reading matter and photographs, and 65 pages of advertisements. Many of the photographs are exceedingly good, especially those which illustrate the fishing and hunting of the Maine woods. There are a number of pictures of wild deer and moose. There is full information about the various regions reached by the Bangor & Aroostook, the game, fishing and guide laws and maps of the various regions. Many of the advertisements set forth the hotels or camps available for visitors. The industrial development of northern Maine is also briefly described. The book is in all respects one of the best of its kind.

Boilers.—Catalogue No. 60, of the Murray Iron Works, Burlington, Iowa, describes the construction of the Murray water tube boilers. It is illustrated with many halftones of boilers and details, and of buildings in which they have been installed. They are designed for 160 lbs. working steam pressure, and are built in sizes from 50 to 500 h.p. They are rated, in general, on a basis of 10 sq. ft. of heating surface per horse-power.

Thermit.—A recent pamphlet issued by the Goldschmidt Thermit Co., New York, consists of shop instructions for the use of thermit in repair work. It shows the styles and sizes of molds for different jobs, and gives the prices of apparatus for making repairs. The repairs described include locomotive frames, driving wheels, connecting rods, motor cases, and flaws in castings and forgings.

Signals.—A catalogue of the Union Switch & Signal Co., Swissvale, Pa., fully describes, with price lists, a.c. block signaling appliances. It is illustrated with halftones and line drawings of separate devices, and diagrams of signal layouts. Bulletin 33 is a reprint from the *Railroad Gazette* of January 17, 1908, describing the a.c. automatic block signals on the New York, New Haven & Hartford.

Fan Motors.—Bulletin No. 4,560, of the General Electric Co., Schenectady, N. Y., describes a number of different styles and sizes of direct and alternating current fan motors, including ceiling fans, column fans, wall fans and exhaust fans. The bulletin also illustrates a number of small motors of from 1 to 30 h.p. for various uses.

Motors and Generators.—Pamphlet No. 226 of the Sprague Electric Co., New York, is an instruction book covering the installation and care of belted round type d.c. motors and generators. It is illustrated with halftones and line drawings of machines and parts. It also gives a number of wiring diagrams.

Locomotive Cranes.—Pamphlet K of the Brown Hoisting Machinery Co., Cleveland, Ohio, briefly describes, with a number of photographs and drawings, locomotive cranes for handling coal or ashes, etc. They are, as a rule, equipped with Brown patent grab buckets, which are also described.

Roofing.—A circular issued by the H. W. Johns-Manville Co., New York, calls attention to the advantages of J-M asbestos roofing, and also to a less expensive roofing known as the J-M-Oid. The latter is made of wool felt saturated with a water-proofing compound.

Brake-beams.—A folder issued by the Pennsylvania Brake-Beam Co., Danville, Pa., shows views of standard brake beams and standard I beams, and special reinforced brake-beams for heavy freight service.

MANUFACTURING AND BUSINESS.

J. A. Venable has been appointed General Manager of the New York Car Wheel Co., Buffalo, N. Y.

T. Kennard Thomson, Consulting Engineer, has moved to the Hudson Terminal buildings, 50 Church street, New York.

The offices of the Railway Steel-Spring Co., New York, have been moved to the Hudson Terminal buildings, 30 Church street.

The offices of the Atlantic Equipment Co., New York, have been moved to the Hudson Terminal buildings, 30 Church street.

The offices of the U. S. Metal & Manufacturing Co., New York, have been moved to the City Investing building, 165 Broadway.

The New York office of the Bettendorf Axle Co., Chicago, has been moved to the Hudson Terminal buildings, 30 Church street.

The New York office of the Union Spring & Manufacturing Co., Pittsburgh, Pa., has been moved to the Hudson Terminal buildings, 50 Church street.

Tho New York office of the American Brake Shoe & Foundry Co., Mahwah, N. J., has been moved to the Hudson Terminal buildings, 30 Church street.

The Canadian sales office of the National Malleable Castings Co., Cleveland, Ohio, has been moved to 710 Canadian Express building, Montreal, Que.

Isham Randolph, Consulting Engineer, Chicago, has moved his offices from the American Trust & Savings Bank building to the First National Bank building.

W. B. Crane, Sr., of W. B. Crane & Co., Chicago, dealers in hardwood lumber, died in Memphis, Tenn., on March 28. The business will be continued as heretofore.

The offices of the Eppinger & Russell Co., New York, dealer in yellow pine lumber and ties, creosoted lumber, ties and piles, have been moved to the City Investing building, 165 Broadway.

The New York offices of the General Electric Co., Schenectady, N. Y., have been moved to the Hudson Terminal buildings, 30 Church street. The entire seventeenth floor will be occupied by these offices.

H. H. Sessions, who, as noted in this column last week, has been made President of the American Car & Equipment Co., Chicago, a car repairing company, remains also Vice-President of the Standard Coupler Co., New York.

Among recent orders received by the Alexander Milburn Co., Baltimore, Md., was one for a number of lights for the United States Reclamation Service and one for a special 5,000 candle power light for an 85-ft. revolving derrick recently built for the Great Lakes Construction Co., Buffalo, N. Y.

The firm of Wood & Van Nest, 26 Cortlandt street, New York, has been formed to represent manufacturers of railroad materials. M. F. Wood has been for many years General Manager of the Eyeless Tool Co., Newark, N. J., and J. A. Van Nest served on the Pennsylvania Railroad for a long time. The firm is prepared, as sales agents, to quote on all materials used in the roadway department.

Ten Westinghouse turbo-electric generators, aggregating 25,000 h.p., are being shipped, or will soon be shipped, to the far East. Most of these machines will go to Japan. One, a 1,500 k.w. turbine unit, is for the Manila Electric Railway & Lighting Co., where four similar machines are in service. The large turbine station of the Osaka Electric Co., Osaka, Japan, now building, will have, for the present, 15,000 k.w. in five units. The remaining four units will be installed in a steel plant and in a ship building yard in Japan.

The Canadian Crocker-Wheeler Co., Ltd., has been organized for the manufacture and sale in Canada of the apparatus made in the United States by the Crocker-Wheeler Co., Ampere, N. J. F. E. Lovell, President of the new company, is a member of the lumbering firm of H. Lovell & Sons, Coaticook, Que. Russell A. Stinson and F. J. Bell, Vice-President and Secretary-Treasurer, respectively, have been employed in the manufacturing, construction and sales departments of the electrical trade in Canada for the past 15 years. The office of the new company has been opened at the Street Railway chambers, Place d'Armes Hill, Montreal, Que.

OBITUARY NOTICES.

Charles Drinkwater, Secretary and Assistant to the President of the Canadian Pacific, died at Montreal, on April 23, of pneumonia. Mr. Drinkwater was born November 17, 1843, at Ashton, Lancashire, England. He entered railroad service in 1859 on the Manchester, Sheffield & Lincolnshire in England, and was for three years in the service of the Great Northern at London. He then went to Canada and from 1864 to 1874 he was private secretary to Sir John A. MacDonald, then Prime Minister of Canada. From 1874 to 1881 he was Chief Assistant to the Managing Director of the Grand Trunk. Since 1881 he has been Secretary of the Canadian Pacific and since 1900 also Assistant to the President.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Franklin Institute.

At a section meeting of the Institute there was an address on "Recent Work in Metallography," by Dr. William Campbell, of School of Mines, Columbia University, New York.

American Society of Mechanical Engineers.

The next meeting of this society is to be held May 12 in the Engineering Societies building, New York. At this meeting a paper on "Clutches," with special reference to the types used on automobiles, by Henry Souther, Hartford, Conn., will be read. Their development will be shown by lantern slides. The meeting will be important also to those interested in the use of clutches for machine tool work, power transmission, hoisting machinery, textile and other classes of machinery, and will afford an opportunity for the full discussion of their design and use. The discussion will be continued at the semi-annual meeting of the society at Detroit, June 23-26.

Central Railway Club.

The next regular meeting of this club is to be held at the Lafayette Hotel, Buffalo, N. Y., May 8. At this meeting a paper on the "Possibilities of High Speed Tool Steel; a Review of Recorded Tests, H P. Requirements, etc.," by L. R. Pomeroy, of the Safety Car Heating & Lighting Company, will be presented.

Engineers' Club of Philadelphia.

At a business meeting of this club to be held May 2 a paper on "Construction Methods on the Market Street Subway," by S. M. Swaab, illustrated by lantern slides, will be presented.

At a business meeting of the junior section to be held May 11, a paper on "Experience in Operating a Diesel Engine," by John S. Haug, will be presented.

Railway Signal Association.

The May meeting of this association will be held at 29 West 39th street, New York City, on Tuesday the 12th, beginning at 10 a.m. The subject in the forenoon will be the Specifications for electric interlocking, beginning at paragraph No. 80, page 27, of advance notice No. 5, issued last year. In the afternoon there will be a paper on storage batteries, by H. M. Beck. Mr. Beck discusses the restoration of low cells. The Secretary announces that as Mr. Beck treats his subject with reference especially to a single type of storage battery, it is desirable that makers of other storage batteries which are used for signal purposes shall be represented at the meeting, with a view to bringing out the best methods of dealing with all kinds of storage batteries which may need restoration. It is expected that at the afternoon session there will also be preliminary reports from some of the committees.

Iron and Steel Institute.

The annual meeting of the Institute is to be held at the Institution of Civil Engineers, London, Eng., May 14 and 15. The Bessemer Gold Medal for 1908 will be presented to Benjamin Talbot. The annual dinner will take place at the Hotel Cecil on Thursday. Among the papers to be submitted at the meeting are the following:

Experimental Electric Furnace for the Smelting of Iron, by Professor B. Igewsky.

Improvements in Plate Rolling Mills, by A. Lemberton.

Application of Color Photography to Metallography, by E. F. Law.

Utilization of Blast-Furnace Slag for Portland Cement, by C. von Schwarz.

New Fatigue Test for Iron and Steel, by T. E. Stanton, D.Sc.

Physical Qualities of Steel in Relation to its Mechanical Treatment, by James E. York.

Reports on research work carried out during the past year are to be submitted by C. A. Edwards, J. A. N. Friend (Germany), D. M. Levy, A. M. Portevin (France), A. K. F. Hiorth (Norway), B. Saklatwalla (India), E. Hess, C. Benedicks (Sweden), and H. C. Boynton, Carnegie research scholars.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

National Lines of Mexico.—J. E. Dennison, Auditor, has been appointed General Auditor.

Union Pacific.—M. H. Loomis, General Solicitor for Kansas and Missouri, has been appointed General Solicitor of the company, with headquarters in Omaha, Neb., succeeding J. M. Baldwin, deceased.

Operating Officers.

Kalamazoo, Lake Shore & Chicago.—H. D. Swayze, Traffic Manager, has been appointed General Superintendent, with headquarters at South Haven, Mich., succeeding James Grant, assigned to other duties.

Mexican Railway.—W. Cockfield, Locomotive Superintendent, has resigned to go to the Peruvian Southern as Locomotive Superintendent.

Missouri Pacific.—See St. Louis & San Francisco.

New York, New Haven & Hartford.—William R. Martin, Superintendent of the Boston division, has been made also Superintendent of the South Station, Boston, Mass.

St. Louis & San Francisco.—H. H. Brown, Superintendent of the Ozark division, with office at Memphis, Tenn., has been appointed Superintendent of the Eastern division, with office at Springfield, Mo., succeeding A. O'Hara, resigned. J. F. Simms, Superintendent of the Missouri Pacific at Osawatomie, Kan., succeeds Mr. Brown.

Saratoga & Encampment.—B. F. Dunn, Superintendent, has resigned and Frank J. Cramer, Chief Engineer, succeeds Mr. Dunn.

Traffic Officers.

El Paso & Southwestern.—Charles M. D. Adams, formerly General Agent of the Missouri Pacific at Memphis, Tenn., has been appointed General Agent of the El Paso & Southwestern at St. Louis, Mo.

Grand Trunk.—See Grand Trunk Pacific.

Grand Trunk Pacific.—J. E. Dalrymple, General Freight Agent of the Grand Trunk, has been appointed Freight Traffic Manager of the Grand Trunk Pacific, with office at Winnipeg, Man.

Kalamazoo, Lake Shore & Chicago.—See this company under Operating Officers.

Missouri Pacific.—W. H. Reid, commercial agent of the Mobile & Ohio at New Orleans, has been appointed General Agent of the Missouri Pacific at New Orleans, La. This office had been temporarily closed.

St. Joseph & Grand Island.—H. W. Prickett, Traffic Manager of the Kansas City stock yards, has been appointed to the new office of General Agent at Salt Lake City, Utah.

Engineering and Rolling Stock Officers.

Erie.—George H. Burgess, Engineer of Terminal Improvements at Jersey City, has been appointed Principal Assistant Engineer, with office in New York. The office of Engineer of Terminal Improvements has been abolished.

Tehuantepec National.—D. Coe, Chief Engineer, having been given leave of absence, Ernest H. Mitchell, as recently noted in this column, is Acting Chief Engineer.

LOCOMOTIVE BUILDING.

The Lehigh & New England has ordered three consolidation locomotives from the Baldwin Locomotive Works.

The Delaware, Lackawanna & Western is said to have ordered 17 locomotives from the American Locomotive Co. This item is not yet confirmed.

The Chicago, Milwaukee & St. Paul will build 70 Prairie locomotives at its Milwaukee shops, and is said to have ordered 50 engines from the American Locomotive Co. The latter item is not yet confirmed.

The Lehigh Coal & Navigation Co. has ordered two consolidation locomotives from the Baldwin Locomotive Works, for June delivery. The specifications are as follows

Type of locomotive	Consolidation
Cylinders	22 in. x 28 in.
Diameter of drivers	56 in.
Boiler, type	Straight
" steam pressure	200 lbs.
" tubes, number	300
" " diameter	2 in.
" " length	12 ft. ½ "
Firebox, length	126 1/16 "
Firebox, width	108⅝ "
Heating surface, tubes	1,880 sq. ft
" " firebox	188 "
" " total	2,138 "
Grate area	95 "
Tender	Steel underframe
Water capacity	6,000 gals.
Coal capacity	12 tons

CAR BUILDING.

The Union Traction Co., Santa Cruz, Cal., is said to have ordered four double-truck motor cars and two trailers. This item is not yet confirmed.

The St. Louis, Brownsville & Mexico is said to have ordered 30 Rodger ballast cars of 80,000 lbs. capacity from the American Car & Foundry Co. This item is not yet confirmed.

The Chicago Railways cars, mentioned in the *Railroad Gazette* of March 27, will be equipped with trucks built by the Pullman Co., and air-brakes furnished by the National Air-Brake Co.

The Grand Trunk Pacific, it is said, has ordered 18 first class coaches, 10 second class coaches, six combination baggage and smoking cars, and six mail and express cars, from the Canada Car Co., and 12 baggage cars from Rhodes, Curry & Co. This item is not yet confirmed.

The Lehigh & New England, as mentioned in the *Railroad Gazette* of April 3 and April 24, has ordered 300 all-steel 40-ton gondolas, weighing 34,000 lbs., from the Cambria Steel Co., and 250 steel underframe 30-ton box cars, weighing 34,000 lbs., from the American Car & Foundry Co., both for June-July delivery. The gondolas will measure, inside, 36 ft. long, 9 ft. 3 in. wide and 4 ft. 2¼ in. high, and over all, 37 ft. long and 7 ft. 7½ in. high. The box cars will measure, inside, 36 ft. long, 8 ft. 6 in. wide and 7 ft. 9¼ in. high. The over-all measurements will be 37 ft. ½ in. long, 9 ft. 3¼ in. wide and 13 ft. 7 in. high to top of staff. The special equipment includes:

Bolsters, truck	Gould
Brakes	Westinghouse
Brake-beams	Davis Solid Truss
Brake-shoes	Steel back
Couplers	Gould
Door fastenings (box cars)	Security
Draft gear	Sessions-Standard
Journal boxes	Gould
Paint (gondolas)	Protectus
Paint (box cars)	Patterson Sargent "Nobrac" and liquid brown
Roofs (box cars)	Chicago Improved Winslow
Springs	Lehigh Valley Spring Co.
Trucks	Arch bar

RAILROAD STRUCTURES.

EAST SOMERVILLE, MASS.—The Boston & Maine roundhouse, with nine locomotives, was recently destroyed by fire.

HOUGHTON, MICH.—The Duluth, South Shore & Atlantic, it is said, will put up a concrete roundhouse in its yards here, to replace one destroyed by fire.

LANCASTER, PA.—The Conestoga Traction has plans made for putting up car repair shops.

MEXICO CITY, MEX.—The new bridges on the National Lines of Mexico include the following: Three span, deck girder bridge to replace a trestle; a five-span, similar type bridge recently finished over the Nazas river, at Los Herreras, also an eight-span bridge over the Sabinas river, near Sabinas. Work is under way on a five-span bridge at Rio Escondida, near Fuente. Contract for the last two let to the Torreon Construction Co., of Torreon, Coahuila. These bridges are to replace the Phoenix column trusses which are now too light for the traffic.

NEW YORK, N. Y.—The New York Central & Hudson River will shortly give a contract for the second of its new terminal buildings at the Forty-second street station. The building for which the new contract is to be given will be the first part of the terminal proper to be built and will constitute about one-fourth of the whole. It will adjoin the new building on Lexington avenue, used for offices, which is now nearly finished.

NORFOLK, VA.—F. S. Gannon, President of the Norfolk & Southern, it is said, has made an announcement that the land recently bought adjoining the present river terminus is to be used as a site for large freight terminals, and for the erection of a general office building. The work is to be started as soon as the general financial conditions improve.

POTTSVILLE, PA.—The Pottsville Union Traction Company, it is said, will at once put up a bridge over the Philadelphia & Reading tracks at Mauch Chunk street.

PRESIDIO DEL NORTE, MEXICO.—Contract, it is said, will shortly be let by the Kansas City, Mexico & Orient to build a bridge over the Rio Grande at the proposed crossing near this place.

READING, PA.—An ordinance is to be introduced to provide money for the erection of a bridge over the Lebanon Valley tracks of the Philadelphia & Reading, at Tulpehocken street.

SAN DIEGO, CAL.—The San Diego & Arizona, it is said, is planning to put up shops, also a roundhouse at a cost of $500,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALTON, ST. LOUIS & CAIRO (ELECTRIC).—Incorporated in Illinois with $100,000 capital to build a line from Alton, Ill., south through Madison, St. Clair, Monroe, Randolph, Jackson and Union counties, to Cairo, in Alexander county, 130 miles. A branch is also to be built from the main line, west to Waterloo and Columbia, in Monroe county. The incorporators include T. N. Chase, J. F. Albrecht, D. W. Young, F. E. Orvis, W. L. Ensel and W. R. Brown.

ATLANTA, BIRMINGHAM & ATLANTIC.—Announcement is reported made that all the work is finished on the branch from the main line at Manchester, Ga., northwest to Atlanta, 71 miles, and that the line is now open for business.

BROWNSVILLE, MASONTOWN & SMITHFIELD STREET RAILWAY (ELECTRIC).—This company, organized to build 15 miles of line in Pennsylvania, has new plans ready for building 120 miles of electric lines in Fayette, Greene and Washington counties, Pa., and eventually into West Virginia. The company has a capital of $3,500,000, and its office is at Masontown. Work has been started on the section from Brownsville south to Masontown. The lines are eventually to connect Masontown, East Millsboro, Gates, Lambert, Edenborn, Ronco, New Geneva, Point Marion, Smithfield, Republic, Martin, Zollarsville, Clarksville, Beallsville and Bentleyville. Connections are to be made with lines entering Pittsburgh. W. J. Sheldon, President, McKeesport.

CANADIAN NORTHERN.—This company, it is said, has notified Hon. Robert Rogers, Minister of Public Works for Manitoba, that the following lines will be built this year: Adelpha, Man., west 10 miles; from a point north of Virden, Man., crossing the Canadian Pacific, 10 miles; from a point on the Rossburn branch through Rapid City, Man., to the Viola Dale district, 25 miles.

CHICAGO, MILWAUKEE & ST. PAUL.—The Milwaukee Terminal Railway Company, it is said, was recently incorporated in the state of Washington in the interest of the Chicago, Milwaukee & St. Paul. The incorporators include H. R. Williams and E. W. Cook, Seattle, and A. H. Barker.

GRAND TRUNK PACIFIC.—A. L. McHugh has been given a sub-contract, on four miles through rock, by Foley, Welch & Stewart. J. E. Craig, August Stewart and Dixon & Moore also have contracts near this section clearing the right of way.

HARRISVILLE & CORNWALLIS.—An officer writes that bids are to be asked for about May 1 to build a line from Cornwallis, W. Va., on the B. & O., southeast, six miles, to Harrisville. The work includes two steel bridges. W. S. Stout, President, and A. Wolverton, Chief Engineer, Harrisville, W. Va. (April 17, p. 559.)

HUDSON BAY PACIFIC.—This company, organized last year with a capital of $3,000,000, has recently been incorporated under an act of the British Columbia legislature. The company proposes to build a line from near Port Simpson, B. C., on the Pacific coast east along the Skeena river to Hazleton, thence via the head of Babine lake to the north end of Stuart lake; thence north of McLeod lake via Pine River Pass, along the Pine river; thence to Moberly lake and along Peace river valley to the eastern boundary of British Columbia. The articles provide also for building branch lines not over 20 miles long. The provincial directors include D. B. May, of Seattle, Wash.; J. McLachan, Los Angeles, Cal.; L. A. Benson, Goldfield, Nev.; N. H. Harding, Jr., and W. H. Duval, New York.

INTERBOROUGH RAPID TRANSIT, NEW YORK CITY.—Announcement is made that this company expects to begin operating, May 1, the extension of its subway from Borough Hall, Brooklyn, to Atlantic avenue, .89 mile. At this point connection is to be made with the Long Island Railroad.

KANSAS CITY, MEXICO & ORIENT.—The extension of this road, north from Chihuahua, Mex., is making good progress and is expected to be finished to the Rio Grande this fall. Work is now under way down the valley of the Conchos river. On the line from the north there remains about 300 miles yet to be built to reach the Rio Grande. The gap of 90 miles between Alpine on the Southern Pacific, and the Rio Grande crossing is to be built within one year. A large tract of land, it is said, has been secured by the company near the site of the proposed international bridge, at which point a town is to be established.

KENTUCKY & OHIO RIVER (ELECTRIC).—The Royal Investment Company, Globe Building, Minneapolis, Minn., is to have entire charge of building this projected line from Paducah, Ky., west to Cairo, Ill. Contracts are to be let at once. The work will include 18 small bridges. Nort Whitesides, President. Wm. C. Langdon & Co., of Minneapolis, Minn., may be addressed. (April 10, p. 525.)

MEXICAN INTERNATIONAL.—Contract has been given to Bartola Corrigan, of Sabinas, Cohuila, and work is under way on a short branch line about 2½ miles long from the Rosita branch at kilo 10 to the Cloete Coal Mines Works.

MILWAUKEE TERMINAL RAILWAY.—See Chicago, Milwaukee & St. Paul.

OREGON ELECTRIC.—This company, which has finished about 50 miles of line from Portland, Ore., via Tualitin and Wilsonville to Salem, except the ballasting, recently increased its capital stock from $2,000,000 to $10,000,000. On April 23 construction work was started on 283 miles of extension branches, and laterals, to the Portland-Seattle Electric line recently put in operation. Plans include lines as follows: Portland to Tillamook, Portland to Eugene, Salem to Mill City, Salem to Dallas, Salem to Albany and Albany to Cascadia. Charles M. Pratt, of New York, is President; N. Talbert, Manager, Portland, and Moffat & White of New York are the bankers.

ROCHESTER, CORNING & ELMIRA TRACTION.—This company, organized to build an electric line from Rochester, southwest to Elmira, 120 miles, is making surveys over a new route, it is said. This will necessitate securing a certificate of necessity from the New York State Public Service Commission, and as soon as this is granted it is promised that construction work will be started. W. C. Gray and S. Fuerstein, 20 Exchange street, Rochester, N. Y., Engineers; F. S. Breckingham, 12 Broadway, New York, is a director.

ROCKPORT, LANGDON & NORTHERN.—This company, operating a road from Langdon, Mo., northeast to Rockport, 5.6 miles, expects to build an extension from Rockport north to Shenandoah, Iowa, about 30 miles. The W. K. Palmer Company, Engineers, 717 Dwight Building, Kansas City, Mo., who will have charge of the engineering work and supervise the construction, want to hear from contractors.

ROME & OSCEOLA.—Incorporated in New York with $500,000 capital to build a line, to be operated either by steam or electricity, from Rome, Oneida county, N. Y., north to Osceola, Lewis county, 25 miles. Incorporators include J. H. Haselton, Rome, N. Y.; W. P. White and W. I. Taber, Utica, N. Y. (April 3, p. 493.)

RUSTON, NATCHITOCHES & NORTHEASTERN.—An officer writes that the route of this proposed line is from Farmerville, La., southwest via D'Arbonne, Ruston, Sallie, Natchitoches and Leesville to the Texas state line, thence through Texas to a point at tidewater not yet determined upon, probably at Port Arthur, about 260 miles. J. C. Nolan, President, and J. Wesley Hall, Chief Engineer, Ruston, La. (March 27, p. 462.)

SPOKANE, PORTLAND & SEATTLE.—On the extension building from Pasco, Wash., northeast to Spokane, work has been suspended from Spokane southwest to Cheney, awaiting settlement of the question whether a satisfactory franchise to enter the city of Spokane will be granted. No new contracts will be let until the franchise is granted.

STEUBENVILLE & EAST LIVERPOOL (ELECTRIC).—This company, operating 19 miles of electric line from Steubenville, Ohio, north to Toronto, recently put at work a large force of men to finish the double-track line on which work was started in the summer of 1907 and suspended last fall. This line is from Toronto, north via Wellsville, and East Liverpool, and thence east to Vanport, Pa., about 40 miles from Steubenville.

VANCOUVER ISLAND & EASTERN.—This company, organized last year with a capital of $2,000,000, is seeking incorporation from the Dominion parliament. The company proposes to build a line from Esquimalt harbor, Vancouver Island, B. C., north to Seymour's Narrows; and from Bute inlet or Frederick inlet on the mainland of British Columbia, east via Yellowhead Pass to Edmonton, Alb., about 900 miles. The provisional directors include T. W. Paterson, T. J. Jones, R. C. Lowe and H. A. Munn, Victoria, B. C.; James Smith, Edmonton, Alb., and M. J. Harvey, Toronto. (Nov. 1, p. 512.)

WASHINGTON ROADS (ELECTRIC).—A. M. Dewey, of Spokane, Wash., with the co-operation of English capitalists, is to finance a line to be built in the northern part of the state of Washington into the Okanogan country. In this section there are a large number of copper mines, 26 having recently been located, and a number of smelters are to be built as soon as the proposed line is assured.

WESTERN PACIFIC.—Track on this line, it is said, is now laid from Stockton, Cal., to a considerable distance north of Sacramento, and it is expected to have trains in operation from Oakland to Oroville this fall. On the section above Oroville the work is very heavy. On 35 miles along the Feather river, about 1,200 men are at work. They recently finished 10 tunnels, each from 200 to 1,200 ft. long, and are now at work on 16 others. The line from this section runs through almost solid rock and it will cost to build through this section about $100,000 a mile. Track is laid from Oroville to Big Bend, 17 miles, and three miles additional will shortly be finished.

RAILROAD CORPORATION NEWS.

BUFFALO, ROCHESTER & PITTSBURGH.—Gross earnings for the third week in April, 1908, were $102,000, a decrease of $64,000 from the corresponding week in April, 1907.

BOSTON & ALBANY.—N. W. Harris & Co. and Bond & Goodwin, both of New York, have sold $3,500,000 25-year 4 per cent. bonds of May 1, 1908-1933, at 98.45, yielding 4.10 per cent. These bonds are guaranteed by the New York Central & Hudson River. The Boston & Albany has no mortgage indebtedness, its total bonded debt being $15,485,000, against which it has in its treasury a New York Central 3½ per cent. bond of 1900-2000 for $5,500,000.

CANADIAN PACIFIC.—During the six months ended December 31, 1907, the Minneapolis, St. Paul & Sault Ste. Marie bought $1,601,600 stocks and bonds of other corporations. Nearly all of these are of the Spokane International, which gives the Canadian Pacific entrance into Spokane. This is a small road, which Sir Thomas Shaughnessy, President of the Canadian Pacific, says earned in its first year of operation, sufficient to pay expenses and fixed charges.

CHESAPEAKE & OHIO.—This company has sold to J. P. Morgan & Co., Kuhn, Loeb & Co. and Blair & Co $2,013,354 consolidated mortgage 5 per cent. bonds of 1889-1939, to meet an equal amount of 6 per cent. first mortgage bonds, series A and B, maturing July 1, 1908. The Chesapeake & Ohio has also sold to the same bankers $1,500,000 of an authorized issue of $2,500,000 6 per cent. notes to retire the $1,200,000 extended notes maturing June 28, 1908, and to get $300,000 new funds.

CHESAPEAKE WESTERN.—All the stock and bonds of this company were sold on April 22 to W. E. D. Stokes, of New York City, for $25,000. All these securities were hypothecated to secure a loan. The company owns or leases 11 miles of line.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—Preferred and common stockholders are offered the opportunity to subscribe at par for all or such part of the $1,000,000 preferred 5 per cent. stock as the board of directors shall determine to issue. The board of directors are to meet on or before June 1. Present holders of both common and preferred stock will have equal rights in subscribing to the new issue.

INTERBOROUGH RAPID TRANSIT.—J. P. Morgan & Co. have offered at par $25,000,000 three-year convertible 6 per cent. notes of May 1, 1908-1911. These notes are convertible for 2½ years into the new mortgage bonds of the company at 95. The notes are secured by a deposit of $30,000,000 new 45-year 5 per cent. mortgage bonds.

IOWA CENTRAL.—E. H. Rollins & Sons, of Boston and Chicago, have offered $750,000 first and refunding mortgage 4 per cent. bonds of 1901-1951. These bonds are part of a total of $25,000,000 authorized, of which about $3,320,000 are outstanding and $7,650,000 reserved to retire an equal amount of 5 per cent. bonds due 1938.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—See Canadian Pacific.

MISSOURI, OKLAHOMA & GULF.—W. H. Trumbull & Co., of Boston and the Banque Franco-Americaine, of Paris, France, have offered the Missouri, Oklahoma & Gulf's outstanding $2,500,000 5 per cent. first mortgage bonds of 1908-1944. The bonds are a first mortgage on the road at the rate of $25,000 per mile, comprising at the present time 95 miles. The road runs from Wagoner, Okla., to Rose, on the Canadian river, traversing the Henryetta and Lehigh coal fields.

MISSOURI PACIFIC.—A large amount of the Missouri Pacific two-year 6 per cent. convertible notes, secured by $12,000,000 Kansas & Colorado Pacific first refunding mortgage 30-year 6 per cent. bonds of 1908-1938, have been converted into these bonds. These notes were issued in January, 1908.

NEW YORK CENTRAL & HUDSON RIVER.—See Boston & Albany.

NEW YORK, NEW HAVEN & HARTFORD.—The Boston Chamber of Commerce has voted decisively to "firmly oppose the proposed control of the Boston & Maine by the New York, New Haven & Hartford." Some of the reasons given in this resolution are that it would place under one control a high percentage of the entire transportation facilities of the New England states, both steam railroads and trolley lines, and because such a consolidation would eliminate all competition, and, also because the Chamber of Commerce is strongly in favor of the Boston & Maine financing its improvements by an issue of its own securities.

The company has sold to Kidder, Peabody & Co., of Boston, $9,000,000 first mortgage bonds of constituent companies. These bonds have been held in the treasury. In addition, the company has sold about $2,000,000 short term notes to Kidder, Peabody & Co. Proceeds from the sale of these securities will provide upwards of $11,000,000 to meet an equal amount of notes and bonds which mature between now and January 1, 1910.

NORFOLK & WESTERN.—A semi-annual dividend of 2 per cent. has been declared on the common stock. This is a reduction of the annual rate from 5 per cent. to 4 per cent.

The Guaranty Trust Co. of New York has sold $7,500,000 two-year 5 per cent. notes of May 1, 1908-1910. These notes are secured by $10,000,000 divisional first lien and general mortgage 4 per cent. bonds of 1904-1944. The notes were offered at 99, yielding 5½ per cent.

SEABOARD AIR LINE.—The receivers were authorized on April 18 to issue $3,564,000 six per cent. receivers' certificates, dated May 1, and redeemable after six months.

SPOKANE INTERNATIONAL.—See Canadian Pacific.

WATERLOO, CEDAR FALLS & NORTHERN.—This company has made a mortgage securing $2,000,000 five per cent. bonds for extensions. The road runs from Cedar Falls, Iowa, via Waterloo and Waverly to Sumner, 52 miles. It also operates street car service at Waterloo and Cedar Falls.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York, N.Y., and the names of the officers and editors of the Railroad Gazette:

OFFICERS:

W. H. BOARDMAN, *Pres't and Editor*
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RAY MORRIS, *Secretary*
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BRADFORD BOARDMAN

CONTENTS

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Being content with loose, inaccurate and incomplete knowledge on important subjects is said to be one of the economic sins of the American people; and we are certainly open to the charge. An illustrative example may be found in the newspaper statements concerning the proposed general advance in freight rates. A Washington despatch of May 2 says that "the anticipated general increase in railroad freight rates seems likely soon to be made. The railroads of the southeastern territory have filed tariffs, effective June 1, increasing freight rates on fresh meats from 3 cents to 10 cents per 100 lbs. This will mean much to the consumers, as it will probably result in an increase of 1 cent a pound on low grades of meats, and perhaps as much as 2 cents a pound on the select cuts. This advance is intended as a feeler of public sentiment, with a view to making a general raise in rates on all commodities." The one statement in this item that will be remembered by the majority of readers is that meat is going to cost 2 cents more a pound—because of the exactions of the railroads. The highest proposed advance in freight rates is one-tenth of one cent a pound (and the lowest is three-hundredths of a cent), so that 1⁹⁄₁₀ cents of the 2 cents added by the retailer is for his own benefit; but that is a point which the reader does not notice. Probably the reporter is quite innocent, for if he saw the absurdity of the statement he would modify it, no doubt. In modifying the article he could lengthen it and thus increase his pay. It is all right for the railroads to put out feelers at proper times and places, but evidently the retail meat trade is not a favorable field in which to try the experiment; the art of raising prices on the strength of a false issue is too well known there.

There is one great objection to feelers just at present, though theoretically they may seem to be justified; it is a time when every man is engrossed with his own internal feelings—intense feelings—engendered by loss of business or fear of loss; and external things are likely to have no influence on him. If he gives a thought to freight rates at all, it will be to observe within himself that all other commodities are falling in price, and that the railroads must be fools. Wages controlled by labor unions, and the prices of some things controlled by powerful corporations, are, indeed, kept at high levels; but the "average man" does not consider these; he thinks more of those wage rates and commodity prices which are ruled by the law of supply and demand. Even if a railroad does feel justified in putting out a feeler, it is probable that a very small and very mild one will be the best. It will be at least two or three months before the rate clerks can prepare tariffs for the general advance that is talked of, and another month will be required for the statutory notice; and to feel the public pulse three months before the surgical operation is to be performed may be worse than useless. In that period there will be time for many changes to occur. One change may be important; the railroad presidents may change their minds as to whether an increase can be agreed on. They may conclude that the rates which cannot possibly be raised are so numerous as to make a general increase wholly impracticable. There is one other contingency: nearly all of these proposed changes are in interstate rates, and those presidents who have conferred about them may be imprisoned for violation of the anti-trust law!

The establishment of a through subway connection between Atlantic avenue, Brooklyn, and the main line on Manhattan island has an importance far beyond that of its immediate benefits. Heretofore, the time required for transit to the remote parts of Brooklyn and to Long Island points has been so great that development was slow; a densely populated territory had to be traversed and a river crossed. But the time-saving of the subway route is tremendous. The Long Island commuter to Wall street saves some twenty minutes each way; nearly or quite three-quarters of an hour a day. the man who sleeps in the Flatbush part of Brooklyn and works in Manhattan saves more than that. Since suburban residence around great cities is determined largely by two factors—ground rent and time of transit—it is obvious that the great empty areas east and northeast of Brooklyn are now going to have their chance, and that a great many city workers are going to have more light and air than they have ever before been able to have at the same rent without increasing the time length of their daily journey. The position of the Interborough Rapid Transit Company as a beneficiary of this travel is most interesting. By giving a service unparalleled in all the world, it gets a maximum haul in both directions at the same time during the rush hours. The southbound train that discharges a mob of passengers at Fulton street and at Wall street at 8.30 a.m. leaves Atlantic avenue 18 minutes later, northbound, with the cars crowded—that is to say, the same train discharges two maximum loads at Wall street in a little over thirty minutes. The Long Island Railroad is almost as fortunate as the Interborough, though not for the same reason. For years it has been spending great sums on its Atlantic avenue improvement, taking the tracks off grade, where rapid service was impossible, and building a splendid tunnel and elevated structure. Now the Interborough brings it the business for this line, and will doubtless continue to bring increasing amounts of it every year, changing the Long Island from a June-to-October road to a January-to-January one, and building up a steady suburban traffic that will tend to push out further and further along the main lines. Last but not least is the tribute the subway extension brings to construction by private capital. The Interborough contracted to open its line on May 1, and it opened it on May 1, in spite of all the construction difficulties that arose. When the city undertook the vastly simpler task of operating the Staten Island Ferry its new boats were two seasons late, its Staten Island terminal three seasons late, and its New York terminal is four seasons late at time of writing, and gives abundant promise of another year.

THE STRENGTH OF CULVERT PIPE.

There is little published information regarding the stresses to which culvert pipes in railroad embankments are subjected by the conditions of bedding and earth pressure. The ordinary cast iron water pipe, generally used for this purpose, is designed merely to withstand the internal hydrostatic pressures encountered in service, since in most cases this gives pipes of the desired rigidity. The external stresses have heretofore been regarded as indeterminate, authorities agreeing that there seemed no satisfactory way of computing them. For that reason the tests which have been made at the University of Illinois on both cast iron and reinforced concrete culvert pipe are of special interest and value in throwing light on this subject.

The experiences of different roads with cast iron culvert pipe do not seem to be uniform, some claiming to have little or no trouble, while others have a great many breakages. We have heard of one road which made it a rule not to use cast iron pipe in banks under 10 ft. or over 25 ft. high. But the real conditions to be observed are careful bedding and tamping to assure as even a distribution as possible of the bearing pressures. This may be further helped by shoring up the barrels of the sections to equalize the support, and some roads do this.

Proper trenching is presupposed. Engineers have reported pipes breaking without apparent adequate cause. With the ordinary rectangular-bottom trench it is harder to equalize the pressures than where the bottom is curved and the material is well tamped around and under the pipe. Tamping is very necessary; otherwise, the earth immediately under the bottom element is unduly compressed and concentrated loading results. There is a record of some 48-in. cast iron pipe $1\frac{1}{4}$ in. thick being flattened $\frac{1}{4}$ in. under an 8-ft. fill, and more than $\frac{7}{10}$ in. under a 22-ft. fill. Pipe of these dimensions distorts slightly from its own weight, careful measurements of lengths lying on the ground, and therefore having one line of support, showing a difference between the vertical and horizontal diameters of over $\frac{1}{10}$ in. With an increase of the thickness to $1\frac{1}{2}$ in. this distortion was not noticeable.

The results of the University of Illinois' tests were presented in condensed form by Professor Talbot, of that university, in a paper presented at the April 15 meeting of the Western Society of Engineers. In addition to the main tests, the investigation included a lot of auxiliary tests to give data on the action of pipes in other methods of testing. In discussing the mechanics of pipes and rings subject to external pressure, formulas were developed for the bending moments under certain assumed conditions of loading. These are intended only to serve as a basis for calculations, since the assumed conditions do not represent accurately the conditions of bedding and loading found in practice. The nature and extent of the possible or probable variations from the assumed conditions were discussed, however, and the effects of such divergence considered. In the main tests a special testing apparatus was used. It included a box of stiff construction, the pipes being embedded in sand in this box and the load applied through a saddle resting on the sand cushion. Nine cast iron and five reinforced concrete culvert pipes were tested. Both light and medium weights in the cast iron pipes were used. Four were of 36 in. diameter, two being 1 in. and two $1\frac{1}{4}$ in. thick. Five were of 48 in. diameter, three being $1\frac{1}{4}$ in. and two $1\frac{1}{2}$ in. thick. In the order given, the average breaking loads were, in pounds per lineal foot, 24,750 lbs., 37,250 lbs., 28,800 lbs. and 51,950 lbs.

The reinforced concrete culvert pipes were the designs of the Chicago, Burlington & Quincy Railroad, described in the *Railroad Gazette*, October 12, 1906, but improved in a number of respects since that time. All of the pipes were 3 in. thick, the difference being in the method of reinforcing. The load at first crack, in pounds per lineal foot, varied from 4,950 to 10,960 lbs. The maximum load varied from 23,800 to 31,500 lbs. The data does not indicate the method of reinforcing corresponding with these figures. It should be mentioned regarding these pipes that two of them were frankly experimental, and in one, for some reason unknown, the concrete proved poor. Only two of the five, therefore, were representative. We assume that it was these two that showed the highest loads.

One notable difference between the reinforced concrete and cast iron pipe is that while the latter collapse completely under a maximum dead load, the action of the reinforced concrete pipe is quite different. Final failure is through crushing of the concrete, and after passing the critical load there is a large margin of strength available in an emergency. Reinforced concrete pipe can be made as strong as cast iron pipe simply by increasing the thickness of the concrete, the gain being proportional to the square of the diameter. The object with this pipe, however, should be simply to make it strong enough to stand the service when carefully and properly laid and thus save as much as possible over the cast iron pipe. Another consideration is the possible saving in transportation costs, which are sometimes excessive on new work. We have heard of one case recently where 60 cents per ton mile was paid for testing cast iron culvert pipe for a new line which was being built through very rugged country. Reinforced concrete pipe can be made at or near the site, saving this considerable additional expense.

PIECE WORK AND PREMIUM WORK.

For just about ten years, or from 1898 through the greater part of 1907, the railroads of the country had so much work to do that the problem of getting it done was paramount, and economy and efficiency had often to be subordinated. Following the brief let-up in the fall of 1903 and the early part of 1904, the urgency was greatest in the last three years of the period of great prosperity, and one very unfortunate result of this urgency was the lessened control of the general manager, the superintendent, the division superintendent and the master mechanic over their men. When men are looking for jobs they are very amenable to discipline; when jobs are looking for men discipline is an exceedingly hard thing to enforce, and the practical application of this principle was, as everybody knows, that operating costs got pretty well out of hand last year. The day's work was small, the price high, the quality not good. Estimates of the average loss of efficiency per unit of labor ranged all the way from 15 to 50 per cent. or even higher, while wages had increased from 10 to 35 per cent. within two years.

The great economies now being practiced in all railroad departments are not due primarily to the increase of individual efficiency, they are due to rigorous weeding out of unnecessary labor—even of labor which is going to be necessary again very soon—to cessation of all except the most urgent work, and, to a certain extent, to reduced costs of material, principally lumber; but the individual efficiency is there, too, to an extent that it has not been for a decade, and the output of work along all lines where it is not strictly measured by rule is astonishingly great, per unit of labor. The place where it has been most difficult to put economy on any sort of basis that gives signs of permanency is in the shops. Wage reductions have been very difficult to make, with the result that a great many men have lost their jobs entirely who could have been retained to mutual advantage if a small general scaling down could have been effected.

It is very natural that it should have occurred to a great many master mechanics and general managers that the times were favorable for an extension of the piece work system or the premium system of work. Piece work and premium work have, on the whole, succeeded very well where they have been firmly established, but there has been the greatest difficulty in establishing them. The attitude of the mechanics' union has been not to refuse work in shops where piece work was already established, but to fight with the greatest bitterness new extensions of the principle. The reasons for this are very plain. When it comes to a show-down, union labor is unable to drive piece work and premium work out of its present strongholds, and it does not care to make the attempt, but every extension of the principle means more workmen who see a tangible reason why they should not be bound to the standard of the dullest—and labor and trade union strength, in the last analysis, rests on the standard of the dullest. It may truly be said, therefore, that piece work and premium work have two very important uses which are clearly defined from one another; they lessen manufacturing cost and they tighten the hold which the general manager or the master mechanic has over his men, not by imposing hard conditions, but by granting very easy ones, and by showing a workman, in terms of dollars and cents, that when he is doing good work for his company he is doing good work for himself, and that if he cares to be a sluggard the cost is borne by him and not by his company.

The strength of the piece work plan and of the premium plan alike is on the surface; the weakness of them lies in the violence which they do to human nature, particularly during the critical period when they are being discussed, but are not in operation, and the labor organizers have been quick to take advantage of the arguments which appeal most quickly to human nature. Unfortunately, in some cases, these arguments have been entirely true. The standard labor union argument against piece work is that the faster a man works the faster he has to work, and if there are three extremely able machinists in a shop of twenty, all working on piece work, in the long run there will be three men earning standard wage and 17 below, instead of 17 men earning standard wage and three men above standard.

Let us frankly admit that this has sometimes been true, or at least that the principle of it has sometimes been found, although the case as stated is exaggerated; but it has not generally been true. The three pacemakers have generally been able to earn a good deal more than they could have earned on the day wage plan, and the rest of the shop has also generally been able to increase its earning power, while the really useless men have been eliminated; but it has been necessary to handle the shop with the greatest care, the greatest skill, and the greatest fairness, to bring this about. When a shop is first put on piece work the master mechanic generally does a little quiet tallying for a few days or a few weeks and gets a good line on the normal average output of the ordinary man, and it is not difficult to get a fair average price out of the figure thus obtained. The difficulty has lain in convincing the workmen that it was a fair price. The premium or bonus plan undoubtedly has an advantage that psychology affords it in this connection. Under the normal workings of the premium plan the workman has his regular, accustomed day wage anyhow, and if he is disposed to accelerate he can earn a premium on the output above an established standard. If he cannot earn a premium, no harm is done; if he can, he does not damage his neighbor even in theory, because his neighbor's guaranteed wage is not affected thereby.

To ascertain the progress of the piece work and premium work movement we recently made inquiry of a large number of railroads, asking them whether or not they were using these methods and how the plan was working. Most of the officers who replied to our inquiry felt that the subject was a delicate one and did not wish to be quoted, either by name or by the name of their company, for the opinions which they expressed. It is possible without violation of confidence, however, to point out in a general way some of the tendencies which clearly appear from the correspondence.

It is curious and interesting that out of fifty replies, gathered from all parts of the country, and representing small individual railroads and large railroad systems alike, the division between those who use piece work or premium work, in whole or in part, and those who do not, was exactly even—25 to 25. Of the respondents who do not make use of piece work ten may be classed as individual roads, relatively small, and fifteen as railroad systems, relatively large. Of the twenty-five companies using piece work or premium work in whole or in part, eighteen are large roads and seven are small roads. It has been substantially the unanimous experience of piece work and premium work shops that car repairs were most easily placed upon the unit basis. In most cases locomotive repairs are also done on this basis, but one or two roads reply that they have been unable to make the change in the locomotive department. Yet difficulties arise in connection with repair work which are found to a much less degree in original manufacture. Where the employee makes only one article as his whole occupation, it is comparatively easy to adjust his pay; where any question arises as to the amount of time it ought to take to do the job, the uncertainty is always very unsatisfactory to the men. Thus in the repairs of freight cars a man may receive a given amount for changing a drawbar, but if the weather conditions are against him, or the make of the drawbar is peculiar, he is unable to make as much as his neighbor who is in better luck. The skilled mechanics on one road make objections on the ground that piece work and premium work alike restrict and limit a man to doing one thing, thereby narrowing his efficiency and limiting his ability. Some of the competent mechanics on this road, who have served their time and know that they are efficient workmen, feel strongly that they cannot afford to restrict their fields of work by confining their efforts to one line or to one machine.

The human nature objection to piece work—that the few men in a shop who can earn abnormally high wages are disliked and distrusted by all the others—is probably the most serious obstacle of all and requires much tact and fairness on the part of the master mechanic. As one superintendent of machinery puts it. "If the piece work price is high enough for the poor workman to make fair wages, the good workman will make such high wages that it is unsatisfactory to the other men."

These difficulties are all tangible, and the obvious chance which the shop foreman or the master mechanic has to discriminate between men and between trades by the piece price which he establishes is also obvious, consequently these objections have been urged so strongly that many roads have tried entirely without success to put some unit pay plan into effect, while others would like to try, but have given it up as hopeless without an attempt. In view of these things it is most interesting to trace out the actual workings of the system. (For simplicity we are now grouping piece work and premium work together, although the principle is radically different. A separation of the two will be made further on in the discussion.) The following list is taken direct from our replies and shows the different kinds of work which different roads specify they are doing on the piece or premium basis:

Turning car axles	Switch and frog work in forge shops
Boring car wheels	Buffing
Moulding	Part of tinsmith work
Some work in blacksmith shop	Coach cleaners
General repairs to locomotives	Brass cleaners
Work in paint shops	Caboose shop
Car cleaning	Air-brake shop
Wiping	General locomotive repair work
Upholstering	New car building
Bolt making	New locomotive building
Steel car repairs	Certain machine tool work

We asked specifically how the earnings of the men and the economy to the road compared under the two systems, and we have tabulated the specific replies to this very important question as follows:

	Men earn.	Saving to company
Road A	55 per cent. more.	45 per cent.
" B	1/3 to 1/2 more.	Output very much increased
" C	12 to 15 per cent. more.	15 per cent.
" D	25 per cent. more.	25 per cent.
" E	25 to 35 per cent. more.	....
" F	15 to 25 per cent. more	20 per cent.
" G	33 1/3 per cent more.	50 per cent
" H	Some men do not make their day rate, others on the same class of work make from 5 per cent to 18 per cent. above it.	

One large road gives a detail statement as follows: For the 1901 fiscal year, during which year all the company's shops doing general repair work turned out 282 locomotives, the cost of labor was $244,706. During the fiscal year 1907, when the company's shops turned out 491 locomotives, the cost of labor was $287,953; that is to say, the number of locomotives increased 74 1/2 per cent. in 1907 over 1901, while the cost of labor increased only 17.7 per cent. This change was not brought about entirely by the piece work system, since standardization of power, new and more improved machinery and better shop facilities also helped, but the principal item for the increased output and relatively reduced cost was the change from day work to piece work during the period. It is noteworthy in this connection that the average weight of the engines increased 66 per cent. during the period.

Another road gives the following comparative statement of employees working at piece work and at day rate in March, 1908:

Comparative Statement of Employees Working Piece Work and at Day Rate, March, 1908.

Department	Total amount earned: Piece work.	Total amount earned: Hourly rate	No. men who worked at: Piece work.	No. men who worked at: Hourly rate only	Average hourly rate paid for: P. W., cts.	Average hourly rate paid for: D. W., cts.	Efficiency for P. W. over day work per cent
Erecting	$1,051.31	$6,647.28	93	93	29.88	22.56	33.6
Machine	4,729.80	1,773.48	76	106	38.50	22.21	72.3
Blacksmith	3,060.24	2,137.85	72	26	34.33	22.13	55.1
Boiler	1,633.56	5,117.24	54	99	33.50	21.11	58.5
Air brake	1,176.92	1,945.20	16	40	44.25	22.81	94.0
Tender	854.62	203.59	21	5	23.52	18.05	[illegible]
Total	$12,506.45	$20,824.64	332	369	34.00	21.17	58.3

The foregoing outline of the piece work and premium work problem the present status of it and the economies to be effected by it must be regarded only as preliminary. We desire to enlarge the discussion, particularly with reference to the objections, good and bad, brought forward by labor when it is proposed to introduce piece work and to the best ways of meeting these objections. We shall welcome additional correspondence on this subject.

General Electric Company.

The sixteenth annual report of the General Electric Company, for the year ending January 31, 1908, shows gross profits of $6,586,653, after deducting all patent, general and miscellaneous expenses and allowances for depreciation and losses, and writing off $3,745,989 from factory plants. After paying $5,183,614 in dividends, a balance of $1,403,039 was carried to surplus account, bringing up the total surplus as of January 31, 1908, to $16,513,836. Last year the company's profits were $8,427,843, but the actual sales billed in the 1908 year amounted to $70,977,168, as against $60,071,883 in 1907.

The reports of the General Electric Company have for some time stood as an example of the way an industrial company ought to handle its finances and tell the public about them. The picture of the business year is made perfectly plain, and there are no frills in the asset and inventory values. The company has naturally had to make very heavy expenditures in the purchase of patents and will presumably have to continue doing so for many years to come in order to keep abreast with the best electrical science of the day. The value of its patents, franchises and good will account stood on the books of the company at $8,000,000 on January 31, 1897. On January 31, 1907, this account had been reduced to $1 by progressive writings off, charged to the current operating surpluses. During the 1908 fiscal year the company spent $872,346 in acquiring other patents, licenses under patents and in patent litigation, and promptly charged it off to profit and loss, so that the company's patents, franchises and good will still stand on the books at $1. This is an admirable record, and the manner in which the book values of the factory plants have been written off, year by year, is no less admirable. Starting in 1893 with plants at Schenectady, Lynn and Harrison, valued on the company's books at $3,958,528, the company during the subsequent 15 years to date has spent $30,892,486 on expenditures and betterments to its plants, making a total of $34,851,014, from which 22 millions have been written off for depreciation and replacement, leaving the book value of the plants, on January 31 of the current year, at $12,900,000, entirely free from mortgage or other lien; an average valuation of but $2 per square foot of floor space, including land, buildings, power houses, machinery, tools and all other equipment.

The company on January 31, 1908, had no floating debt at all and had only $1,759,517 in accounts payable, as against $29,857,727 of notes and accounts receivable. It reported $12,250,721 of cash, as against $3,910,709 in January, 1907, the difference being in considerable part accounted for by the funds derived during the year by the issue of $12,872,750 of 5 per cent. 10-year convertible debentures and by the sale of $1,594,600 of new capital stock. Thus the company's cash position is excellent, as it is highly important that it should be. Collections of its very large accounts receivable will presumably be slow in dull times, although the company actually collected some $66,000,000 from notes and accounts receivable during the year, as against $53,000,000 collected in the 1907 fiscal year. All but $3,544,586 of the $27,094,348, representing the face amount of notes and accounts receivable on January 31, 1907, was collected during the year.

Among the important orders received during the year were: One hundred and sixty-five-mile transmission for Great Western Power Company, California; Detroit tunnel electrification; Cascade tunnel electrification, Great Northern Railway; electrification of Southern Pacific suburban lines in California; electrification of Hudson tunnels; additional equipment for West Jersey & Sea Shore, and for New York City terminal of the New York Central.

The following table shows the company's sales and orders for the last six years:

	Sales billed.	Orders received.		Sales billed.	Orders received.
1908....	$70,977,168	$59,301,040	1905....	$39,231,328	$35,094,807
1907 ..	60,071,883	60,483,659	1904....	41,699,617	39,060,038
1906 ..	43,146,902	50,044,272	1903....	36,685,598	39,941,451

NEW PUBLICATIONS.

Locomotive Breakdowns, Emergencies and Their Remedies. By Geo. L. Fowler. Revised and enlarged by Wm. W. Wood. New York: Norman W. Henley Publishing Co. Fifth edition, 266 pages, 4½ in. by 6¾ in., 90 illustrations, semi flexible cover. Price, $1.00.

This is a revision and enlargement of a book that was first published in 1903 and was reviewed in the *Railroad Gazette* for November 27, of that year. The present revision consists of the addition of chapters on the Walschaerts valve gear and the Pyle-National headlight, the intercalation of a number of questions into the chapter on injector troubles, a complete revision and rewriting of the chapter on air-brake troubles and the omission of the one on the first aid to be given to the injured. The book is valuable and convenient.

American Railway Association, Proceedings, Vol. IV, 1903-1906. New York: Published by the Association, 24 Park Place. Price, $5.00.

This volume of the Proceedings brings the record down to and including October 24, 1906. It consists of 737 pages and, as in former volumes, the index is very full, serving in some cases to make unnecessary a reference to the text. For example, under the head of Car Service Committee's reports, the index item consists of a two-page abstract of the things done at the several meetings which were held in the four years covered by this volume. All of the doings of the association in connection with the International Railway Congress at Washington in 1905 are here recorded. The volume also contains the Rules for Determining the Educational and Physical Qualifications of Employees, which were reported in September, 1904, and again in April, 1905; also all the revisions of the standard code which were adopted in the four years named.

CONTRIBUTIONS

Written Examinations on Train Rules.

New York, May 4th, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your editorial on "Written Examinations on Train Rules" in your issue of April 24, 1908, you state "we understand that this is the first interurban road to follow this plan." The writer begs to call your attention that complete written examinations were required of all trainmen by the Rochester & Eastern Rapid Railway Company more than two years ago.

J. H. PARDEE,
Operating Manager, J. G. White & Co.

Young and Inexperienced Telegraphers.

TO THE EDITOR OF THE RAILROAD GAZETTE:

According to a press despatch of April 28 the Railroad Commissioners of New Hampshire blame the Federal government for a butting collision of freight trains which happened near Haverhill, in that state, on March 20, and in which five men were killed and two others injured. Because of the Federal statute the road "had to hire young and inexperienced operators." The collision was due to the dropping of the word "East" from a telegraphic order directing the trains to meet at East Haverhill, making it read "Haverhill." The trains met at Haverhill, running 30 miles an hour.

I do not know whether this is a true report of the Commissioner's opinion but there is no doubt that many citizens do accept the view set forth, especially where an official body, competent or incompetent, promulgated it as a reasonable one; therefore I ask you to take a line or two to show its absurdity. Assuming that good operators really are unobtainable, how is it that the New Hampshire Commissioners did not earlier report the fact to Washington? Congress allowed a year in which to prepare for the law, but no protest was made until the year had nearly expired. And if poor operators have to be employed is it rational to run trains in exactly the same way as though the offices were properly manned? It would seem more reasonable from the standpoint of safety of life and limb to reduce the speeds of trains if the operators are not well trained; or to run trains entirely by time-table rules as we used to do, and not to try to use the telegraph. Suppose the Federal government had ordered the railroads to dismiss their bridge inspectors and boiler inspectors and trust to luck for safe passage over bridges and for immunity from boiler explosions; would a sensible New Hampshire railroad man obey the order and continue trusting his life on his trains? Of course not. He would either disobey the order or else cease running trains. If the Federal government requires impossibilities why not accept the situation, and "lay down"? Then Congressmen might perhaps see their folly.

D. W. C.

[If such a dilemma really exists, the superintendent who aims to give safe service is indeed "up against" the question of going back to the methods of 1850. More likely, however, the story is only a hodge podge of generalities. We cannot class it as "sensational" because operators who omit words from orders, and despatchers who fail to detect errors in operators' repetitions have been heard of too frequently in the past. If "young and inexperienced" persons are the only ones available as telegraphers and if after a year no remedy is discoverable, it would seem wise to use telephones, as a number of railroads have done. Surely, an established railroad is not reduced to the necessity of employing "young and inexperienced persons" as station agents. But why have not the New Hampshire Commissioners long since secured the adoption of the block system in that state? Under that method of regulating trains "young and inexperienced" persons are far less likely to make fatal errors.—Editor.]

Refrigeration in the Transportation of Fruit.

BY JOSEPH H. HART.

The transportation of fruit from California and the South constitutes an ever increasing phase of railroad freight. The question of the preservation of this fruit during transit is one that has been solved in a general way with more or less success. At present, the greater part of the fruit is shipped under two general systems, namely, ventilation and icing in the winter and early spring when temperatures are low. The fruit is shipped in refrigerating cars with the ventilators left open, so that currents of air circulate through the car when in motion. Later in the season when the temperatures are higher, ventilators are closed and the tanks at the end of the cars kept filled with ice. Both of these methods are subject to considerable objection and are very inefficient from an economic viewpoint, at least in comparison to the possibilities in this line. In order to supply adequate ventilation the cars are never completely filled and the ice tank at the end of the car represents so much waste space. When ice is used the fruit undergoes a gradual cooling process which sometimes takes as much as seven days to lower the temperature of the fruit to that at which decay is prevented. Thus the ice must not only do the duty of cooling the fruit but also maintain low temperatures during transit. At least this is the condition in theory, while in actual practice much of the fruit is merely undergoing initial cooling during the entire period of transportation.

In order to determine the bearing of the different methods of handling and shipping and also of the effect of delayed shipment upon the losses by decay and the keeping quality of the fruit after arrival at the market a comprehensive series of shipping experiments have been conducted in California and elsewhere by the United States Agricultural Department and some interesting results have been attained. The results of these experiments are quite fully set forth in a bulletin which is in process of publication by the Bureau of Plant Industry. However, a number of railroads and individual shipping associations have conducted a series of similar experiments which have equal bearing upon the conditions and these are not fully stated.

Pre-cooling of the fruit has been the line upon which all these developments and experiments have been attempted. Oranges shipped from California have been pre-cooled in the government experiment plant in Los Angeles, and the Santa Fe interests and Southern Pacific system have also erected plants of the pre-cooling type. The chief difficulty in this process of pre-cooling is in the time which must elapse in order to accomplish this. Generally from 18 to 24 hours is required to cool oranges or other fruit in bulk to a temperature at which decay is impossible, and even under these circumstances portions of the fruit are cooled considerably below the danger point at which freezing occurs. The railroads, however, and private interests as well, are going ahead with pre-cooling plants, and it undoubtedly will prove a commercial success not only on account of the saving in fruit due to diminution in decay and the better quality of the shipment after transit but on account of a large number of other factors which enter as well in limiting the efficiency of the transportation process.

Thus pre-cooled fruit requires less ice for its transportation since the sole duty of the ice under these circumstances is to maintain the initial temperature. It is even advocated that pre-cooling be used during the period where ventilation is the prevailing method and icing is not necessary. With pre-cooled fruit, packing can be much closer and ventilation is not nearly as necessary and need not be as thorough. Thus recently oranges have been shipped to New York City in car lots from 519 to 584 boxes each, an increase of more than 40 per cent. over the standard car of 384 boxes. This increase in capacity is due not only to closer packing but higher packing as well. In many refrigerator cars during the icing period it is impossible to fill the car on the top tiers without very considerable loss due to the fact that the temperature is much higher at all times in the top of the car than in the bottom. With pre-cooling the average rise in temperature at the top of the car is from 8 to 10 deg. and the bottom about one-half of this. Even with this rise in temperature the average temperature of the fruit on arrival is usually lower than it is in a car under standard icing under the same conditions of weather and transit.

This development of pre-cooling fruit before shipment is undoubtedly bound to be of increased importance in the near future. The saving in ice for icing in space for shipment, in inefficient labor in handling, and in improved quality of the shipment after transit, are the main features which determine this result. With this question of pre-cooling as one apt to become important, the question of methods of pre-cooling and a determination in regard to the agent for the performance of this duty are of interest. Undoubtedly the railroads in supplying refrigeration for shipment do not keep the material cooled during transit. The effect of icing is merely to produce initial cooling toward the end of the transit period. The advantages of pre-cooling may be such in the line of space and increased efficiency for the railroad that they may undertake this duty for their own individual interest. The question of time involved, however, during this process is one of very great importance and its solution is dependent upon a number of factors which may or may not limit the efficiency. Thus, to-day pre-cooling is accomplished either before packing or after installation in cars. The Southern California system has erected in central California a plant of the car cooling type. This plant is arranged to cool one car at a time by circulating cold air through the car. It was completed too late this season to be used for extended experiments. A few experiments have been conducted by the Department of Agriculture here in the pre-cooling of grapes but considerable difficulty has been encountered in the cooling of the grapes at the centers of the packages. The Santa Fe line has erected a plant of the warehouse type to which the fruit is brought and unloaded for cooling. This plant has a capacity of six or eight carloads and is provided with an air circulation system. The government plant at Los Angeles is of the car cooling type, with air conducts and fans capable of handling large quantities of air, and is similar in many respects to the installation by the United Fruit Co. at Springfield, Mo., installed for the refrigeration of the bananas during transit. An average of 18 hours is generally required for cooling shipments already installed in cars by even the best methods of refrigeration. More inefficient methods easily require an increase in time of 50 per cent. over this amount.

The cooling of fruit before packing will probably not be accomplished without considerable development in refrigeration practice and the design of automatic handling machinery, since employees object to working in the low temperatures in packing. Thus, if pre-cooling is to come under present conditions, it must be accomplished either in car units or package units. The question of adequate refrigeration is essentially one for refrigerating engineers and presents interesting new developments, although ones not involving new principles. Again, from the railroad or shipper's point of view must be considered the first cost of installation of a refrigerating machine in consideration of the fact that this latter is used only a small fraction of the time throughout the entire year. The question will be in regard to the installation of these plants, whether a series of small plants will be more efficient in actual practice than the shipment of the fruit directly to large central station pre-cooling plants or whether possibly the refrigeration can be sent by pipe line to a number of surrounding sections. A number of interesting developments and possibilities present themselves to both the railroad manager and the refrigerating engineer in this development. The possibility of utilizing ice plants for this system is of interest to the railroads, since natural ice is in the majority of cases the chief source of refrigeration in this field, even though mechanical refrigeration can be accomplished very efficiently and with a distinct advantage to the railroads. Again, not only is variability of supply for transportation an important factor in railroad consideration, but often personal interests and weather conditions affect the demand greatly. Thus in the last season the Santa Fe system was compelled to carry 20,000 tons of ice nearly 1,000 miles to take care of an increase in the shipment by icing of about 10 per cent. of the citron crop. This increase did not represent increase in output really but was merely an increase in the percentage of the citron crop supplied to the railroad for shipment under standard icing conditions.

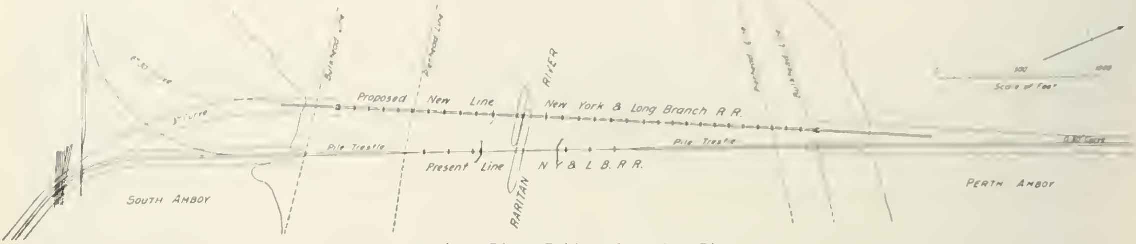
Thus the problem to the railroad is an essentially complicated one; not only cannot the demand for refrigeration be accurately foretold from crop conditions but immediate weather conditions enter as well. The requirement for railroad refrigeration is an extremely mobile and transportable refrigerating plant embodying all the increased efficiency of the mechanical refrigeration in the production of the icing but one capable of operating in large units with great efficiency and under what are often regarded as inadequate conditions by the refrigerating engineer. Whether this problem will be satisfactorily solved from the railroad viewpoint is a matter for the future alone to decide.

Training Enginemen—Prussian State Railroads.

The Prussian State Railroads had a rule which required a preliminary training as machinist or smith of all those who were permitted to become locomotive firemen. As an experiment, trial was made of approved laborers who had no trade, especially of men who had had experience in cleaning the engines. This has been so satisfactory that the practice will be continued; but such firemen are not eligible to promotion as locomotive enginemen, for whom the shop experience continues to be obligatory. And it is only after eight years' service on the railroad that laborers may be made firemen.

Raritan River Bridge; New York & Long Branch Railroad.

When the new bridge over the Raritan river between Perth Amboy, N. J., and South Amboy was put in operation on April 21, the New York & Long Branch Railroad was relieved of an obstruction which has been the source of troublesome delays in operation, especially during the months when seashore travel has been at the highest. The road is operated jointly by the Central Railroad of New Jersey and the Pennsylvania, and is on the direct line between New York and the numerous seaside resorts of the eastern coast of New Jersey—Long Branch, Asbury Park, Atlantic City and others. Heretofore, the Raritan river was crossed by a bridge near to the site selected for the one now in operation, but its capacity had been seriously hampered by the fact that although the line is double-track the draw was of the gauntlet type. Occupancy by two roads has made this feature even more objectionable than it would have been under other circumstances. In addition to the improvement which was effected by the reconstruction, advantage has been taken of the opportunity to adjust the alinement at the south end of the bridge so as to ease the curvature.



Raritan River Bridge; Location Plan.

The relations of the old and new alinement are shown upon the accompanying location plan. The lines of the New York & Long Branch and of the Pennsylvania Railroad diverge at South Amboy, just beyond the south approach to the bridge, the latter line leading to Camden and the former to the seaside resorts. As formerly built, there was a 7-deg. curve on the New York & Long Branch just at the approach to the bridge. By a change of alinement such that the south end of the bridge lies some 200 ft. west of the location of the old bridge it has been possible to reduce this curvature to 3 deg. without changing the curvature of the connection with the Pennsylvania line to Camden. This remains at 6 deg. 30 min. The new alinement strikes the former line at Perth Amboy, the new bridge thus standing at an acute angle to the position of the old.

In connection with the change of alinement at the south approach, other changes have been planned, but will not at present be carried out. In general, these involve the removal of the South Amboy station, or rather the construction of a new union station, in the angle of the Y formed by the divergence of the two routes, and the widening of the overhead roadway crossing to permit the construction of a road to the depot parallel to and west of the New York & Long Branch tracks. At present, such trains of the Pennsylvania Railroad as are scheduled to stop at South Amboy are forced to proceed around the curve and then back up to the station. The improvement will involve the expenditure of about $100,000 and will probably be undertaken in the near future.

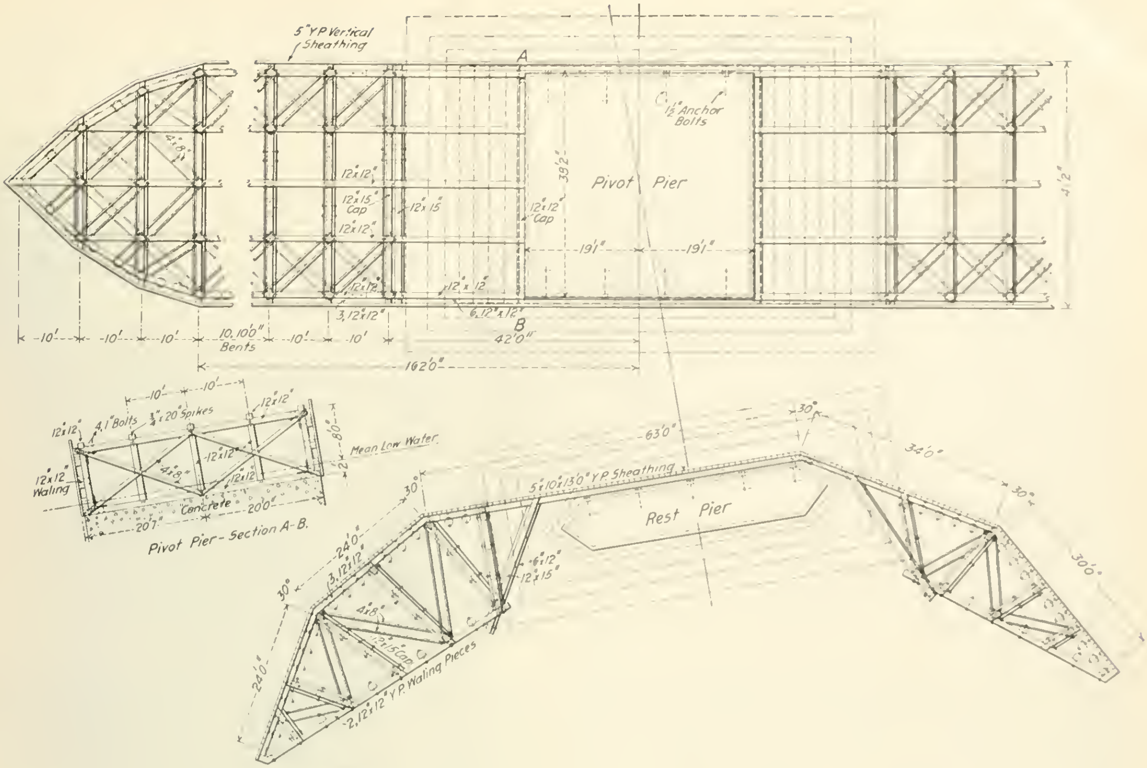
Actual work upon the new bridge was begun two years ago—in February, 1906—though some preliminary work in the way of borings had been attempted before. Owing to the nature of the river bed borings were taken to a depth of 145 ft. as a maximum. The soil was found to consist of mud, clay and sand and gravel in order. Under such conditions piling formed a considerable proportion of the substructure work and some delays were experienced by the difficulty of securing piling of suitable length. As shown by the elevation the bridge consists of 17 spans of 88 ft. each, 11 spans each 100 ft., and a draw span of 331 ft. The magnitude of the pile-driving operations is best indicated by the accompanying table showing the number of piles, the length of piling used and the depth to which they were driven. Piers Nos. 1 and 31 are the north and south abutments respectively, and pier 20 is the pivot pier of the draw span.

Raritan River Bridge—Statement of Piling.

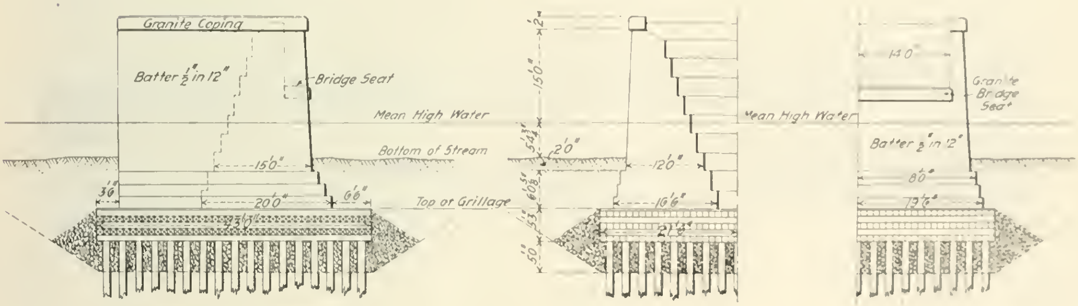
Pier.	Number piles driven.	Length of piles, ft.	Depth driven, ft.
No. 1	291	55 to 59	—25 to —30
" 2	102	55	— 55
" 3	102	65	— 65
" 4	102	80 to 90	—78 to —90
" 5	102	80 " 81	— 81
" 6	102	80 " 84	—80 to —84
" 7	102	84 " 92	— 95
" 8	102	84 " 92	—102
" 9	102	85 " 89	—100
" 10	102	85 " 89	—100
" 11	102	85 " 89	—100
" 12	102	85 " 89	—103
" 13	117	85 " 89	—102
" 14	121	85 " 89	—102
" 15	128	85 " 89	—109
" 16	130	80 " 87	—108
" 17	140	80 " 89	—110
" 18	167	80 " 85	—115
" 19	259	85 " 89	—122
" 20	576	85 " 94	—132
" 21	260	85 " 89	—124
" 22	190	85 " 89	—125
" 23	167	85 " 90	—118
" 24	128	85 " 89	—112
" 25	120	80 " 84	—100
" 26	116	75 " 80	— 94
" 27	102	70 " 74	— 85
" 28	102	60 " 74	— 64
" 29	102	60 " 64	— 70
" 30	102	55 " 59	— 60
" 31	291	55 " 59	— 30

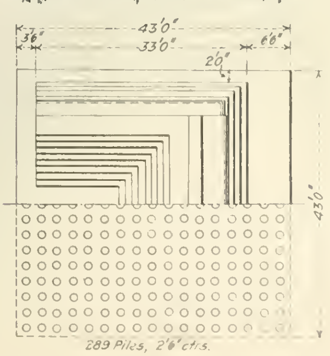
The piers and abutments are of stone masonry with concrete backing. The center pier, rest piers and four piers on each side from the draw are of granite; the others are sandstone. Before piles were driven the river bed at the side of each pier was excavated, and the piles after driving were cut off from 5 ft. above the bottom of the dredged area. The space between the heads of the piles was filled in with broken stone and concrete. A grillage of five courses of 12 by 12 timbers was built upon the heads of the piles, 18 by 41 ft. in the case of piers Nos. 2 to 12 and Nos. 27 to 30, and increasing up to 26 by 58 ft. under piers 22 and 29 by 68 ft. under the rest piers Nos. 19 and 21. Under the pivot pier the grillage is 57 by 78 ft., and in this as under the rest piers six courses of

Raritan River Bridge; New Deck Girders.

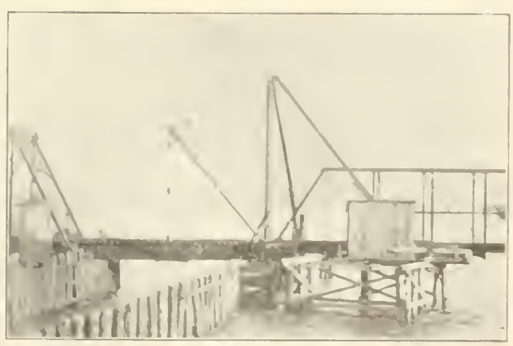


Raritan River Bridge; Pivot Pier and Rest Pier.





Sections and Plan of Abutments.



Improved Draw Span During Construction.

12 by 12-in. timber are used. The grillage and the outer rows of piles are protected on all sides by rip-rap extending to the level of the bottom of the foundation course of masonry.

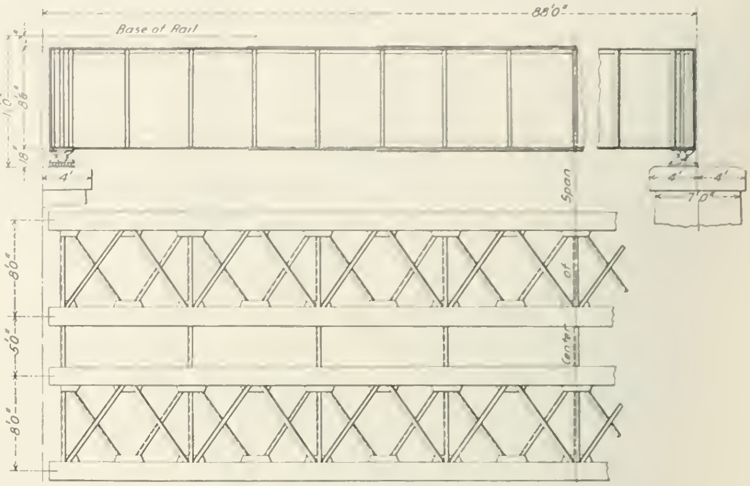
Upon this grillage the foundation courses are carried up to within 2 ft. of mean low water line where neat work commences. The latter is continued on a batter of ½ in. per foot and finished with a granite coping 2 ft. in thickness and with its bearing surface 6 ft. above the line of mean high water. The difference between mean high and mean low water is 5.4 ft.

For nearly the whole of the pile-driving a 70-ft. steam pile-driver was used, and it was found that the same number of piles could be driven in about one-third the time required by the use of the drop-hammer. The driver was one that was built by the contractors with such extensions as were necessary to adapt it to the driving piles of unusual length. The total number of piles driven was 7,600, ranging in length from 55 to 94 ft. Some of the other quantities involved in the work were: Dredging, 72,670 cu. yds.; rip-rap, 16,000 cu. yds.; lumber in grillage, 2,300,000 ft. board measure; concrete below neat line, 11,276 cu. yds.; masonry above neat line, 4,274 cu. yds.; granite coping, 660 cu. yds. The proportions in which the concrete was mixed were 1-2-5.

The entire length of the structure is: From face of south bridge seat to center line of rest pier, 936 ft.; from face of north bridge seat to center line of rest pier, 1,652 ft.; draw span, center to center of rest piers, 331 ft.; total, 2,919 ft. The length of the old draw was 172 ft.

The fenders for pivot and rest piers are built of 12 by 12-in. timbers supported on piling. That of the pivot pier is built in 10-ft. bents with 4 by 8-in. diagonal bracing between piles, 6 by 12-in. clamps and 4 by 8-in. bracing, all of yellow pine, and bolted with 1-in. and 1¼-in. bolts. The sheathing is 5-in. yellow pine placed vertically and carried by three 12 by 12-in. stringers. The bents next the pier itself, on each side, where pile support is impracticable on account of the pier foundation, have six 12 by 12-in. stringers in place of three.

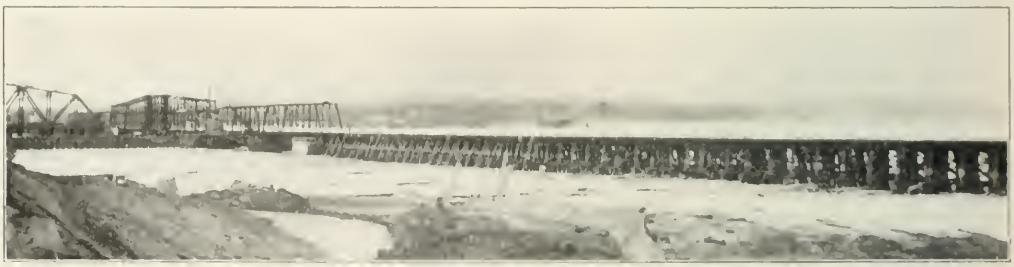
to their former position. The extent of the pressure exerted is shown by the bulging of the surface of the ground as far over as the embankment of the old line, some 200 ft., and by the fact that in some cases the ends of the brace piles were forced through the 5-in. sheathing though supported by the stringers on 5-ft. centers. The position of the abutment, however, was not disturbed.



Elevation and Floor System of Girder Spans.

SUPERSTRUCTURE.

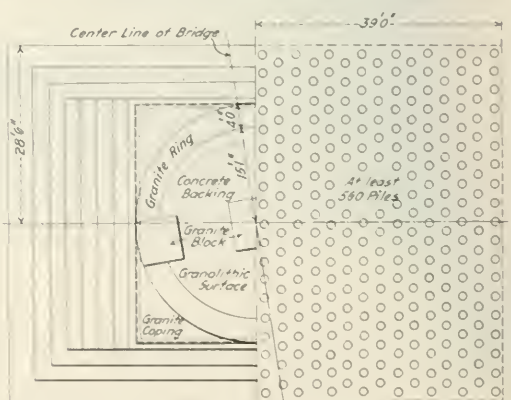
The superstructure, which was erected by the Pennsylvania Steel Company, presents no features of special interest beyond a general appearance of substantiality. With the exception of the draw, all spans are plate deck girders, 8 ft. 6 in. deep; four spans at the south end and 11 at the north end being 88 ft. long, the abutment spans 81 ft., the intervening spans 100 ft., and the draw span, as stated, 331 ft. The plate girders amount to about 4,000 tons of steel and the draw span to about 1,200 tons.



Raritan River Bridge; "Squashed-Out" Bulkhead and Old Trestle.

The fender for the rest piers is carried at an angle of 30 deg. to the face of the pier for a distance of 24 ft., and then at an angle of 60 deg. for a distance of 30 ft. on the side against the current of water traffic, and at the same angles for 24 and 30 ft. on the opposite side. The pivot pier is set at an angle of 10 deg. to the faces of the rest piers with the wider opening facing the current of river traffic. The construction of the rest pier fender is substantially the same as that of the pivot pier protection. The clear channel is 130 ft. on each side of the pivot pier.

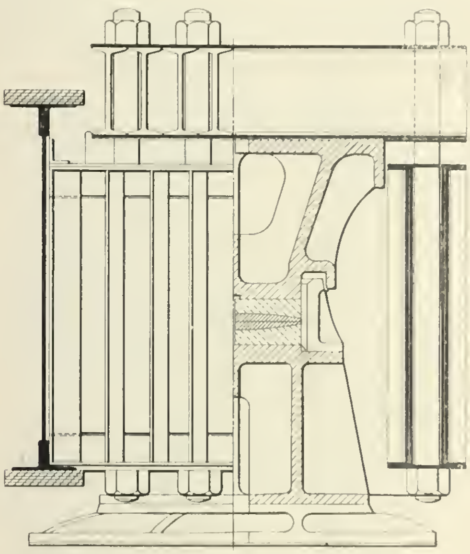
At each approach the embankment is protected by a pile and sheathing bulkhead, that at the Perth Amboy approach being about 380 ft. long and that at the South Amboy approach about 275 ft. These were built 50 ft. on each side of the center line and the piles were driven to a depth of 45 to 50 ft. and spaced about 5 ft. apart with pile brace at each driven pile. The sheathing is 5-in. yellow pine plank carried by two 6 by 12-in. stringers. A remarkable demonstration of the character of the soil was given in the course of constructing the embankment within the south bulkhead. The weight of the fill carried the bulkheads in each direction to a maximum distance of perhaps 40 ft. The movement took place bodily until the position of the brace piles was brought so nearly to the vertical that they no longer afforded support, and the structure now rests with the brace piles in a substantially vertical position and the formerly vertical piles leaning at an angle of about 45 deg.



Raritan River Bridge; Foundation of Draw Span Pivot.

Though in no way connected with the new construction, an interesting expedient has been developed in connection therewith. On September 11, 1907, the center casting of the old draw span broke, making it impossible to operate the draw. In view of the prospect of speedy replacement with a new structure no attempts were made at repairs. Instead, the span next south of the draw was made removable and a derrick rigged on pile foundation just to one side of the adjacent span by means of which the span could be lifted from its seat and swung around away from the channel. A double row of piles was driven to serve as guides to the new channel, and in 18 days—during which, as may be supposed, the river on both sides became badly congested with craft of all kinds—the extemporized draw was in operation and afterwards worked as satisfactorily and expeditiously as the old draw. On the first day of its operation 115 boats passed through. Seventeen to 21 times per day is the maximum number of draw openings required in the busy season. The lift span weighs 20 tons, and it requires 1½ minutes to operate it with the derrick to give a clear passage way.

The cost of the entire structure as above described was about $1,000,000. All the steel work has been painted with Dixon's graphite. The contractors for the substructure and superstructure are named above. The work was done under the general super-



Half Section Showing Bolt Girder. Half Section Showing Pivot.

Raritan River Bridge; Details of Draw Span Pivot.

vision of Rufus Blodgett, General Superintendent, New York & Long Branch Railroad. James F. Cullen, Assistant Engineer, Pennsylvania Railroad, and H. R. Leonard, Engineer of Bridges and Buildings, Pennsylvania Railroad, were in actual charge of construction.

Foreign Railroad Notes.

Karl Stieler succeeds von Balz at the head of the Würtemberg State Railroads. Stieler, like his predecessor, had a juristic training, and has been in the railroad service only since 1900. The Würtemberg railroad administration is a bureau of the Ministry of Foreign Affairs.

A telegram from London prognosticates the completion of the "Cape-to-Cairo" Railroad in about six years, when the railroad in Portuguese West Africa from Lobito Bay to Katanga is opened. As this latter line is to extend nearly due east from the Atlantic in about 12 deg. south latitude, it is hard to see how it will bring the Cape railroads any nearer Cairo, an outlet which they need about as much as the Texas railroads need a connection with Hudson's Bay.

The Prussian State Railroads are experimenting with signal horns, with which conductors and brakemen are to repeat brake signals given by the enginemen, which on long freight trains sometimes are not heard by all the brakemen, especially in stormy weather when they have their collars turned up. It is also purposed to ascertain whether these horns may not be used to advantage when trains break in two. One management which has used the horns for repeating starting signals, reports that they can be heard for great distances, even against the wind.

Existing and Projected Railroads in China.

According to a consular report from Thornwell Haynes, of Nankin, the mileage of roads in the Chinese Empire now in operation, being built and projected, including the railroads built under the Manchurian concession, is about 9,000 miles. This is more than Spain's, only a thousand miles less than Italy's, and nearly half as much as in the United Kingdom. As compared with the United States, however, it is less than that of the single state of Illinois or of Ohio, or Pennsylvania, or Texas. The railroads are grouped below according to the nationality of their concessionaires.

CHINESE CONCESSIONS.

Peking-Siling.—This line, extending from the capital westward to Siling, is nearly 40 miles long. It was built by native engineers some years ago and has since been in continual operation.

Shanghai-Woosung.—This 12-mile line was first built in 1876 by an English firm. For a year it carried considerable traffic, but then the Chinese Government, objecting to its being in the hands of foreigners, bought it, tore it up and transferred the rails and rolling stock to Formosa. In 1898 the Chinese Government rebuilt it and it is now paying well. It is to be made a part of the Shanghai Soochow system.

Wuhu Sengan.—Surveys were recently begun on this line, beginning at Wuhu and running 30 miles to the southeast. At present the work seems to be at a standstill through lack of money. It is projected to Hangchow, in Chekiang, 150 miles, to connect with the projected railroad system of that province.

Pinghsiang Chuchow.—This line, which at first connected the coal mines of Anyuen with Liling, 23 miles, has been extended west to Chuchow, on the proposed Hankow-Canton, and east to Pinghsiang, 66 miles in all.

Nanchang-Kiukiang.—A concession for this line, 76 miles long was granted to a Chinese syndicate some years ago. Recently the gentry of Kiangsi decided to begin building.

Chengtu Hankow.—The building of this road was authorized some years ago. It is said that the gentry and officials of Szechuen have decided to start the construction of the 60 miles between Chengtu and Chiangkou and thus begin the building of the proposed road to Hankow, which will be the great trunk line crossing the Empire from west to east, as the Peking-Canton line is to be from north to south. When completed the road will be some 800 miles long.

Changsha-Chenchow.—During the early part of 1906 a Chinese syndicate was formed and got permission to build a road between Changsha and Chenchow via Changseh, about 200 miles. These cities are large and important commercially, all being in Hunan province, which is rich in coal.

Canton-Whampao.—A concession was given in 1906 to this line. It is only 10 miles long, but it is important not only because it would form part of a line passing through Swatow to Amoy to connect with the system of Fukien province, but that Whampao, with its deep and magnificent harbor, might seriously affect the commercial interests of Hongkong.

Amoy-Changchow.—This line, which will be about 30 miles long, is being built under the direction of the famous Lin family, formerly the millionaires of Formosa. It may, later, be extended to Foochow.

Swatow-Chaochowfu.—This line, which is 30 miles long, connects the port of Swatow with Chaochowfu, the capital of the prefecture of that name. It was built by Japanese contractors, and all the material except rails and locomotives was imported from Japan. It was finished in 1906.

Canton-Hankow.—This line was planned as a 750-mile extension to the coast of the existing line from Peking to Hankow. For financing the Canton Hankow line, the American China Development Company agreed in 1898 to spend $20,000,000. The concessions were sold back to the Chinese Government in 1906 for $6,750,000. Work on the main line has been carried about 70 miles above Canton, where it remains awaiting the settlement of a seemingly interminable struggle for dictatorship between the Viceroy at Canton, the gentry and the merchant.

Peking Kalgan.—This line, connecting the capital with Changchiakou or Kalgan, 125 miles, is being built with Chinese Government capital and by Chinese engineers at an estimated cost of $1,500,000. It has been decided by the government, at the recommendation of Viceroy Yuan Shih kai, to extend the line, when finished, from Kalgan to Urga, the capital of Mongolia, and thence to Kulun, on the Mongolian frontier, the funds for this extension have already been provided.

Chinanfu-Chentung.—The concession for building this line was originally granted to Germany, but, being redeemed, preparations for its construction and rolling stock are progressing.

Hangchow Soochow.—The gentry and people of Chekiang Province have formed a company to build their own railroad. They have appointed a Chinese engineer as chief engineer and are busily engaged in collecting capital. The first line to be built will run from Kungshun Bridge, near the settlement of Hangchow, to Kiangkan, on the Chentang River, 15 miles, whence it will be pushed on to Kashing and Soochow. A wise arrangement has been made among the gentry of the five provinces, Kiangsu, Kiangsi, Anhui, Chekiang and Fukien, by which the roads in their respective provinces when completed will have a uniform gage so as to form an intercommunicating system in east central China.

Kaifeng-Chengchou. This is a branch line of the Ching-han Railway, and connects Kaifeng and Chengchou. It is 50 miles long, and grading is completed.

Taiyuan-Pingyao.—This line is in Shansi Province, and the officials and gentry there have decided that the first road built by them shall connect Taiyuan and Pingyao, in the Fen Chou prefecture, 100 miles. They have also decided to build the following lines, for which they have the necessary authority: (1) From Tatungfu to Kalgan; (2) from Puchou to Tungkuan, in Shensi, crossing the Yellow River; and (3) from Pingyan to Tsechou, connecting with the Taokou & Tsechou Railway, which was built by the Peking Syndicate and afterward sold to the Chinese Government.

BRITISH CONCESSIONS.

By certain concessions in Shansi and Honan Provinces the Peking Syndicate (Anglo-Italian) secured rights to build a road from Taiyuan, in Shansi, to Singan, the capital of Shensi, whence a line is planned parallel to the Yellow river to connect with Kaifang, the terminus of a branch of the Peking-Hankow Railway. The same syndicate is also to build a line from Tsechou, on the southern boundary of its mine fields, to Singan, 250 miles, on the Han river. To connect the coal fields of northern Honan, work was begun on a line from Chinghua to Taokou, whence the Grand Canal could be reached by the Wei river, thus having water connection with Tientsin. The line has already been completed and ballasted for 90 miles from Taokou.

Peking-Newchwang.—This line, 555 miles long, is in operation. It was built with British capital, but sold two years ago to the Chinese Government. It runs from Peking to Tientsin, to which point it has a double track, thence through Tongku, Shanhaikwan and Kinchow to Newchwang.

Tientsin-Chinkiang.—The concession for this line is owned by the Anglo-German syndicate. The southern half has been apportioned to the British & Chinese Corporation and the northern half to a German company.

Soochow-Hangchow.—This line, 200 miles long, and the Kowloon-Canton line, which is under construction and 100 miles long, are concessions of the British & Chinese Corporation.

Shanghai-Nanking.—The concession for this line was secured by the British & Chinese Corporation. The Shanghai-Woosung line is included. The length of the road is 200 miles, passing through the cities of Soochow, Wusieh and Chinkiang. The line is in operation for about 150 miles from Shanghai. It is expected that the rest will be opened in the summer of 1908.

GERMAN CONCESSIONS.

Kiaochou-Chinanfu.—In 1889 certain German syndicates and the German Government obtained from the Chinese Government railroad and mining concessions in the province of Shangtung. By the treaty of March 6, 1898, the construction and maintenance of these roads were to be carried on by a German-Chinese company, formed as a joint stock company with the title of "Shangtung Eisenbahn Gesellschaft." This company was formed in Berlin in June, 1898, with a capital of $12,852,000, and shortly afterwards headquarters were transferred to Tsingtau. It was soon decided not to build the line from Chinanfu to Ichoufu, or any other point on the southern boundary of Shangtung Province. The Tsingtau-Chinanfu line was built during the winter of 1903, and has been in continuous operation ever since. It had its own postal and telegraph services until recently, when, owing to the strong representations of the Chinese Government, the separate postal service was given over to the Imperial Chinese postal service.

Tientsin-Chinkiang.—In May, 1898, a concession was granted to the Deutsch-Asiatische Bank and the British & Chinese Corporation, represented by the Hongkong & Shanghai Banking Corporation. The northern half of the line is to be under the control of the German bank, and the southern half is to be under the control of the Hongkong & Shanghai Bank, and is to run from Tahsien to Chinkiang on the Yangtse. The line will be in all about 600 miles long.

Chinan-Chingting.—A concession was granted to the Germans to build this line to connect with the Pekin-Hankow Railway, but the concession was recently, when the German railroad garrisons were withdrawn, resold to China for the price originally paid.

FRENCH CONCESSIONS.

Tongking-Yunnan.—This line is intended to connect Hanoi, in Tongking, with Mengtze and Yunnanfu, through the Lan river valley, about 290 miles. This line is in operation as far as Mengtze, and grading has been finished as far as Yunnan.

Langson Lunchow-Nanning.—The concession for this line, which is about 100 miles long, was secured in 1889. No work has been done on it.

Pakhoi-Nanning.—Nothing has been done on this line. The two cities are about 120 miles apart.

BELGIAN CONCESSIONS.

Ching-han or Peking-Hankow.—This line, which is about 800 miles long, was authorized in 1889. The part of the line between Lu-kao-chiao and Paotingfu, some 90 miles, was built with Chinese Government capital under the direction of British engineers. The concessionaire of the portion from Paotingfu to Hankow was the Franco-Belgian Syndicate. At present one train leaves Peking and one leaves Hankow daily and already attract many passengers and much freight.

PORTUGUESE CONCESSIONS.

Macao-Samshui. This line from Macao is to run to Siang-shan, thence to Kong-Moon and to Samshui, the terminus, where it connects with the Canton-Samshui branch of the Canton-Hankow Railway. Unlike nearly all the other railroads in China, this one will be an entirely commercial undertaking, free from all governmental interference or political control. As it will pass over the Canton and West river delta, many bridges will be necessary, making the work costly. The distance is about 130 miles.

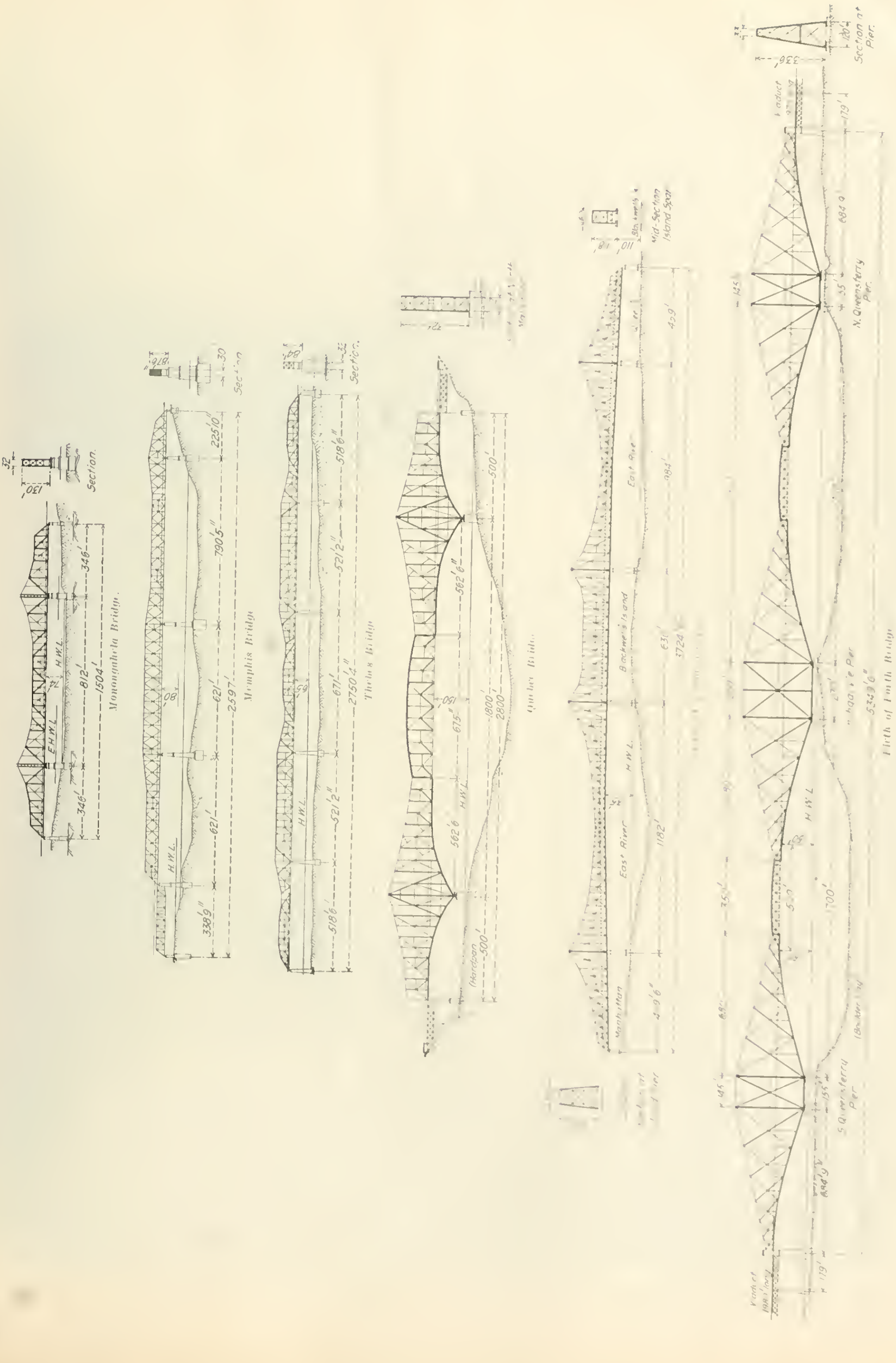
CHINESE IMPERIAL RAILWAYS.

Peking-Tientsin-Shanhaikwan-Newchwang.—For this road a loan of $11,155,000, bearing 5 per cent. interest, was made by the British & Chinese Corporation, whose agents are the Hongkong & Shanghai Banking Corporation. The lines mortgaged as security for this loan, and which are in operation, are the 84 miles Peking to Tientsin double track; 27 miles of single track Tientsin to Tongku, and 147 miles Tongku to Shanhaikwan, single track. This loan also has a first lien on the earnings of the 130 miles, Shanhaikwan to Kinchow, single track, and 130 miles Kinchow to Newchwang. These lines constitute a continuous 526 miles of road, exclusive of 30 miles of sidings, all of standard English gage. It has been computed by the engineer in chief of the imperial railroads in North China that the capital cost of the intra-mural line from Peking to Shanhaikwan, 258 miles, exclusive of sidings, was $9,529,000, or about $36,650 per mile. The cost of the line from Shanhaikwan to Chunghousu (40 miles) was about $40,315 per mile.

For the line from Peking to Chunghousu, a point 40 miles outside the Great Wall, according to the same authority mentioned above, the gross earnings before the year 1900 averaged $1,466,000, while the net income was $586,400, or 5 per cent. on the $11,728,000 capital. But railroad enterprise was then only in its infancy and the volume of both passenger and freight traffic must have greatly increased since, so that under proper management there is no reason why a profit of 8 or even 10 per cent. should not be returned. During 1905 it is computed that the net income was enough to pay a dividend of 20 per cent. on the capital cost. The bridges of these lines consist of steel girders resting on masonry or concrete piers and abutments, sunk by compressed air to a proper foundation. The largest and longest bridge on the intra-mural line is that over the Lan Ho, spanning a distance of 2,200 ft.

At Tongshan are the principal workshops, where several thousand men are employed in car building and general repair work. Here and in the vicinity are also the Chinese Engineering & Mining Company's mines, the products from which yield much traffic. The mines are now working as a joint stock company composed of foreign and Chinese stockholders and registered in London. They employ about 10,000 men; with an output of about 3,000 tons of coal per day. The shops for girder building are at Shanhaikwan, and can turn out 6,000 tons of girders per year.

The rolling stock is built similar to American types. The freight cars have 30 tons carrying capacity. The passenger cars are similar to those in America, having through passages and end platforms. At Kaochiao, which means "High Bridge" and is 60 miles from Shanhaikwan, there is a branch line running northwesterly for 30 miles, and connecting with the Nanpiao coal mines. These mines are pronounced by experts to be the richest and most valuable coal mines in North China. There are two large bridges on the Shanhaikwan-Newchwang lines—one across the Talingho, east of Kinchow, and the other over the Siaolingho, immediately south of the same city. The latter bridge, which was of much more difficult construction than the other, was built by a Chinese civil engineer who graduated from the Sheffield Scientific School of Yale University. At Yingkow, the sea port of Newchwang, is the more important terminus of the extra-mural line; 1,000 acres have been bought to take care of the traffic. The author states that in the preparation of this report he was greatly assisted by the *Chinese Daily Nanfangpao.*



Elevations and Spans of Six Great Cantilever Bridges.

Picked Up on the Road.

BY GULL.

The use of snow fences by American railroads in the northern climates has come *de novo* during the past 15 years. It was along in 1893 or 1894 that an article appeared in the *Revue Generale des Chemins de fer*, giving, in the usual French completeness of detail, the designs of snow fences on the several European roads and the results obtained from their use. At that time a snow fence was almost entirely unknown in the United States, while abroad they were common, especially in the Alpine country, though there was very far from being a uniformity of design. Soon afterward, in consequence of attention having been called to the matter or because of spontaneous processes of thought, the snow fence appeared in this country. Its form was tentative at first, and in some cases recourse was had to throwing up a bank of snow to serve as a deflector—a device said to have been efficient, but not sufficient. Soon, however, the present form was evolved, which now may be called standard. It consists of an open fence with horizontal bars of boards about 6 in. wide leaning towards the track at an angle of about 45 deg. with a slope back at the top at right angles to the lower part for a foot or 18 in. These fences are portable and it is interesting to note their location with reference to the track at different points, showing the effect of natural topography on the deflection of wind current and the drifting tendency of the snow. This drifting can be turned to good account, and it is strange, with all the troubles roads in the North had with snow shifts before the advent of the rotary plow, including expensive hand shoveling where the snow was thrown from one level to another until it reached the top of the bank, that no one ever noticed the tendency of snow to gather on the lee side of a fence, and utilized it to protect a suffering railroad beyond. But we didn't, and we had to wait for some scientific chap on the other side of the water to teach us the trick. However, we have evidently learned it now, and are profiting accordingly.

If there is any one thing more than another that adds to the comfort of the traveler by night, it is the berth light used in the sleeping cars of most western roads. It changes discomfort into luxury and is probably the most highly appreciated improvement that has been made for many a day. It does not take a very old man to recollect when there were no lights in the staterooms of our river boats, but that is a thing of the past, and it is to be hoped that the dark berth of a sleeping car will soon be in the same category. It seems strange that, though these lights have been used for years in the West, they are still a scarcity on eastern roads.

To paraphrase the enthusiasm of a western railroader, we (westerners) are the people. Whenever anything is brought out that makes for comfort or luxury, or, I may add, that has an advertising value, we take it up and put it through. So we have electrically lighted trains and trains brilliant with acetylene and Pintsch gas, and we use the latest wrinkles in them all. We have tourist sleeping cars to accommodate those who want them; and that weary, forlorn crowd that fills the ordinary coach on the night runs of eastern lines is almost unknown. We also have the chair car that gives almost all the comfort of a Pullman parlor and costs nothing extra.

Why is it that the average newspaper manager thinks that anyone can correctly report scientific matters, and, above all, matters pertaining to railroad mechanics, especially the mechanics of an accident, when they consider it necessary to have an especially trained expert to report on musical or dramatic performances? Are the intricacies of the locomotive or the track so very much simpler than the intricacies of the sonata or the fugue that anyone can understand, or, not understanding, can convey an understandable idea to the average reader? But really, isn't it quite as important, in its way, not to say that the main crank pin of the forward truck was broken off just inside the rear driving axle of a consolidation locomotive as it is to be able to point out the recurrence of the theme of the apprentice song in the Meistersinger? So, when some event of importance in railroad affairs is to be chronicled, why does not the Associated Press or the daily paper send a man who knows how to do the work? During a recent inquiry, the New York and Philadelphia papers gave from a half column to a column and a half every day to the matter, and discussed it very thoroughly and apparently to their own satisfaction, and yet not one of them came within gunshot of stating the case, but each went off and discussed a matter entirely foreign to that in hand, simply because the first reporter in the field jumped to a conclusion, and, as usual, jumped wrong.

I was the amused and highly instructed recipient of a Pullman porter's confidence the other day. "I ain't got no use fo de women," he said. "Dey needs mo waitin on dan a sick kitten. Dey wants dis and dey wants dat, and den dey wants de oder ting, and when you get true wid 'em, dey just says 'Tank yo.' Now you know dat a man can't live on 'Tank yo' and dat he wud starve to death on wot he gits fum de company. Now wid de men its diffunt; yo see a man puts his shoes down on de flo, and yo gits at 'em befo' he's up in de mawnin and blacks 'em up kinder nice, and dey ain one man in a hundred mean enuf not ter give yer suthin, whether he wants his shoes blacked or not. In a parlor car its diffunt too. What yo can make out o' a car depens morely on who sits in de front seat. If you comes along wid yo brush and he shakes his head, its mos' likely hat de men in de car will shake der heads too, and you won't git nuffin til yo comes to a man wif a lady. Den you kin git started and make suthin out o' de res' o' de car." All of which goes to show that there is a mutual understanding between the porter and the passenger that the tip is decidedly the result of a virtual hold-up, and that most men are too great moral cowards to resist, unless there is some courageous soul in the front end of a parlor car whom his fellow travelers follow with all the boldness of a flock of sheep.

Traffic Arrangements in Japan.

The annual report of the Imperial Government Railways of Japan for the year ended March 31, 1906, recently published, contains the following remarks:

"Among the principal traffic arrangements adopted during the year may be mentioned as follows:

"From April 1, 1905, alterations were effected as to the period of availability of tickets and at the same time rules relating to extra fare and overcharge were enacted and put into force. The available limit in the old system was graded at three days for distance of not less than 100 miles and under 200 miles, four days for distance of not less than 200 miles and under 300 miles, and five days for distance of over 300 miles. In the new arrangement one day is to be added for each additional 100 miles or fraction thereof, for distance of not less than 100 miles. The extra fare is to be exacted within the limit of three yen* for the first class, two yen for the second and one yen for the third in the following cases: when a traveler gets in a train without a ticket (this applies also to cases when a passenger has traveled without permission of the proper officials beyond the distination mentioned on the ticket), or has boarded a train with an invalidated ticket, or refuses to produce the ticket for examination or to deliver it for collection, the additional fare equal in amount to the regular fare will be exacted. When a traveler has removed to a superior class car without giving notice to the officials, besides exacting the balance the sum equal to it will be additionally charged. The additional payment is to be charged when a traveler who has no time to buy the ticket is allowed to get in the train by the proper officials, this payment being 20 sen† in addition to the regular fare. When the regular fare is less than 20 sen this payment shall not be more than the fare. * * *

"In April, 1905, a new arrangement was adopted for the handling of parcels of the same kind when they start at the same station and are destined to the same address and station, in case the parcels are more than two in number and come from one and the same consigner. The freight on such parcels is to be determined with the consent of the consigner on the average weight of one parcel. The new system was applied only to the three kinds of fresh fish, vegetables and fruit.

"In regard to the handling of wagon goods, it may be mentioned that from May 1, 1905, the grade of tea that was formerly included in the list of valuables was lowered to the third class. On October 1, rules relating to the rebate of freight for wagon goods were revised in regard to section pertaining to the Shin-Yetsu, Shinonoi and O-U lines. According to the former arrangement the rate was 3 per cent. for the sum that amounted to not less than 5,000 yen and under 8,000 yen a month, 4 per cent. for the sum of over 8,000 yen and under 10,000 yen a month, and 5 per cent. for the sum above 10,000 yen. In the new arrangement the rate was graded as follows: 2 per cent. for a sum over 10,000 yen and under 15,000 yen a month; 3 per cent. for a sum above 15,000 yen and under 20,000, 4 per cent. for a sum above 20,000 yen and under 25,000; 5 per cent. for a sum above 25,000 yen.

"From January 1, 1906, the scope of express delivery service of goods that was formerly confined within the limit of the seat of a station was extended and was made deliverable within the limit of a city where the station is situated or within the radius of 1½ miles from the station."

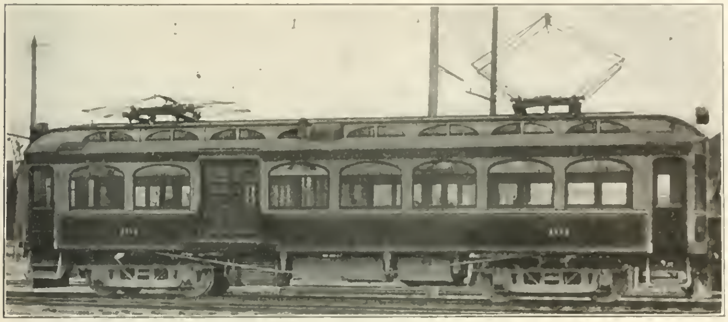
The railroads included in the German Railroad Union had 62,813 miles of road at the beginning of this year, of which 34,159 miles were in Germany, 24,338 in Austria-Hungary, 1,938 in Holland, 1,913 in Rumania, 306 in Russian Poland, and the remainder in Luxemburg and a Balkan state.

*A yen is about 50 cents in United States money.
†100 sen make a yen.

Single Phase Equipment for the Richmond & Chesapeake Bay.

The Richmond & Chesapeake Bay Railway was recently completed from Richmond, Va., to Ashland, 15 miles. It is planned to later extend it to serve the territory lying between Richmond and Washington. It is a single-track electric road with turn-outs, using single-phase current with a trolley potential of 6,600 volts.

There are no sub-stations for the operating current, but there is a lighting sub-station at the Ashland terminus. The road has at present no power station of its own, the generating apparatus being installed in the Twelfth street power house of the Virginia Passenger & Power Co. This consists of two General Electric 750-k.w., 25-cycle, three-phase generators running at 128.5 r.p.m. and designed to give 6,600 and 13,200 volts. One of these generators is direct-connected to a 1,450-h.p. hydraulic turbine at one end of the shaft and to a 750-k.w., 60-cycle, 2,300-volt, three-phase generator at the other end, both units being mounted on the same base. Should there be insufficient water to operate the turbine, the 60-cycle generator will be run as a motor. The other 25-cycle machine is coupled to a water turbine, and also to a 750-k.w. direct-current generator, the latter machine being used as a motor in the event of low water. When water power is plentiful the 60-cycle generator and the direct-current generator can be used for city lighting.



Combination Car, Single-Phase; Richmond & Chesapeake Bay Railway.

Under present operating conditions, only one phase of the generators is used to supply the line voltage. The transmission cable is laid underground in a vitrified earthern-ware conduit to the Richmond terminal depot, 1½ miles distant. It is a three-core, lead-covered cable, each core having the capacity of No. 0 wire. One core is used for the line feeder and the others are connected to the rails and serve as a return circuit. At the terminal depot the cable enters a high-tension cabinet before its connection to the trolley.

The electrical equipment of each of four motor-cars, which at present comprise the rolling stock, consist of four GEA-603-A railway motors, and a full complement of multiple unit, type M, Sprague-General Electric control apparatus. The motors are the series-repulsion type. The fractional pitch winding of the armatures performs the same function as do commutating poles in direct-current motors. Each motor has 125 h.p. capacity. The capacity and high starting torque of these motors were well illustrated on one of the trial trips, when one car was coupled up to a train of five Norfolk & Western standard passenger coaches carrying 300 passengers, and hauled the load with ease. To further test their capacity, two of the motors were cut out, and the remaining two started this same train on a 1 per cent. grade.

The control is in duplicate. Each pair of motors, with their compensator and contactors, forms a practically independent equipment. Should one motor or any part of half of the equipment become damaged, the car could be operated as a two-motor car by throwing one blade of a double-knife disconnecting switch. The actual control apparatus is nearly standard throughout. The master controller is type C-40-A and the contactors are the ordinary a.c. type.

These are the first General Electric equipments ever put in operation with two compensators. The compensators are oil cooled and are provided with taps to give 600, 450, 400, 340, 280 and 113 volts. The 600-volt taps are used only on the auxiliary circuits. All the high tension apparatus is enclosed in an asbestos-lined cabinet. Each car is equipped with two pantagraph trolleys with steel pans, this material having been found to give greater satisfaction than either copper or aluminum.

The car bodies were built by the St. Louis Car Co. and closely resemble the standard Pullman car. Each has separate accommodations for white and colored people. The combination passenger and smoking car has a seating capacity of 64 persons, and the seating capacity of the combination passenger and baggage car, shown in the accompanying photograph, is slightly less.

The trucks are the inside suspension type and were built by the Baldwin Locomotive Co. The air-brakes have graduated release, which is found in the straight air type, and can also be operated as an automatic system.

The overhead construction is the catenary suspended type. The

Reinforced Concrete Viaduct; Richmond & Chesapeake Bay Railway.

trolley wire is No. 0000 grooved copper, and the messenger cable is steel and has seven strands. On the first section of the road, between the Richmond depot and the car barns, the track is laid on a reinforced concrete viaduct shown herewith, the trolley being supported by steel spans. Bracket supports are used on the other sections of the road.

The sub-station at the Ashland terminus, as already mentioned, provides for the lighting of the town. This is probably the first time that an attempt has been made to supply a lighting system from a high tension single-phase trolley subjected to severe load fluctuations. Tirrill regulating apparatus is used in both the sub-stations and main station. The 6,600-volt single-phase current is transformed to 440 volts by two 25-cycle oil-cooled transformers of 150 k.w. each. From the low tension side, the current passes through a reactance or phase splitting device to the induction motor end of a motor-generator set, consisting of a 150-h.p., 25-cycle, 440-volt, single-phase induction motor direct connected to a 100-k.w., 2,300-volt, 60-cycle, single-phase generator. A 4-k.w., 125-volt exciter is mounted on the common shaft at the generator end. The 2,300-volt, 60-cycle current leaves the sub-station through a two circuit single-phase feeder panel for general lighting purposes in the town of Ashland. All oil switches are designed for 6,600 volts and are enclosed in cells constructed of brick and fiber floors. All the machinery, switchboards, indicating and measuring instruments are of General Electric manufacture.

Car Surpluses and Shortages to April 15.

The Committee on Car Efficiency of the American Railway Association has issued Bulletin 21-A, giving a summary of surpluses and shortages of freight cars by groups from October 30 to April 15. The total surplus, which showed a slight increase in the last bulletin, now reaches 375,770, the highest figure yet recorded. The largest increase is in coal cars, 160,205. There is a further increase of 26,317 in box cars, although the surplus is still considerably below the maximum for this class. Group 7 shows a slight improvement; Groups 1 (New England), 2 (Eastern), and 10 (Pacific), about hold their own, but there are increases in all other groups, the heaviest being in Group 3 (Middle), where the accumulation of idle coal cars is largest.

SURPLUSES AND SHORTAGES BI WEEKLY, FROM OCTOBER 30, 1907, TO APRIL 15, 1908, INCLUSIVE.

		Surpluses.					Shortages.				
	Number of roads.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
April 15, 1908	153	138,065	23,811	160,205	53,689	375,770	83	7	1	55	146
April 1, 1908	158	111,748	24,774	120,669	50,316	307,507	319	117	8	84	528
March 18, 1908	160	103,509	25,122	119,205	49,206	297,042	533	151	250	73	1,007
March 4, 1908	162	103,905	27,232	139,223	44,632	314,992	943	19	600	57	1,619
February 19, 1908	161	113,776	30,088	134,217	44,432	322,513	697	141	249	162	1,249
February 5, 1908	158	112,046	30,312	156,634	44,936	343,928	737	281	15	67	1,100
January 22, 1908	161	124,622	27,328	142,338	48,292	342,580	302	132	79	135	738
January 8, 1908	163	149,664	23,087	127,138	41,874	341,763	457	34	42	120	663
December 24, 1907	158	87,714	14,740	64,556	42,300	209,310	187	81	101	265	724
November 27, 1907	160	16,246	3,645	10,028	10,429	40,348	11,908	868	2,964	2,224	17,964
October 30, 1907	161	786	600	1,285	1,275	3,946	61,592	3,546	15,987	9,632	90,757

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

XVIII.

The Present Situation and Future Outlook.

Most of the factors which are now important in ocean transportation are factors in which there is progress. This is true both in the technical side which concerns the actual carrying of the goods and it is also true in the management side in which we find the transportation problems affecting law and public and economic relationships.

There are at least four aspects of the technical side which should be briefly referred to before taking up the more important or management side.

First.—The change of vehicle from sail to steam goes on apace. The general speed and celerity of modern business is violated by the irregular slowness of the sailer and the great size and economy of the modern steamship have long since enabled it to practically supercede all sail line traffic, and the last seven years of fierce competition in the shipping world has developed a steam tramp of such a size and such economy of operation that profit rarely hovers over the white wings of the sailer that tries to compete. The recent words of a British tramp vessel owner seem to be significant of its doom: "We still own five sailing ships but we find it very hard to make ends meet as steamers are getting into sailing ship trades. The passing of the sailing ship entirely as an ocean carrier is in my opinion only a matter of a few years."

Second.—The relative positions of charter and line traffic are both shown by the discussion of one, for the other has virtually all the rest. The tramp as a factor in traffic appears to be relatively on the decline and absolutely on the increase. These conditions will doubtless continue for a very considerable period although it is conceivable that in a few decades the tramp may assume a stationary and possibly a declining total of service. This possibility of a static or declining position arises from the great growth of commerce in all parts of the world which is continually causing the establishing of lines in places where the tramp alone had previously sufficed. A good illustration of this is to be found in the port of Pensacola, Florida, from which for a number of years tramp vessels had sailed to Europe and occasionally to the Orient with cargoes of lumber and cotton. This service, which has been almost entirely devoted to carrying the freights of the Louisville & Nashville Railroad, has been so organized that the management now announces a line service to various European ports, although the infrequency of departures has caused some people to question whether it is really a line service. However, the departure of vessels under regular management from one port to another, year after year, can probably be classed as line rather than chartered traffic although the interval is somewhat uncertain. It therefore represents a transfer of one more piece of the world's ocean from tramp to line territory—a development which must inevitably go on as world commerce following the development of railroads embraces a great and greater part of the world's sea coast.

Third.—The private steamship line seems destined to have considerable absolute growth during the reasonably near future. It is part of the growth of the modern industrial corporation and there is no indication that we have reached the end of the development of larger scale operations. Indeed the magnitude of industrial units is still on the increase and the development of integrated enterprises is very new. The exceedingly large part transportation plays in all manufacturing industry makes the development of units of transportation one of the most natural secondary developments in the integration of industry. Next after the acquisition of coal and ore lands by steel companies came the acquisition of steamship lines and railroads. The increasing knowledge of the world's resources, the limitations of local supplies are likely to make more and more reasons why the modern industrial corporation should have its own steamship service as a part of its equipment.

Fourth.—The railroad steamship line is also steadily increasing upon the surface of several oceans. It is also an accompaniment of the large scale enterprises, particularly those in which railroads are driven through vast and undeveloped territories and find their termini in ports of insignificant local trade. Another generalization may be pointed out, namely, that there is much greater likelihood of railroad steamship line development along coasts where the current of ocean trade is at right angles to the coast line rather than along the coast line. For example, the railroads to the Pacific coast of North America find the goal for their ocean traffic across the sea. The steamship line sails away from the coast, there is no temptation for it to pass other ports. In South America these conditions are essentially different. The commerce of both the western and eastern shores of that continent going up and down the coast passes all ports so that any railroad that taps that coast finds its terminal facilities within near reach of a stately procession of steamships which will gladly call for any reasonable amount of freight. The necessity of a South American railroad supplying its own oversea connections is therefore unthought of.

If there had been a similar coastwise development of transportation routes along the shores of the North Pacific to the only available markets our Pacific railroad steamship lines would probably never have existed. The conditions would have resembled those to be found in New York where every railroad that can get a terminal upon that splendid harbor is within reach of steamship connections to every quarter of the globe.

There is therefore a tendency for the necessity of railroad steamship lines to decline due to the development in other ports of many ocean lines, but there nevertheless remains and will remain a large number of ports which must be comparatively small because of the proximity of other ports, and for the small ports there will continue to be the need of railroad steamship lines.

The second main division, the management is one in which there are also changes in progress. There is steady increase in the size of the carrying unit, the vessel and in the management unit, the line. Both are growing astonishingly and the end is not in sight for either unit.

It is around the question of rates—line traffic rates—that the greatest interest centers and the greatest problems lie.

We have no great changes to expect on the cost of service to the shipper. He is already accustomed to all kinds of rates, one might say all kinds of rates together, so greatly do they at times fluctuate. The real rate question is that of rate control. Will it be by the free force of competition or by the restraint of rate agreements?

To start with we have the fundamental factor of the freedom of the sea, which has, so far as line traffic is concerned, practically developed for much of the world ocean into a normal condition of rate control with frequent adjustments. This is the normal condition in the trade of Europe with practically all parts of the world except the United States. Furthermore, it has come to be the normal condition with regard to the rates from New York to most quarters of the world, and it is probably safe to say that there is visible a distinct movement toward the increase of rate control. If it comes to include the North Atlantic it has practically embraced the world. Several reasons for this may be mentioned:

1. The companies are steadily getting larger and the time has now been reached when the agreement of seven or eight interests would produce a minimum agreement that might hold if a satisfactory freight classification omitting grain and flour should be made.

Will the greater part of the carrying trade upon the North Atlantic ever be controlled by stable agreements? As has been previously pointed out, the difficulties are many, but the chances of agreement seem better than they have ever been in the past.

2. The growth of the single port conferences is suggestive of the final control. The German situation described above is an overgrown port control with Hamburg as its point of origin. The London carriers have a better agreement than the Liverpool carriers, and it serves as a good example to those who have not agreed so well.

3. Grain, long the great staple of the eastbound trade, is now becoming of less relative importance in the trade, because of the great increase in manufactured goods. This freight change is favorable to rate control, because manufactures will stand a much higher and more steady rate than that paid by grain.

4. Recent improvements in ship building have practically emancipated the newer ships from their old dependence on grain. When they had to have it as ballast, they were willing to bid low to get it. Now the newer ships admit water into their ballast tanks, and they no longer depend on grain if it does not pay them as freight. The lowest mark in grain rates from New York to Liverpool occurred prior to 1890 before the general introduction of water ballast.

5. The losses of the last great depression in the ocean shipping business have brought home to the shipowning fraternity the necessity of some protection, and they have had some rather valuable object lessons in the various attempts that have been made to alleviate the situation.

There are some principles any freight agreement must observe. It must limit itself to a minimum and there must be rather frequent readjustments of rates and of traffic divisions. It is because of the necessity of readjustments of traffic divisions that most of these arrangements in other trades have come to their end. The steamship companies will probably have to do as the railroads do, agree on a rate, but compete in some of the other forms that competition may take, readjusting their agreements with resulting changes in conditions. The great trouble with these agreements is that a flat rate with insufficient business throws the traffic to the best lines and cuts off the poorest who at once begin to cut rates to get freight. The aim of the steamship rate agreements should be to maintain living rates and leave all parties free to grow and develop and then readjust without a resort to the rate wars which now come so easily. This is no simple task, and it is further complicated by the fact that it is impossible to establish and maintain a rate which prohibits the export of produce to a competitive market to meet regional competition. Those interested in shipping think that they have been more ready to make rate concessions for this than the American railroads. This has occurred in part because while the railroads, during the last five years, have been crowded with domestic traffic, the steamship lines have been sorely pushed for freight. The prompt concessions made by the Atlantic steamship lines have unquestionably rendered a valuable service to America's export trade. As one carrier expressed it: "If the hog crop in Austro-Hungary is larger than usual, it affects the provision market of the whole continent, and we have to reduce the rate on Chicago packing-house products to get them on the market. And the rate on southern cotton-seed oil is always the same as the rate on provisions."

This list of requirements as stated in the above paragraphs is essentially sound and its requirements bear upon human nature with a load almost as heavy as does the golden rule upon ordinary human conduct. The voluntary agreement is a weak thing and it must be so. Persons in the best of positions to know assure me that these gentlemen's agreements are frequently broken under the pressure to get freight.

That means that agreements to be strong will be dominated by some strong central force, like the Hamburg-American Line in the German-American situation, the International Mercantile Marine in the London American situation, or the Union Castle Line in the United Kingdom-South African situation.

A group with such a leonine member is strong enough to make tremendous competition to repel a new rival. It has cost a million dollars for a firm to fight its way into the South African conference, and this money was for the fight, not for the capital.

When once these rate control groups are established, especially as in the case of the Hamburg-American Company, where one management does nearly all and has many services it develops a peculiar death dealing power in competition.

There is no indication that the present wave of government control of corporations for the benefit of the individual is likely to stop rate control upon the sea, or limit the monopolistic power that comes with the power to kill that results from the great size of the largest companies.

The British government has recently investigated the matter very thoroughly through commissions and the result was a surprising amount of condoning after the many fierce and bitter things that have been said against the shipping combines. Upon the American side of the water the situation seems at the present time even more hopeless so far as government is concerned.

The recent attempt of Messrs. Peter Wright & Sons, of Philadelphia, to secure the aid of the Interstate Commerce Commission against the encroachments of the Hamburg-American Steamship Line is an interesting proof of this point. Their appeal for relief against pooling and rate control in restraint of trade has been denied. The closing words of the decision of the Commission are as follows: "This ruling is the only one which is consistent with what seems to be the policy of the law, viz., that while restriction and control are essential as to the inland carriers of foreign commerce, the ocean carriers of such commerce should remain unrestrained and free. There is not to-day, and never has been, such a thing as stability of rates upon the water. Perhaps it is not desirable that there should be. The ocean is a highway free to all. No franchise is needed to sail the seas, nor is the establishment of a line, of ships founded, either in law or in economics, upon the theory of a public serving monopoly which underlies the relation of the railroad to the state. It may well be, therefore, that without regulation and by reason of natural competitive conditions, the public will be best served, and in the end treated more equitably, by leaving the water carriers to foreign lands entirely unhampered by legal restrictions such as the people of this and other lands have found it necessary to impose upon the railroads. Under the ruling here made the fluctuation in the total through rate charged from an inland point in the United States to a European or Asiatic country will fall, where, in fact, the fluctuation is at the seaboard. The competition in rates will thus manifest itself where the competition really exists, and where the law presumes it will unrestrictedly continue, viz., where the ships bid against each other for cargo."

It is most unfortunate that the lawyer has to make our laws, for the legal mind dealing with precedents is like its Latin words fed by the medieval past and constantly striving to control and interpret present conditions in the terms of the long dead past. It is notorious that legislatures talk about railroad transportation and legislate about it with the idea that the business is as competitive as the selling of horses and wagons at a public vendue and here we see the Interstate Commerce Commission referring to the law's vision of the freedom and free competition of the sea "where ships bid against each other." This vision seems well nigh ludicrous when inspired by the Hamburg trade of the Hamburg American Company, which it is well known has long had a wonderful control over almost the entire line trade of the port of Hamburg with the North American continent.

This legal view point entirely overlooks the fact that there can be control through agreements where competition is theoretically possible and there can be the most emphatic kind of control through the development of one interest that has such great size that it can destroy by competition any ordinary new beginner in any field, and it can do this with profit to itself because with the great scope of its business it can be making money with eight or nine-tenths of its organization and losing money over the remaining fraction where it is effectively killing a competitor.

Just how far this rate control is going to go and how much it is likely to cause hardships through excessive rates it is difficult to predict. Unrestrained competition is usually disastrous to carriers, and monopoly is not noted for its reasonableness.

The opportunity and limitations of the individual and the way line competition soon works around into rate control are all well illustrated by a recent episode in the trade between New York and the Orient. The lines to this quarter of the globe had a good agreement to which they were holding with considerable firmness and to the irritation of many shippers. One of these shippers happened to be the United States Steel Corporation (the largest individual in the world), which in the year 1907 had contracts for the delivery of 100,000 tons of steel goods in Manchuria. This was a splendid nucleus for the founding of a new line in a trade where the ordinary vessel carried about 6,000 tons of freight, but inasmuch as there was prospect of other orders, the company itself was in a position to furnish more than half the cargo for a fortnightly sailing. Accordingly arrangements were made with European owners for the founding of a new line to China. As the steel goods furnished all the heavy cargo that the ships needed, the managers were in a position to make very keen competition for necessary light cargo to finish filling the space in the holds of every outgoing vessel. After a few months of this competition, the new line was admitted to the conference. By this agreement with the other members of the conference, competition ended, and the steel company got the full rate for the outside cargo which its vessels carried, and it of course got this much more advantage for the carrying of its own goods.

Rate agreements, or some form of rate control, with frequent readjustments are the normal thing in all important trades but the North Atlantic, and are the existing condition in a considerable part of that, and the prediction is made that this will increase. One of the two great traffic classes, namely, the passenger traffic, has a normal condition of rate agreement and is a constant and shining example for the warring makers of freight rates. Two causes are conspicuous in explaining the difference between the extent of passenger rate control and freight rate control. One is the question of ballast, the other of the great fluctuations in the amount of traffic.

Ballast.—For a long time, every ship that sailed the ocean had to get some heavy cargo from New York (usually grain) to make her ride well. There is now less need for this because of the construction of ships with water ballast compartments, but this ballast factor yet lingers in the making of freight rates because there is always a desire to get a certain kind of freight to complete the vessel's cargo. If she is full of heavy goods a little light goods can be put in and the rate be cut to get them. The reverse may be true for other kinds of goods for the ship in the next pier. Hence the constant tendency to cut rates. The passenger accommodations of a ship have no such shifting utility. They can be carried empty or full and it makes no difference to the navigation of the ship.

The fluctuations of passenger traffic.—There is no important body of passenger traffic where there is not at some season all the ships can carry and at some other season but a fractional part of this amount. Therefore this seasonal and absolute inability of all ships to get their full quota brings them annually face to face with the problem of rate cutting. If they start to cut the rates to get passengers they can come down and down to absolute cost and still most of the carriers cannot get the traffic. Therefore they have annually had this problem to face and they long ago found that wisdom demanded that they should restrain the desire to compete, for it could but lead to loss for all; hence the virtual constancy of passenger agreements.

In a period of almost uniform loss in 1902 we saw the same reasoning bring about a minimum freight agreement between carriers running 46 services between the North Atlantic and United Kingdom. There are good reasons why this will have many successors. At least two factors are of importance to make reasonable the expectation of this increase. First is the great tendency toward the decline in weight of the American trade with Europe. Our increase in population and industries are generally recognized as being factors which through our increasing demand for food and raw materials will cause a decline in the bulk of our traffic with Europe; certainly a decline in relation to its value, if not a positive decline in bulk.

Along with this there has been a tremendous increase in passenger traffic, both of the pleasure class and from the movement of labor which has lately taken developments which show us that we have an international labor market. Not only can prosperity in America call a million workers a year from Europe but the same prosperity will send scores of thousands of them back to winter with their friends in pleasant Europe, while depression in America sends hundreds of thousands back across the Atlantic possibly to stay, probably to return upon the next call of high wages, which call can be heard very promptly through millions of letters from friends scattered in almost every county in the United States.

This passenger increase and freight decrease is showing itself in the positive decline of purely freight lines from New York and in the great prominence of large steamers of medium speed which can carry surprising numbers of passengers or tremendous quantities of freight. Many of them go further and have considerable space which is useful for either freight or passengers as the exigencies of the trade demand.

This increased importance of passenger trade will bring more and more before the minds of trans-Atlantic carriers, particularly those from New York, the importance of agreements in their operations as evidenced by their passenger agreements. Further, the great amount of shipping that the passenger traffic demands is likely to bring with increasing frequence those periods when the amount of freight is utterly insufficient for their capacity so that they are with regard to freight as with regard to passengers in the dull season—not enough to go round, and if they choose to cut each other's throats by striving for the fraction that exists they can do so and still make little or no profit out of it. The freight business is becoming a by-product of the passenger business, with a tendency to share its rate control.

The Mediterranean is the first region in which these conditions have been developed to their fullest. Here the increase of passenger business has assumed unprecedented proportions and the freight has had a similar astonishing decline from the great development of the American fruit business in Florida and California which has almost entirely cut off the greatest staple of Mediterranean freights to New York.

A recent agreement covering Mediterranean freights is the most natural consequence of the above. Therefore we may expect normal developments to produce an ultimate freight control in the North Atlantic approaching in method and force the passenger control which already exists, and it may be expected to start in the Mediterranean and gradually embrace the North Atlantic trade. The trade of the Gulf of Mexico with its great seasonal development of cotton and grain will be more difficult to control because of the greater importance of the tramp steamer in it

(*The end.*)

Concrete Coal Trestle and Ash-Handling Plant.

In connection with the new power house which the Delaware, Lackawanna & Western has now nearly completed as a part of its Hoboken terminal station, a concrete coaling trestle and ash-handling plant have been built. The power house is south of the station tracks and a little beyond the center end of the train shed of the new terminal station. The purpose of the trestle is to form

Partly Finished Trestle before Power House Was Built.

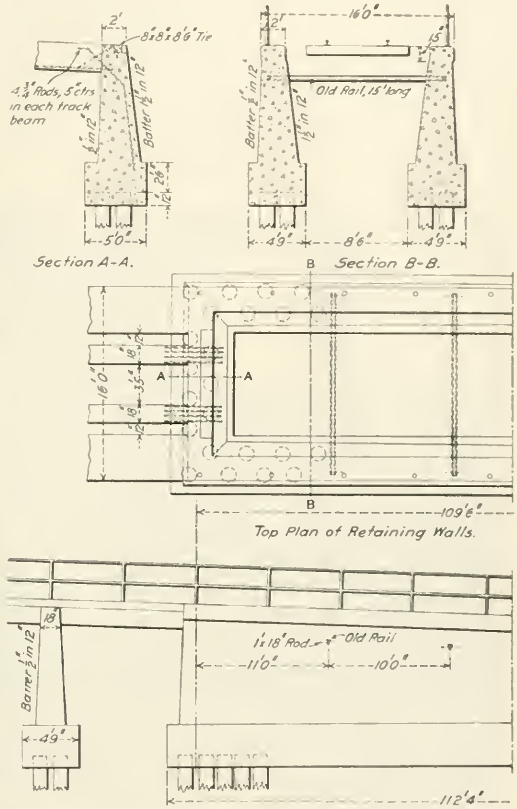
an approach by which loaded coal cars may be taken to the level of the second floor of the power house whence coal is dumped to the space in front of the boilers. The trestle also serves as the support, on one side, of a steel structure which carries the trolley track of the conveyor for handling ashes from the boiler room. The rest of the structure is entirely of reinforced concrete.

As shown in the accompanying photographs, the trestle lies alongside of and parallel to a two-story coach house and material building just beyond the power house, on the ground floor of which the boilers are located. The power house is three stories high. Between the trestle and the building is the ash-car track, over which, for 130 ft., extends the trolley and its supporting structure. The trestle proper is 226 ft. 3 in. long, consisting of 18 bents on piers spaced 12 ft. center to center. The inner abutment is the wall of the power house and the outer abutment is the end of an approach 112 ft. 4 in. long. The surface of the whole structure, trestle and approach is on a 1 per cent. grade up to the last three bents toward the power house. Here a vertical curve is introduced between the incline and the level within the power house, into which the tracks are carried through an arched entrance on the level of the second floor. The approach is filled in between retaining walls tied together near the abutment by old rails 15 ft. long extending from one wall to the other and fastened in each wall by an 18-in. rod passing through the end of the rail and embedded in the concrete. Four of these rails are used, spaced 10 ft. apart. The walls are necessary because of the limited ground space, the tracks on each side being too near to let the fill take its material slope. From out to out, the structure is 16 ft. wide, about one-half this width being occupied by a walk on each side. These are protected by railings of iron pipe.

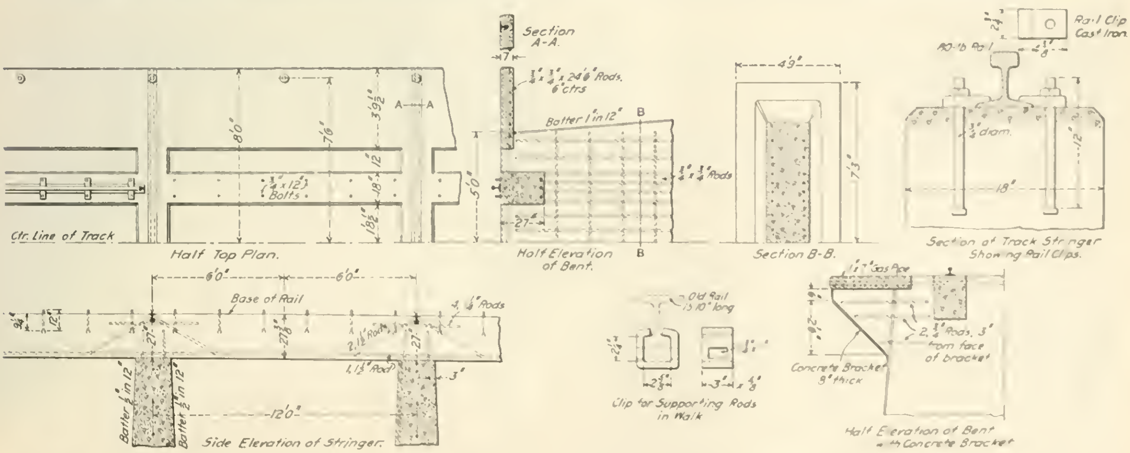
The bents vary in height from that of No. 1, next the approach abutment, which is 11.32 ft. high, to No. 18, nearest to the power house, which is 19 ft. All are on piles on account of the nature of the soil, which is largely made ground. Footings are 4 ft. 9 in. wide and in length vary from 11 ft. 9½ in., at bent No. 1, to 13 ft. 1 in. at bent No. 18. The thickness is 3 ft., of which 1 ft. is filling between the tops of the piles. Each pier is 19 ft. wide and 18 in. thick at the top with a batter of 1 in. per foot in cross section of the trestle and ½ in. per foot in longitudinal section. On these are concrete stringers, 18 in. x 27 in., in which are embedded ¾-in. bolts, 12 in. long, to which are secured the clamps which hold the rails in place. Ordinarily, in structures of this kind metal plates are put between the concrete stringer and the base of the rail. In this case, the plate was dispensed with and the indications are that this construction will prove satisfactory. The anchor bolts, however, project far enough above the stringer to allow for plates, should they subsequently be found desirable. Between the stringers and on each side of them open spaces, 3 ft. 5 in. and 12 in. wide, respectively, have been left, partly to separate the stringers which carry heavy loads from the floor structure which is of lighter construction, and partly to facilitate the dumping of material along the incline for any reason. This arrangement has already been made use

Side View of Trestle and Approach.

Trestle and Approach, Looking toward Power House.



Plan, Elevation and Sections of Approach.



Plan, Elevations and Details of Hoboken Coal Trestle; Delaware, Lackawanna & Western.

of in connection with the handling of construction materials for the power house

The piers are reinforced by ¾-in. square rods placed vertically in two rows 3 in. from the outside of the pier, spaced 5 in. apart underneath the stringers, and 8 or 9 in. apart outside of and between the stringers, by similar rods are laid horizontally, spaced 18 in. apart. The stringers are reinforced by three 1¼-in. square rods laid with centers 3 in. from the bottom of the stringer. Over each bearing point the upper part of the stringer is reinforced by four rods, each 1½ in. square and 8 ft. 4 in. long, and on these upper rods an inverted rail, extending the width of the structure, rests at each bent. On each side of this rail, abutting against the flange and web, are two 1¼ in. square rods, extending to the lower reinforcement at an angle of about 35 deg. with it.

In the construction of the sidewalks, a novel method was used. The cross rails above referred to are the principal means of support. These rails, as stated, extend to the outer edge of the sidewalk. At intervals of 6 in., clips of the form shown in one of the drawings are attached to and hang from the head, and through openings in each leg of the clip are passed the rods which form the horizontal reinforcement of the sidewalk. As shown in the cross-section, the sidewalk on the outside away from the power house, has no other support than that just described; on the opposite side, a bracket 8 in. thick, tied to the pier by reinforcing rods, is formed to serve as a support opposite each bent. This bracket is solely for the purpose of giving additional support to the columns on which the cross-beams of the ash handling plant are carried. The other extremities of these beams are supported in the wall of the power house extension.

The trestle was designed and built by the engineering department of the Delaware, Lackawanna & Western, Lincoln Bush, Chief Engineer, and George T. Hand, Assistant Engineer, to whom we are indebted for data and illustrations.

Foreign Railroad Notes.

The first section, 360 miles, of the road from Rio Janiero, Brazil, to Goyaz, 630 miles, has been opened.

The Chinese are building on their own account and with native engineers a railroad from Pekin northwest to the great wall at Kalgan. It is reported that in January a tunnel on the route caved in and killed 180 workmen.

Arrangements have been made for a railroad ferry between Lasznitz, on the island of Rugen, and Trelleborg, in Sweden, 63 miles. There are to be two ferry boats, each with a speed of 16 knots, and large enough to carry a whole train, after the manner of similar ferries on the Great Lakes in the United States. When in operation this will give direct connection between the railroad systems of Scandinavia and of Germany.

Russian journals say that foreigners are beginning to develop the meat production of Siberia, for which the railroad gives an outlet for the first time. Germans are raising, fattening and refrigerating cattle and sheep; and Englishmen, hogs and geese. Such production and preparation as was common to the natives furnished a product which foreign markets would not accept. There is an enormous field for the development of these industries—many times greater than that fit for grain production.

Construction of the St. Michel Station of the Paris Metropolitan Subway.

BY E. OMMEGANCK.

The construction of the St. Michel station of the Paris Metropolitan Railway is illustrated in the accompanying photographs. This station is under one of the boulevards of Paris. As it had to be built in water-soaked ground, the ordinary method of excavation could not be used. Neither could shield construction be used, because of the large dimensions of the station. The work was therefore done by caissons sunk vertically. These caissons were like coverless boxes with air-tight walls entirely surrounding the work. They were first built over the place where they were to be sunk with a working chamber at the bottom to allow the laborers to excavate underneath the caisson, which was sunk progressively by its own weight as the spoil was removed. Compressed air was used to keep the water out of the working chamber under a pressure that increases with the depth. The upper or main part of the caisson and the working chambers were separated by a strong horizontal partition made air tight by a thick layer of concrete. Passage of men and materials back and forth between the upper part of the caisson with normal air pressure and the lower part under compressed air, was made through air locks at the end of vertical shafts which, of course, were longer the farther down the caisson had gone. The caissons were sunk gradually, and finally disappeared completely under the soil with which they were covered, the shaft alone extending through the soil.

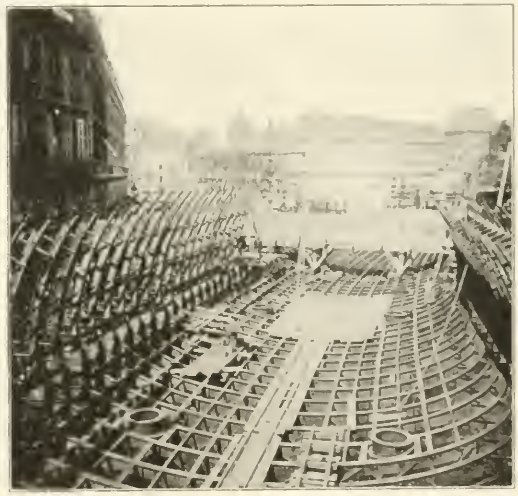
The St. Michel Station, Under Construction, Showing One of the End Caissons; Paris Metropolitan Railway.

The station itself is curved on a radius of 984 ft. It is made up of three caissons, 390 ft. long altogether. The center caisson is semi-cylindrical, 226 ft. long, 55 ft. wide and 41 ft. 8 in. high, containing the station proper. At each end an elliptical well connects the stations with the subway. The height of this well is the distance from a point 8 ft. below the lower part of the station to the level of the street. It contains the ticket office and stairs and elevators reaching to the passenger platform of the finished station.

The metallic frame of the large central caisson is made of transverse trusses in the form of an arc of a circle, 4 ft. apart and connected by cross ties. On the cross ties are placed the jointed iron plates which constitute the external envelope of the work. The transverse section of this caisson forms a semi-circular vault with an opening 41 ft. 8 in. wide. Its height in the clear is 28 ft. 3 in. The station will be provided with two lateral platforms for passengers, with a space for trains 18 ft. 3 in. wide. The platforms will each be 11 ft. 8 in. wide and as long as the station, which is about 250 ft.

The walls of this large caisson are formed of iron plates $^{7}/_{16}$ in. thick, riveted to the outside shell and stiffened internally by angle irons. These angle irons have holes for reinforcing irons forming a bed for a layer of concrete. The concrete will be faced with white enamel tiles. All around this internal envelope, concrete will be poured to a depth of 3 ft. 3 in. at the key and 6 ft. 6 in. at the springings of the vault, entirely embedding the transverse trusses. Moreover the iron plates of the external shell, instead of following the round contours of the caisson, are set vertically at its sides and held by steel stanchions that will serve as webs between two parallel sustaining walls of concrete. The object of this arrangement is to prevent any movement of the ground during the sinking which might result in the settling of the surface of the street. The working chamber of this central caisson is separated longitudinally by a central partition which divides it into two chambers, each with four working shafts. By this means the sinking of this large caisson will be made more sure and regular. Such precaution is necessary, for it weighs at least 18,000 tons, of which 7,000 are concrete and 11,000 steel, and, by reason of the inequality of the ground, it is likely to get out of plumb or even to become displaced.

The Large Central Caisson Being Mounted.



The Large Central Caisson Being Erected.

The two end caissons, one of which is shown in the largest photograph, are identical. They have an elliptical internal section, the major axis of which is 86 ft. long and the minor axis 61 ft. They are to be sunk about 76 ft. beneath the street level. For 66 ft. of the height the walls consist of a double lining of steel weighing 650 tons. The 5-ft. space within this lining has counterforts and crossbraces and is filled in with 2,500 tons of concrete. Once in place, the continuous ring thus formed will be surmounted by a masonry coping 6½ ft. high. This coping will support a strong metallic floor completely closing the work at the top. On this the roadway will be laid.

Working of the Massachusetts Stock Law.*

Strong complaints have been made to the Commission concerning the effect of the Massachusetts statutes which regulate the issue of stock by public service corporations. The opinion is widely spread among persons familiar with financial affairs that investment in these corporations is discouraged by our laws, and that money which should be invested in Massachusetts to the advantage of the public is attracted to other states where more profitable returns are permitted, with the result that such enterprises are sometimes altogether prevented, and when undertaken are often retarded in their development.

So far as concerns the laws which govern the inception of these corporations, and which prevent stock watering by requiring full payment of par value in cash as a condition for the issue of stock the Commission has heard little criticism and is satisfied that these requirements are salutary. While an opportunity to issue stock without such payment, or to give it as a bonus with bonds, as is permitted in some states, facilitates the raising of money for new enterprises, and may possibly be necessary in order to attract capital into a new and unsettled country, Massachusetts does not need to offer such inducements. No public service corporations bear a higher reputation as safe and conservative investments than those of Massachusetts, and her laws which prevent watering stock by an issue for less than par, and provide for supervising financial management, are generally accepted as models of wise state control, administered as they are by boards of commissioners free from suspicion of political influence or bias.

It is some of the provisions respecting a subsequent issue of stock when a public service corporation wishes to increase its capital that are questioned. There is, first, a requirement that no increase of capital be allowed except for a purpose approved by the Board of Railroad Commissioners. Of this no complaint has been heard, and in the judgment of the Commission it is in every respect wise. But there is a further regulation which forbids an increase of stock on the terms which apply to an original issue that is uniformly at par, and requires that if the stock has acquired a higher value the new stock must be issued at a price correspondingly advanced. This requirement, which first appeared in our law in 1893, is much criticised.

The course of our legislation on this subject has been as follows: prior to 1870 there seems to have been no regulation by general law, each case being dealt with by special act, and the recognized principle seems to have been that issues of stock whether made at the inception of the corporation or subsequently, stood on the same basis and were to be made at par, and in 1870 this principle was established by general law. The next year, however, a new method was introduced for railroad corporations, by requiring that when the new stock was worth more than par it should be offered at public auction; and this was soon extended to street railway companies.

This requirement of a sale at public auction was disapproved by the Board of Railroad Commissioners in their report for 1872, as seeming "to threaten results not contemplated in the passing of the act," and was declared to be "a reversal of the long-established policy of the commonwealth as regards its railroad corporations"; and the Railroad Commissioners proceed to criticise the act in these terms:

> The theory of our legislation hitherto has been that the state needed both new railroads and the most complete development of all old railroads, the full accomplishment of both objects require large investments of private capital upon which the Commonwealth guaranteed no certain return, but it authorized a return not exceeding 10 per cent if as much could be earned. In other words, a possible return of 10 per cent was held out to induce private capital to enter into railroad enterprises, and this amount, if it could be earned, the law declared the community willing to pay. There is not a railroad in Massachusetts of any general importance which does not now stand in urgent need of additional large outlays to accommodate the growing business wants of the community. Especially is this the case, without any exception, with the lines terminating in Boston; the growth of the community imperatively calls for liberal outlays on the part of all of them. The former policy of the Commonwealth by holding out a

*From the majority report of the Commission on Commerce and Industry, Massachusetts, 1908.

prospect of 10 per cent. dividends on the new capital necessary to effect these needed developments, offered a strong inducement to the stockholders of the corporations to adopt a liberal policy and to go energetically forward with it. The act of 1871 in its practical operation cuts off this inducement by limiting the return of new capital invested in the development of all the leading lines of the state not at 10 per cent. but at $10 per annum on the market value of the stock of such companies, thus reducing the return on new capital from 10 to 8 or even 7 per cent. Less inducement is thus held out to private capital to seek investment in the railroad system of Massachusetts than in any other state of the Union. In all of these the law authorizes a possible return of 10 per cent. as a minimum, and in many the limit is fixed much higher. It is therefore matter of consideration whether the act under discussion, by reducing the possible return to so low a point, will not cause those managing the corporations to become indifferent to a further development which cannot accrue to their own advantage, and to divert their capital to other quarters where it will be more liberally remunerated.

It is to be observed that since the report just quoted from was published, the holding out of 10 per cent. as a possible dividend has disappeared with the repeal, in 1874, of the law referred to by the Railroad Commissioners. There is now no statute restricting the power of the legislature to reduce tolls to be charged by steam railroads, so that the inducement to invest referred to above has been withdrawn.

The act requiring sale at public auction instead of an issue to stockholders at par stood (with an amendment not important to consider here) until in 1878 it was repealed for steam railroads, and in 1879 for street railways; and the law was then re-established as it had stood before 1871; that is, new stock was issued to stockholders at par. Thus re-established, the law was reaffirmed in 1882 in Public Statutes, and stood until 1893, when a regulation of a novel character were introduced. By this new provision it was required that, whenever a steam railroad or street railway company increased its stock by an issue exceeding 4 per cent. of its existing capital stock, the amount necessary for the contemplated purpose should be offered to shareholders at its market value at that time as determined by the Board of Railroad Commissioners, "taking into account previous sales of stock of the corporation and other pertinent conditions," any shares not subscribed for to be sold at public auction, but no share to be sold or issued at less than par. This act was amended by Acts of 1894, so as to cover gas, electric lighting, aqueduct or water companies and telegraph and telephone companies, and the law now stands substantially as enacted in 1894.

The introduction of this requirement for a sale of new stock at a premium instead of at par was referred to by the Board of Railroad Commissioners in their report for 1895 as establishing "a substantially new system of statutory regulation with respect to the increase and issue of capital stock." The Railroad Commissioners, without definitely expressing approval or disapproval of the new law, go on to observe:

The laws of this state have always recognized the right of the investor to an ample and even liberal return on the actual investment in railroad securities, such return to be made in the form of a regular cash payment of interest to the bondholder and a regular cash dividend to the stockholder. It is for the benefit of the public as well as the investor that this return be made more rather than less secure. Any cause of legislation that is calculated to reduce the revenue of the corporation to a point which does not admit of such return, and which does not moreover allow a margin of profit sufficient for the maintenance of a high standard of construction and equipment, is not only unjust but impolitic, as tending to discourage the investment of capital in legitimate railroad enterprise and to disable the corporation from rendering the best public service.

It appears from the successive enactments referred to above that prior to 1871 new stock issued by railroad corporations was to be offered to stockholders at par; from 1871 to 1878 it was to be sold at auction; from 1878 to 1893 it was again to be offered to stockholders at par; and since 1893 it is to be offered only at market value determined by the Railroad Commissioners, stock in street railway companies being regulated by similar legislation passed at nearly the same dates. We have therefore had 15 years' experience in which to judge of the operation of the present provision of law in its effect on railroads.

So far as known to the Commission, the provision in question was a novelty in corporate regulation in this country when adopted in Massachusetts. Since then our example appears to have been followed only by Maine and New Hampshire.

The theory on which the present law is based is apparently that it is for the public interest to keep new issues of stock as small as practicable, in order that the portion of profits to be applied to the payment of dividends may be kept down. It is assumed that by this means the tolls and charges paid by the public will keep at a minimum, and also that of the profits which are earned a greater proportion will be left available for improved service. It is asserted that an issue of stock in excess of what is actually necessary is stock-watering, and the law of 1894 which prohibits it is sometimes referred to as "the anti-stock-watering act."

It is undoubtedly a sound theory that the amount of the capital stock to be issued by a public-service corporation should be regulated by a law requiring each share when issued to represent what it purports to represent—a proportionate part of a capital authorized by law and actually paid in in full. The evils of excessive capitalization, by issuing shares which have not behind them what they purport to have, which is properly called stock watering, have been demonstrated by experience, and may be taken for granted. These evils are guarded against in Massachusetts by the long-established requirement that the stock shall be issued not below par, and for cash. Par is thus adopted as determining the normal and established value. From that point on the investor takes his risk of the market value increasing or diminishing as the enterprise goes on. Based on this par, the established proportionate value of each share is expressed in the certificate, by it is regulated the liability which each original subscriber is under to creditors, and with reference to it is determined the amount of bonds which the company is authorized to issue. By this and this alone should be determined what is a fair return of profit, whenever that question becomes material, since no other constant element exists by which the reasonableness of the return can be estimated.

Now, the provision introduced by the laws of 1893 and 1894 creates a fundamental difficulty. By requiring new stock to be issued at a price above par, it breaks in on the uniformity of the method of capitalization, with the result that it impairs the effectiveness of the control which the state can exercise in regulating the service to be furnished by the corporation. The declared object of keeping down the amount of shares is that a larger portion of the profits which might otherwise be paid out in dividends shall be applied in diminishing rates or improving service. Yet the moment that the state should demand such an application of profits, and insist that the rate of dividends should be reduced in order that the demand be complied with, it would be met with the proposition that the rate of dividend should be determined not by a reference to the par value of the stock, but by a reference to the higher price which the state itself has prescribed as a minimum. And this proposition would be reasonable.

Par being the established basis on which the rate of dividend is fixed and quoted, the state, so long as it does not interfere in the price to be paid, except to require that it be not less than par, is justified in treating par as the permanent standard by which the reasonableness of dividends shall be measured. Every one who buys in the open market buys on that basis, and takes his chance that the stock may go up or down, and the law pays no regard to market fluctuations. Though he buy at a premium, he cannot complain if the state subsequently deals with dividends by reference to the standard that it has itself fixed, and the only one that it has ever sanctioned or recognized. But all this is changed the moment the state prescribes a new and higher price. Every stockholder who has bought his stock at a premium fixed by the Board of Railroad Commissioners may properly insist that that price be taken as the basis in determining what rate is reasonable. For the state to forbid a sale below a stated price, and then refuse to recognize that price when it is proposed to regulate dividends, would be little short of bad faith; and any tribunal passing upon the reasonableness of rates charged, with a view to the stockholder's fair return, could hardly fail to find force in the contention that to ignore the price fixed by the state would approach confiscation. Nor would it be a sufficient answer to tell the stockholder that he had not been obliged to buy at all and, having bought, must take the consequences. This would do if he had bought in the ordinary open market, but not if he had bought at a price regulated by the state. The regulation becomes, in such a case, a part of the scheme of the enterprise into which the buyer enters; and if the state interposes the regulation for one purpose, it should not repudiate it for another purpose. Of course the state could expressly announce at the outset that, although the stock would be sold only at a premium, the premium was to be disregarded in all subsequent actions by the state, and this would free its hands. But how much stock could be got out in the face of such a warning may be conjectured.

By requiring a sale at a premium, it results that the state fixes, then, what becomes in effect a new par; and a new par not only for the particular stock now issued but, since all stock must stand on the same dividend basis and cannot be separated into classes, the new par is fixed for the entire capital stock. Thus it happens that for the sake of keeping down the number of shares to be issued on the occasion of some fractional increase, often a small one, the state has permanently estopped itself from treating any of the shares as having the par which it had originally fixed, and has advanced the measure of a fair dividend on all. In this way the law actually overreaches itself. A general advance of the dividend standard on all shares results, and this is tantamount, so far as the public is affected by dividends paid, to a stock-watering since it would increase the total of dividends to be permitted before public demands should be acceded to. This is the fundamental objection to recognizing by law any normal value other than par.

It is a misleading stretch of language to speak of issuing at par stock which commands a premium as "stock watering." So long as it is issued for cash at par it conforms to every standard set by the state, and every standard which the stock certificate purports on its face to require. To stigmatize stock as "watered" because it is not issued at a premium is to confuse the settled basis of capitalization and set up a basis varying with the prosperity of the company; and to do it, too, on a theory of the public interest, which, if we are right in our conclusion stated above, is short-sighted, because it weakens rather than strengthens the state's control at the point where it sought to sustain it.

Looking at the actual practical working of the law of 1894, there seems to be no doubt that it has worked badly, so far as concerns steam railroads, and apparently it is doing no good in street railways. The Commission has heard much condemnation of it from many quarters. The Commission on Taxation, in its report presented to the present legislature, confirms the conviction which this Commission had already reached, that the law is making it difficult to raise money needed for the proper development of our transportation facilities, and that report calls the attention of the general court to the need of legislation which shall lessen the severity of the present law.

The method now prescribed is unquestionably poorly adapted for raising money. It requires, first, that the Railroad Commissioners fix the market value, and this is usually difficult to do with any definiteness because quotations of sales of ordinary lots of stock furnish no proper criterion of the market value of a large block. Moreover, as the stock market is subject to wide fluctuations from causes quite independent of the intrinsic value of the stock, there is no assurance that a market price once adopted is to stand long enough to warrant any calculations of the result of a sale to be made in the future, when the necessary votes and other preliminaries shall have been arranged. The Railroad Commission is thus called upon to fix a price without definite or permanent facts on which to base its judgment. A recent experience of the Edison Electric Illuminating Company shows how impracticable a price carefully fixed by commissioners may become before the stock can be actually subscribed. After the commissioners have fixed a price the directors must offer the stock proportionately to shareholders, and as the price is purposely required to be fixed at a figure which precludes a special inducement to buy it is uncertain how much stock will be taken. Whatever is not subscribed must be sold at auction—a requirement which suggests to any stockholder that if he does not subscribe he may buy later at a lower price. An auction sale is uncertain, and in the case of a large block of stock has also the disadvantages of both of depressing the price and of carrying a substantial influence in the management of the railroad to any chance bidder—a prospect which neither the public nor a railroad management would look at with satisfaction. Meantime, the board of directors, which has a definite proposition on hand, is left unable to foresee how much money it is to have. Certainty on that point is so essential to proper financial arrangements that a competent board of directors would naturally make sure by a contract in advance that all stock not subscribed should be taken at some satisfactory price, but if an auction sale is to be interposed such an underwriting contract is difficult, if not impossible. Taken in all its parts the machinery which the present law prescribes for raising money for what is to be assumed to be a desirable public improvement is such as to make the process difficult and costly, if not impossible.

As might have been expected, railroad companies have been discouraged from raising money for large improvements, in the face of this law. The management of the Boston & Maine Railroad explains its backwardness in this respect as due almost wholly to this cause. Since the law was adopted there appears to have been but three applications made by railroad companies for a fixing of price, and the railroads have been driven, when making new issues, to resort to small issues of amounts less than 4 per cent. of their capital, since this can be done by sale at auction without the preliminary of fixing a price. Of the three applications made for large issues one was by the Norwich & Worcester Railroad Company, in 1899, when the price was fixed at 215; one by the Boston & Maine Railroad, in 1901, when the price was fixed at 190, and the third also by the Boston & Maine, in 1906, when the price was fixed at 165. The Commission is informed that the Boston & Maine Railroad was able to get out all its proposed issue in 1901, the market being favorable, but in 1906 the price was found to be so prohibitive that it never has been able to get out the entire issue. For issues of less than 4 per cent. of the capital the Old Colony Railroad Company has applied twelve times since 1893, the Connecticut River Railroad Company once, the Boston & Maine Railroad Company once and the Boston & Lowell Railroad Company twice.

Respecting street railway companies the actual effects of the law are less clear, the period since 1894 having been one of large investment in street railway enterprises throughout the country. While it cannot be said, therefore, that the starting of such enterprises has been prevented, it may still be true that the extension and development of the stronger companies, whose stock is at a premium, has been retarded, and it is asserted by many persons familiar with the situation that this is the fact. It appears that applications for new issues of stock of street railway companies have been made in 207 instances under the present law. Of these, however, 153 were cases of issue at par, leaving only 54 cases of sale at a premium. It is difficult to say with definiteness how far the present law is actually retarding desirable extensions and improvements in the case of street railways, but in the opinion of the Commission it certainly is not encouraging development. It is desirable that public service corporations, when they are so prosperous that their stock sells at a premium, should be encouraged to look for opportunities for development, provided the new plan be approved as promising well for the public, and Massachusetts capital should be drawn into just such investments, rather than tempted away.

Aside from the difficulties experienced in marketing stock at prices fixed by the Commissioners, it is to be remembered that allowing shareholders the possibility of getting new stock at less than its market value offers obvious advantages to shareholders, and works as an inducement to put money into Massachusetts enterprise of this character. Looked at in this light the question whether the state should offer such an inducement is one of practical expediency. These corporations are trustees and agents for the public, but they do not carry on the public business on the terms applicable to private trustees, who are allowed reasonable compensation but are forbidden to make any profit from the trust estate. Public service corporations are in a quasi-partnership with the state. They are allowed to receive all the profits, but are required to charge only such tolls and furnish such service as the public may reasonably demand. It is at the point of tolls and services, then, that the public interest should be protected and public control applied, and so long as these are satisfactory the state should not limit the profits of railroads, since it is always for the interest of the public to have railroads prosperous. An unsuccessful company is the poorest public servant. The right to issue stock at par, in so far as it is a privilege of pecuniary value, is to be considered as a part of the compensation allowed to the corporation. As railroad matters now stand in this state, it is expedient, in the judgment of the Commission, aside from the reasons given above, to concede this as an element of compensation, and by this means attract capital to investment in Massachusetts public enterprises.

It may be suggested that if the law is to be modified it need not be changed to the full extent of allowing the company to issue stock which bears a premium to be sold as low as par, but that some middle course might be found which would secure to the corporate treasury at least a part of the premium, while leaving something as an attraction to subscribers. But every regulation which fixes a price other than par is open to the objections stated above. Moreover, it would be difficult to frame a regulation which should be less explicit than that now in force, and yet be definite enough to work satisfactorily. If the commissioners are to fix a price, but are not to have market value as their criterion, by what rule shall they fix it? Is there any basis which can be prescribed for all cases? If it were left to the commissioners to determine price, with no direction as to the basis to be adopted, the commissioners would either have to adopt for themselves market value as the most definite standard obtainable, or they would be obliged to make arbitrary decisions for which only vague reasons could be given and the whole method would lack the certainty and uniformity which are desirable in such matters. A sale at public auction, without any price fixed by commissioners, and without a privilege of subscription first offered to shareholders (which was the law in force from 1871 to 1878), is open to the objections that it deprives stockholders of all benefit of the premium as effectively as they are now deprived of it, and that it involves the risk of undesirable control pointed out above.

The Commission recommends that the law be modified so as to permit railroad and street railway companies, when authorized to increase their capital, to issue new shares to be offered to stockholders at such price, not below par, as the stockholders may vote, any shares not subscribed for to be sold at public auction. By this modification the law as it stood prior to 1871, and again between 1878 and 1893, will be restored. It is not to be assumed that new stock will always be issued under this permission at par if a higher price can be obtained for the treasury. Experience in other states where the law is open shows that it is common for companies whose stock is at a premium to issue new shares at a price above par, though low enough to tempt investors. This has been the practice of the New York, New Haven & Hartford Railroad Company in issuing shares under its Connecticut charter. But whatever price may be adopted it will be the action of the company itself which fixes it and par will remain for all purposes the fixed standard by which the reasonableness of dividends shall be measured when concessions are demanded by the public.

The present provision, which requires approval by the Railroad Commissioners of the purpose for which an increase of stock is to be made, will prevent, in the opinion of the Commission, an issue for any purpose not warranted by public necessity or convenience.

The recommendation made above is made irrespective of the recommendations in this report concerning the New York, New Haven & Hartford Railroad Company and the Boston & Maine Railroad. Whatever may be done in that matter the Commission considers the change in the general law now recommended to be desirable.

The Commission has not examined the question of stock issues by public service corporations other than railroads and street railways with sufficient thoroughness to enable it to make any recommendation. Although the objections stated above are applicable in principle to an issue by any public service corporation at a premium fixed by the state, special considerations may apply, at least to gas companies, since the commodity furnished by these companies is susceptible of regulation on the basis of dividends paid, or otherwise, in a manner not practicable in the case of railroads, and special provisions of law for these companies may be expedient. That our laws are considered severe, however, by some public service corporations other than railroad companies is suggested by the experience of Massachusetts with the American Bell Telephone Company, which is understood to have left the state chiefly because of restrictions imposed by law on its capitalization and its power to hold stock in other companies.

Freight Car Balance and Performance for December, 1907.

The American Railway Association Committee on Car Efficiency has issued its Bulletin No. 22 covering Car Balance and Performance for December, 1907, the summary of which is given herewith. The committee says:

"A general decrease is noted in the total car mileage, ton mileage, and freight earnings, due to the prevailing business depression, and as a consequence the averages by which car efficiency is usually measured show a marked decrease. While the relief from congestion makes possible a higher mileage by loaded cars, and the homeward movement of empty foreign cars tends to accelerate their mileage, the increase is more than offset by the cessation of mileage by surplus cars.

"An approximate figure for cars actually in service may be obtained, however, by allowing for the idle cars reported in our Bulletins of Car Shortage and Surplus, and the increased percentage of cars in shop. These surpluses are as follows:

Per cent. of shop cars, December, 1907	5.57 per cent.
Normal percentage of shop cars (Jan. Mar., 1907)	5.02 "
Excess percentage	0.55 per cent.
Average surplus cars December, 1907, 164,325.	
Per cent. of total cars..........................	7.89 per cent.
Total per cent. surplus and excess shop cars..	8.44 per cent.

"Deducting 8.44 per cent. from the total cars for which mileage is reported, and applying the remainder to the total car mileage, an average of 23.9 miles per car per day is secured, which is very little lower than the normal average.

"The present rules governing freight car interchange are founded on the principle that every car owner has a right to the control of his cars, and each successive change in rules or rates simply emphasized this right. This principle, although based on strict equity, has had opposed to it the inevitable tendency toward a free interchange or common use of cars adapted to general traffic. The extent to which this natural tendency has prevailed over artificial regulations at variance with it, is denoted by the per cent. of foreign cars in use on all lines, which increased from 30 per cent. in 1904, to 41 per cent. for the first six months of 1907. The rate of rental for car hire which has not availed in times of car shortage to secure the car owner in the use of his property, operated immediately on the appearance of a car surplus to create a new difficulty, the excessive and useless cross haul of empty cars. The per cent. of cars on their home roads, which was but 56 per cent. during the first half of 1907, and only 54 per cent. during the month of April, 1907, averaged 64 per cent. in December, with indications that the homeward movement had only fairly started. This change was brought about only at great expense.

"The proportion of empty to total freight car mileage in December was 35.4 per cent. as against 27.1 per cent. in October. It is fair to assume that the average business can be handled with at least as low a percentage of empty mileage when the car supply is plentiful as during a period of shortage, and it would therefore appear that 8.3 per cent. of the total car mileage, or 117,287,407 miles, was absolutely unnecessary. It is impossible to calculate the cost of this enormous empty movement, but that it was a heavy drain on the already depleted revenues of the railroads, cannot be denied. It may be claimed that the saving made by individual roads in per diem balances justified the expenditure which this excess empty movement entailed, but the fallacy of this claim is apparent in the face of the fact that the gain by one line was necessarily offset by the loss to another. Further, in a majority of cases, the movement resulted in practically an even exchange of cars.

"Nor was this the only deplorable result. A great many roads took extreme measures to reduce the number of foreign cars on their lines and to force their own cars into service. Roads which had, during the period of shortage, gladly accepted cars belonging to affiliated lines, revised their rules when cars became plentiful and refused to accept cars not properly routing over their lines. Foreign cars were in many instances stopped at junction points and their lading transferred to home cars. In other cases home cars were applied on loading to foreign lines, while foreign cars were sent home empty in the same direction * * * The experience gained at such great cost may lead to the adoption of more flexible rules

FREIGHT CAR EFFICIENCY, DECEMBER, 1907.

Items.	New England.	New York, New Jersey, Del., Md., Eastern Pa.	Ohio, Ind., Mich., Western Pa.	Va., W. Va., No. and So. Carolina.	Ky., Tenn., Miss., Ala., Ga., Fla.	Iowa, Ill., Wis., Minn., Dakotas.	Mont., Wyo., Neb., Dakotas.	Kansas, Colo., Okla., Ind. T., Mo., Ark.	Texas, La., New Mex.	Ore., Idaho, Nev., Cal., Arizona.	Canadian Lines.	Mexican Lines.	Grand total
Revenue freight cars owned	38,927	641,312	278,741	134,730	166,053	376,515	16,122	137,504	26,222	106,665	96,989	585	2,020,363
Average number system cars on line .	24,196	399,209	174,637	77,491	97,108	271,915	5,774	85,809	13,871	65,711	70,282	573	1,280,576
Average foreign railroad cars on line.	23,288	210,251	82,801	50,320	56,510	96,089	16,255	45,771	28,214	62,994	23,938	2,130	698,561
Total railroad cars on line	47,184	609,460	257,438	127,811	153,618	368,004	22,029	131,580	42,085	128,705	94,220	2,703	1,985,137
Excess	8,557	....	....	.....	....	....	5,907	....	15,863	22,040	.	2,118	......
Per cent. railroad cars on line of total owned:													
Home	62	62	62	58	59	72	36	63	53	62	72	98	61
Foreign	60	33	30	37	34	26	101	33	107	59	25	364	34
All railroad	122	95	92	95	93	98	137	96	160	121	97	162	98
Private cars on line	1,469	40,722	14,400	2,829	7,006	11,165	1,622	5,309	2,401	8,086	3,830	.	98,833
Total, all cars on line...	48,653	650,182	271,838	130,640	160,624	379,169	23,651	136,889	44,486	136,791	98,050	2,703	2,083,976
Per cent. of cars in shop	2.81	1.11	6.71	7.01	1.72	5.14	4.27	9.73	5.18	1.93	5.21	.	5.57
Number freight engines owned	708	9,542	3,682	2,225	2,503	6,332	438	2,445	631	2,280	2,099	35	32,919
Av. cars on line per frt engine owned.	69	68	74	59	64	60	54	56	70	60	47	77	63
Total freight car mileage	25,039,620	455,223,345	159,085,040	77,467,918	108,705,482	249,522,045	24,156,097	84,348,811	30,087,493	114,035,678	84,960,116	469,650	1,413,101,295
Average miles per car per day.......	16.5	22.6	18.9	19.2	21.9	21.1	32.9	19.9	21.8	26.9	28.2	5.9	21.9
Per cent. loaded mileage	68.7	61.7	61.1	63.1	66.0	70.3	63.5	63.4	65.9	64.7	69.3	70.2	64.6
Ton mileage revenue freight......	230,405,031	6,283,764,569	2,001,578,059	840,387,148	1,007,096,978	2,011,149,731	315,735,394	970,173,049	352,889,232	1,575,306,187	1,050,522,626	7,439,631	16,646,747,641
Average ton miles:													
Per car mile.	9.2	13.8	13.4	10.8	12.4	13.8	13.4	11.5	11.0	13.8	12.4	15.8	13.1
Per loaded car mile	13.4	22.4	21.9	17.2	16.4	20.0	21.2	18.3	18.1	21.4	17.8	22.6	20.5
Per car per day	152	313	260	208	282	289	451	229	244	373	347	93	289
Gross freight earnings	$2,548,923	$37,720,582	$12,512,000	$6,691,942	$9,197,947	$17,170,635	$2,921,118	$8,880,650	$3,181,986	$14,359,445	$6,924,631	$113,611	$122,523,479
Average daily earnings.													
Per car owned	$2.11	$1.90	$1.45	$1.60	$1.83	$1.94	$5.84	$2.09	$3.90	$4.35	$2.30	$6.26	$2.65
Per railroad car on line	1.73	2.00	1.57	1.69	1.98	2.01	4.28	2.18	2.46	3.61	2.37	1.36	2.09
All cars on line	1.68	1.87	1.48	1.65	1.88	1.94	3.98	2.10	2.32	3.40	2.28	1.30	1.98

governing the use of freight cars in interline traffic. To the extent that such rules recognize the necessity for free interchange of cars, with such regulation as the principle of private ownership demands, to that extent will the future efficiency of freight cars be increased."

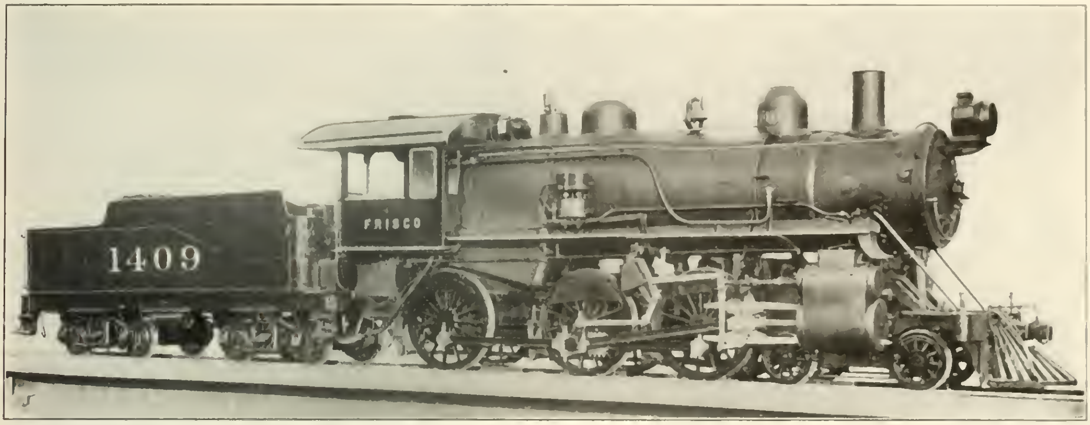
Ten-Wheel Passenger Locomotives for the 'Frisco.

The Baldwin Locomotive Works have recently delivered to the St. Louis & San Francisco ten passenger locomotives of the 10-wheel type. These are among the heaviest engines of this class thus far made by the builders, as they have a total weight of 194,450 lbs. in working order. The cylinders are 23 x 26 in. and the driving wheels 69 in. in diameter, the resulting tractive force with a steam pressure of 200 lbs. being 33,900 lbs. As the weight on the driving wheels is 141,050 lbs. the factor of adhesion is 4.16.

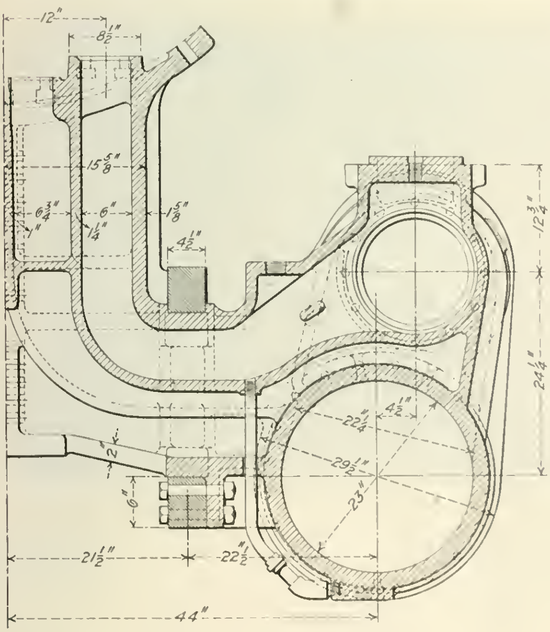
The cylinders are arranged for double front rails, and the castings are bolted to the smokebox and to each other by a double row of 1¼-in. bolts. The valves are of the internal admission piston type, 13 in. in diameter, and work in bushings ⅝ in. thick. The by-pass valve consists of a plate which rests on a horizontal seat, and normally covers openings leading to the live steam ports. When the throttle is open the plate is held down by boiler pressure which acts on its upper surface. Excessive pressure within the cylinder will cause the plate to lift from its seat, thus opening communication between the two live steam ports.

The center lines of the steam chests are placed 4½ in. outside the center lines of the cylinders, thus making possible a simple arrangement of Walschaert's valve gear, with all moving parts in practically the same vertical plane. As the engine is equipped with inside admission valves the eccentric cranks follow the pins. The cranks are of cast steel, and are secured to the main pins by a tapered fit and through bolt. A substantial steel casting, secured to each frame by three 1¼-in. bolts, supports at each end a combined link and reverse shaft bearing. The links are of the built-up type, with cast steel side plates. Each radius rod is made in one piece, the jaw which embraces the hanger and link block being slotted out. The combining levers are placed back of the crossheads and are coupled directly to the valve rods, which are supported in bearings bolted to the guide yoke. The valves are set with a constant lead of ¼ in. and a maximum travel of 6 in. The steam lap is 1 in. and the exhaust clearance ⅛ in.

The frames are of cast steel, 4½ in. wide, with double front



Ten-Wheel Locomotive; St. Louis & San Francisco.



Cylinder of Ten-Wheel Locomotive.

rails of wrought iron. The lower rail is double-keyed, while the top rail is hooked to the main frame, without keys. The pedestal binders are lugged and bolted to the pedestals.

The boiler is of the wagon-top type, with a wide firebox and sloping throat and back head. The center line is placed 9 ft. 8 in. above the rail, and the depth of the throat from the underside of the barrel to the bottom of the mud ring is 23⅛ in. By spacing the second and third pairs of driving wheels 9 ft. apart ample room is secured for a wide firebox with a moderate inclination of the grate. The mud ring is supported on sliding shoes in front and a buckle plate at the rear.

The firebox is radially stayed, with two T irons supporting the front end of the crown. The roof and side sheets are in three pieces, with a double riveted lap seam on each side, while the crown and sides of the inside box are in one piece. The boiler barrel is built up of three rings, with the gusset in the middle. The longitudinal seams are butt jointed and sextuple riveted, and are welded at each end. The seam on the dome ring is placed on the top center line and is welded throughout its entire length, with a heavy liner inside.

The tender is furnished with a steel channel frame and water bottom tank. The trucks are of the arch bar type, with cast steel bolsters, triple elliptic springs and steel-tired wheels.

The following are some of the principal dimensions of these engines:

Cylinder, diameter	23 in.
Piston, stroke	26 "
Boiler diameter of shell	68 "
Boiler, thickness of sheets	[illegible] in. and ¾ in.
Steam pressure	200 lbs.
Firebox, length	101⅜ in.
" width	67¼ "
" depth, front	77⅜ "
" depth back	59⅛ "
" thickness, side, back, crown	⅜ "
" thickness tube	½ "
" water space, front	4 "
" water space, sides and back	3½ "
Tubes, number	364
" diameter	2 in.
" length	15 ft. 1½ in.
Heating surface firebox	172 sq. ft.
" " tubes	2,867 "
" " total	3,039 "
Grate area	47.7 "
Wheels, diameter, driving	69 in.
" " truck	33 "
" " tender	33 "
Journals, main driving	10 in. x 12 in.
" trailing	9 " x 12 "
" truck	6½ " x 10 "
" tender	5½ " x 10 "

Wheel base, driving	15 ft. 10 in.
" " engine	26 " 10 "
" " engine and tender	57 " 10 "
Weight on driving wheel	141,050 lbs.
" on truck wheels	53,010 "
" of engine	194,450 "
" of engine and tender	315,000 "
Tank capacity, water	6,000 gals.
Tank capacity, coal	12 tons
Tractive effort	33,900 lbs.
Weight on drivers / Tractive effort	4.16
Total weight / Tractive effort	5.74
Tractive effort x diameter of drivers / Heating surface	769.6
Heating surface / Grate area	63.71
Firebox heating surface / Total heating surface	5.66*
Weight on drivers / Total heating surface	46.41
Total weight / Total heating surface	63.98
Volume of two cylinders, cu. ft.	12.5
Total heating surface / Volume of 2 cylinders	243.12
Grate area / Volume of 2 cylinders	3.82

*Per cent.

An Engineering Department Filing System.

The method of filing drawings in the engineering offices of many railroads is antiquated and unsystematic, and is a constant source of annoyance and delay within the department as well as without. When a managing officer asks for a drawing he wants it at once, and the engineering department should be able to produce it without delay. Under the system, or lack of system, followed in many offices, this is impossible. In addition to this important requisite, a satisfactory system should preserve the drawings in good shape and should be capable of being easily expanded. A system of this sort has recently been installed in the office of the engineer of maintenance of way of the Chicago & Eastern Illinois.

Special filing cases were designed, comprising units of two kinds: one containing shallow drawers and the other pigeon holes. The units are all 41 in. long, and all but one kind are $17\frac{1}{2}$ in. high. There are three widths of pigeon hole units—15 in., 22 in. and 29 in.—and of the last there are two arrangements, one having the pigeon holes running the 29-in. direction and the other running the 41-in. direction. The larger drawer unit is the same size as the largest pigeon hole unit—41 in. x 29 in. x $17\frac{1}{2}$ in.—and has eight drawers $1\frac{3}{4}$ in. deep. The small drawer unit is $9\frac{1}{2}$ in. high and has four drawers, $3\frac{1}{2}$ in. deep, arranged in two tiers of two drawers each. The pigeon-hole units are divided into an upper and lower story, each of which is closed by two sliding panels running in parallel grooves, so that only one-half of the opening can be uncovered at one time.

In the large drawers are placed the larger drawings, like right-of-way maps, according to the system of indexing to be described later. For the pigeon holes the drawings, which are tracings of course, are rolled around cardboard tubes $\frac{7}{8}$ in. in diameter, with closed ends. There are three different lengths—18 in., 26 in. and 38 in.—and midway of each is pasted, by one end, a strip of unprepared Hyperion cloth, about 5 in. x 10 in. for a 26-in. tube. This is rolled in with the tracing to keep the latter from slipping on the tube. A circular sticker on the end of the tube carries the filing numbers, which are made with a rubber stamp. The only rolled drawings not put around tubes are profiles, their length making a tube unnecessary. A blueprint copy is kept in the pigeon hole with each profile tracing to save too frequent handlings of the latter. The original drawings of all of the tracings in the filing cases are kept in a vault.

The small-drawer units are intended for miscellaneous small drawings such as sketches, small maps, etc., which are either legal size ($8\frac{1}{2}$ in. x 14 in.) or correspondence size ($8\frac{1}{2}$ in. x 11 in.) Also a stack consisting of a small-drawer unit, a 29 in. wide pigeon-hole unit and a base is put under each drafting table. In the pigeon-holes are kept drawings on which the draftsman may be working or using for reference, and in the drawers are kept drawing instruments, material, papers, etc.

The drawings are indexed in station order and also according to classification; therefore much that appears in one is cross-indexed in the other. There are three divisions of the road, each with branches. The stations are taken in order on the main line first, and then each branch in turn. For the more important points, where there are a great many drawings, the index is split up into subjects. As already mentioned, much that is in the "classification" index appears in the "station" index also. However, there are some things that cannot be indexed in the "station" file, as, for example, charts, diagrams, reports, forms, tables, statements, etc. The card gives all essential information concerning the drawing. For a right-of-way map, for instance, it will show the division or branch, the town, county, mile-post, scale and file number. These maps are kept in the large drawers, as already mentioned, there being one drawer for each county.

A photographic view showing both the drawer and pigeon-hole units is reproduced herewith. The units numbered 3 and 4 open at the left-hand end, the sliding panels showing plainly. The opened cases show the ends of the cardboard tubes on which the tracings are rolled.

In the index cabinet are three vertical file drawers in which are kept current records of side-track changes, there being one drawer for each division of the road. These changes are recorded on a regular blueprint form of legal size, and a blueprint map showing the change is attached. The office tracing is changed to correspond, and a notation of same made on the record. These drawers will hold a year's records, after which they are removed and placed in Shipman binders.

The C. & E. I. system of indexing has been made as compact as possible, a feature that its users consider a great advantage. Instead of one entry to a card, as with some systems, as many entries as possible are made on a single card. The cards are 4 in. x 6 in. and are ruled with 13 lines. It is claimed that less time is taken to glance over a dozen entries on a single card than to look at a dozen cards. It is absolutely essential, of course, that the index be kept up to date. The C. & E. I. engineering officers are much pleased with the system and say that it has justified its cost many times already in the short period it has been in use.

Filing Cases for Drawings; Engineering Dept., Chicago & Eastern Illinois.

It may possibly console some of us who have been impatient because sundry railroad terminals have been some years under way and are not yet completed to know that we have company in our misery. In 1878 a commission was appointed to report on what should be done to remedy the totally inadequate facilities of the passenger station in Copenhagen. In 1903 the Minister of Public Works submitted plans for a new station. Recently work was begun on it, and it is to be something fine, costing little less than \$7,000,000; it is to be completed in 1915.

GENERAL NEWS SECTION

NOTES.

The railroad commissioners of Massachusetts have declined to recommend that every street railway car be provided with a lifting jack.

The Southern Railway has decided to employ train collectors on its passenger trains generally throughout its lines, and has appointed as superintendent of the department R. W. Hunt.

The West Jersey & Sea Shore has announced an increase in passenger fares, taking effect June 1. Between Philadelphia and Atlantic City the round-trip rate will be advanced 25 cents.

The railroads of Mississippi, with the approval of the State Railroad Commission, are now issuing 1,000-mile books, good for families, at $25. The principal roads also issue 2,000-mile books at $40.

The railroads in the Transcontinental Passenger Association have abolished second class fares, so that henceforth passengers riding in tourist sleeping cars will have to pay at the first class rate.

Through passenger trains are now running between St. Paul and Spokane over the Canadian Pacific and the Spokane International. These trains were taken off about four months ago on account of the light traffic.

The Atchison, Topeka & Santa Fe has just opened at the Needles, Cal., a new hotel, "El Garces." The hotel cost approximately $250,000, and is one of the finest station hotels on the line. The building is of reinforced concrete, 518 ft. long and two stories high.

On the Pittsburgh division of the Pennsylvania two helping engines are now used with some of the heavy freight trains ascending grades, instead of one, as heretofore, thus increasing by 50 per cent. the number of cars that can be taken in a single train.

The railroads in the Central Passenger Association, in deciding to make a reduction of 25 per cent. in the round-trip rates to large conventions during the present year, voted to grant this allowance only for occasions where 1,000 or more passengers will be likely to want the reduced rate tickets.

At Spokane April 22 the Northern Pacific was fined $4,000 in the Federal Court for violation of the law forbidding carriers to keep animals in cars over 28 hours. It was shown that on two separate occasions the company had carried large shipments of cattle and sheep for many hours without water, feed or rest.

The State Railroad Commission of Texas has suspended the order which it issued some time ago requiring the Missouri, Kansas & Texas to buy 165 engines and 6,000 freight cars within three years, the railroad company having shown that it has a sufficient supply of cars and engines for the present amount of business.

The appellate division of the Supreme Court of New York has affirmed a decision awarding $120,000 damages against the Long Island Railroad for fires caused by sparks from locomotives. The decision is said to have been based on the neglect of the railroad company to burn all brush and other inflammable matter along its right-of-way twice a year, as required by law.

It appears that the 18-hour New York-Chicago train of the Pennsylvania road runs so slowly that it has been getting in the way of other trains! This we learn from a Chicago press despatch. The incident which gave rise to this statement was the running of a special train of four cars, carrying a theatrical party, on May 3, from Pittsburgh to Chicago in seven hours 42 minutes. This is almost exactly a mile a minute for the whole trip, the distance being 468 miles.

Near Walkers Mill, Pa., on the Pittsburgh, Cincinnati, Chicago & St. Louis, about ten miles west of Pittsburgh, Pa., on the night of April 30, the express messenger on westbound train No. 25 was overpowered and bound by robbers, and a number of bags of gold and other valuables were stolen from the express car. It appears that the robbers must have boarded the train at Pittsburgh, and they succeeded in stopping it and escaping before anyone but the express messenger knew of their presence on the train. On the same day a robbery of $63,000 from a Wells-Fargo express car on a railroad in Mexico was reported.

The Attorney-General has begun proceedings against 15 carriers for violations of the Safety Appliance Act reported by inspectors of the Interstate Commerce Commission. The companies are the following: Atchison, Topeka & Santa Fe; Baltimore & Ohio; Buffalo & Susquehanna; Buffalo, Rochester & Pittsburgh; Cleveland, Cincinnati, Chicago & St. Louis; Delaware, Lackawanna & Western; Erie; Illinois Central; New York Central & Hudson River; St. Louis, Iron Mountain & Southern; Seaboard Air Line, Washington Southern; Philadelphia, Baltimore & Washington; Southern, and Wiggins Ferry Company.

The Chicago, Milwaukee & St. Paul has organized the Continental Telegraph Company and the Continental Express Company, organizations which it is said will take and manage the telegraph and express business throughout the lines of that road. The contracts of the Western Union Telegraph and the United States Express Companies with the St. Paul road have expired, or will soon expire, it is said.

Samuel Rea on the Industrial Situation.

The *Wall Street Journal* quotes Samuel Rea as follows: "While I fully appreciate the present situation, which seems to me to be about as follows:

1. Business is seriously depressed—as it must be following a decided break in confidence;

2. Conditions are affected by the forthcoming Presidential election;

3. There are more idle railroad cars than since the inception of the panic, and from the railroad standpoint business can scarcely be worse.

On the other hand, every business man must not forget that:

1. This country is sound at the core. There has never been a time following a panic when the country had a better outlook.

2. There is no longer any question, as there has been in former panics, that the country is on anything but a gold basis.

3. Stocks in all lines of trade are depleted, which means that large orders must be given when demand arises.

We need a return of confidence and this requires time, patience and economy, both private and corporate, and especially do we need federal, state and municipal economy, because business retrenchment set in a year ago. We now have an indication of a return of confidence, and everything possible should be done to encourage it. The outlook for crops so far is good, and it would not be unlike the usual good fortune of this country to have in this particular year, when they are so badly needed, bountiful and profitable crops. It is, therefore, the duty of citizens to continue in a conservative and cheerful frame of mind, and to think, read, write and do only such things as will banish pessimism and timidity, which are no longer justifiable."

Telephones for Train Despatching.

The Chicago, Milwaukee & St. Paul is preparing to install telephones for train despatching between Chicago and Milwaukee, 85 miles, and between Chicago and Savanna, 138 miles. On the Chicago, Burlington & Quincy, between Aurora and Mendota, train orders are handled by telephone in the same general way as with the telegraph, except that the despatcher instead of sending the order and then copying it in the order book on the first repetition, now copies the order in the book as he talks it off. He thus gages his speed of conversation to his ability to write so that the receiving operator is not likely to be "rushed" beyond his ability to make a legible copy. All figures in the body of the order are spelt out, as for instance, "Engine 1,124—one, one, two, four," and on single-track the names of the stations are spelt. The operators in repeating observe the same rule as regards spelling out of figures and names. At unimportant stations where an operator is not always on duty a set of telephone instruments is maintained so that a conductor can if necessary, communicate direct with the despatcher and get an order.

Sixteen Months Under the Revised Rate Law.

Logan G. McPherson has made a two weeks' study of the complaints on file with the Interstate Commerce Commission and finds that, judging by the number of cases and the results, comparatively satisfactory service has been given by the railroads. Mr. McPherson found that in the 16 months from August 29, 1906, to Jan. 1, 1908, 5,952 complaints were filed with the Commission, the total including, presumably, all long standing grievances which had been held back owing to lack of confidence in the efficacy of the law as it was before the 1906 amendment. Of this total 2,105 were on matters not coming within the jurisdiction of the Commission. Of the remaining 3,847 complaints 3,374 were informal and 473 formal.

The informal complaints are taken up by the Commission with the railroad companies and adjusted without a set hearing. They refer almost entirely to oversights, clerical errors and misconstructions of tariff. Of the total of 3,374 in this class, practically one-half were adjusted by the carriers after correspondence with the Commission and the other half were dismissed by the Commission for lack of cause. Twenty-five of the 473 formal complaints apply to express and sleeping car companies. Of all the formal complaints considerably more than half are what Mr. McPherson designates as unimportant—that is, complaints that affect the transportation charge on but one shipment or a few scattering shipments, or that affect the transportation charge between stations that are not in a principal channel of traffic.

In the 16 months there were 87 complaints on the rates on food stuffs, 25 of these involving rates on grain and grain products. Of these 26 were decided in favor of the complainants, 23 were dismissed, withdrawn or indefinitely postponed, five were adjusted or compromised, and 33 had not been decided.

Cotton, the great staple of the South, produces but two complaints. Lumber is really the only article of commerce upon which the rates of freight are in turmoil, the rapidly changing sources of supply necessitating a continual readjustment of freight rates.

Summing up, Mr. McPherson showed that of 425 formal complaints affecting freight transportation, 86 were decided in favor of the complainants, 115 were dismissed, withdrawn or indefinitely postponed, 40 were adjusted or compromised and withdrawn, while 181 remained undecided on April 11.

"When the total number of complaints made during these 16 months," said the speaker, "is compared with the total transactions between the shippers and the railroads of the United States, with the volume and variety of the traffic movement, their number and their importance dwindle into insignificance."

Three-Cent Street-Car Fare in Cleveland.

Since Monday, April 28, all the street railway lines in Cleveland have been operated by the Municipal Traction Company, a company formed in pursuance of Mayor Johnson's plan for providing 3-cent fares throughout the city, which plan, after a controversy extending over seven years, has now been put into effect. At a meeting on April 27, the city council agreed with the different owning companies on the terms of a consolidation, and the "Cleveland Railway Company" was incorporated as a holding company. This company is the owner of the properties, which are leased to the Municipal Traction Company for 50 years. The total valuation of the property of the four companies which are included in the arrangement is $23,690,000; and it is proposed to make extensions and betterments aggregating about $11,310,000. All existing franchises were abandoned by the old companies. On Tuesday, April 28, by way of celebrating the "victory" of the people, all passengers were carried free throughout the city. Since Tuesday the uniform fare has been 3 cents. On Wednesday the 1,850 conductors and motormen employed on the lines presented a demand for an increase in their pay of 2 cents an hour, which, it is said, had been promised them by the old companies, and the newspapers talked of an impending strike; but after three or four days' discussion it was decided to submit all questions to arbitration. The people of East Cleveland have already entered a complaint in the courts because the new low rate does not extend into the village.

The Westinghouse Mill Motor.

The mill type direct-current motor, which has recently been put on the market by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., is designed to meet the severe conditions of service in steel mills. It is also adapted to such railroad work as operating transfer tables and bending rolls in the boiler shop. The motor used on the transfer table may be provided with two friction clutches, one of which operates the drum for pulling cars or dead engines on to the table, and the other the mechanism which drives the table. As it is possible to disconnect both clutches at once, there may be times when there is no load on the motor. An ordinary series motor relieved of all load would run at a dangerous speed; this motor has a shunt field connection, which limits the no load speed to approximately double the full load speed.

The motor frame is divided horizontally and is hinged so that the upper half can be quickly swung back for repairs. The frame is so heavy as to minimize vibration. The frame is provided with handholes for inspection of the commutator and windings, but the covers fit tightly and the frame and bearing housing are dustproof.

The shaft is large, with keyways of liberal dimensions. The bearings have large wearing surface and the air gap between the fields and the armature is large, so that there may be considerable wear in the bearings before the revolving and stationary parts could rub. The bearings are split and made interchangeable for either end of the motor. No dowel pins are used, as lugs cast with the bearings are used to keep them from turning. An eyebolt on each bearing makes handling the armature convenient. Only asbestos, mica, porcelain and an insulating compound are used for insulating. The coils are treated with the compound and then baked at a temperature far higher than any that will ever be met in actual service. The armatures are wound with strap copper insulated with mica tape, handwound. This form of coil can be easily repaired by the customer. The coils are held in place by hard fiber wedges and bands which are below the surface of the laminations.

Automatic Carline Grain Door Hook.

An automatic carline hook for grain doors, recently brought out by the Chicago Grain Door Co., Chicago, is illustrated herewith. This company has used for many years a malleable iron hook for holding the grain door in raised position against the carline which was satisfactory for cars which were not too high for a man to reach the hook. But with present large capacity cars, where the roof is above the reach of the tallest man, the hook has to be worked

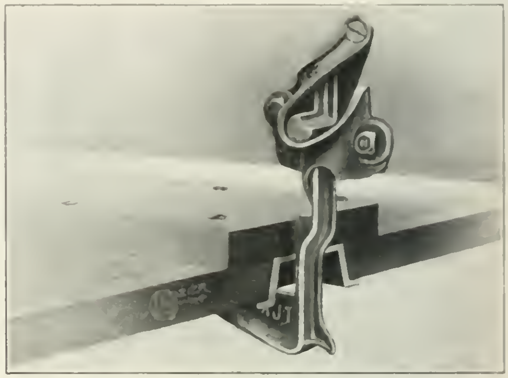


Fig. 1.

with a bar or stick. To meet this condition the fixture here shown was designed and patented. It works automatically, both in putting up grain doors in high box cars and taking them down from the roof when needed to load grain or other bulk cargoes. It is claimed that the hook is a positive lock when the door is folded up in the roof of the car, and the door cannot possibly fall down until released as described below.

To fold the grain door up in the roof of the car, raise it vertically until the swivels are on the top ledges of the rods, pull the bottom of the door inwardly to a horizontal position, then, with a

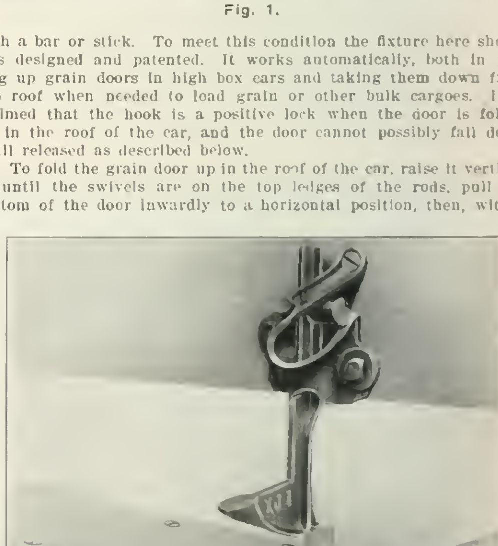


Fig. 2.

bar or stick, push the door upward against the hook XJ1, which will automatically raise, making a quarter turn to the left, pass by the door and immediately drop downward (by gravity and the slide) to its former position, under the grain door (Fig. 1). The door is positively locked between the hook and the slide plate of the box car and cannot possibly change its position until the hook is moved to release it. To take the door down (Fig. 2), use a bar or stick 3 ft. or more long, push upward on the bottom of the hook (or the small projection at the back of same) raising the grain door with the hook. The hook will make a quarter turn to the left, release the door and then, by gravity and the slide, drop to place and former position automatically.

A Southern Impression of the Railroad Situation.

The story, apocryphal but illustrative, is told of a visitor who desired to see the president of an important southern railroad. He called at the office and was told that the president was in Washington appearing before the Interstate Commerce Commission. He asked for the vice-president, and was informed that he was in Georgia attending a legislative conference. The general manager was reported as in Alabama, summoned there by the legislative conditions which threatened ruin to the railroads of that state. The passenger agent was in North Carolina pointing out to the Legislature the injury which would surely follow the enactment of its bill for lower passenger rates. Finally, in despair, the visitor asked for the highest official in authority, and the office boy told him that he was trying to run the railroad while all of the officials were trying to save it from destruction by legislation. That very nearly states the case.

What of the future? With the physical condition of railroads deteriorating because of their inability to find money to make improvements so long as anti-railroad legislation continues, we are facing what is probably the most critical period in the history of American railroads.

Of recent years the public seems to have come to the conclusion that men with bulging bank accounts are eagerly waiting for an opportunity to put money into railroad securities, though the control of the railroads is taken from them, and though other people who have no financial interest in them are given authority to fix the rates at which they can do business. The idea is fallacious. The capital needed for railroad expansion is not going to seek railroad investment, but railroad men must seek the capital with diligence. They must be able to present the matter in such a way as to indicate profits large enough to justify the risk, or otherwise those who have the bulging bank accounts will keep their money themselves or else put it in securities over which they do have some control. Are the people in public and private life who are fighting railroads or demanding impossible improvements willing to invest their own money in railroad securities at present? Not one of them. As a field for investment the railroad is no longer an attractive proposition, and this, too, comes at a time when never in our history did we need so much money for railroad expansion. We ought within the next five or ten years to put more than one-half as much money into the enlargement of railroad facilities as the total amount now represented in all the stocks and bonds of the railroads of the country. Where is so vast a sum to come from? If it should not come, then business will be halted, railroad facilities will grow steadily worse instead of better, and the country will suffer as it has suffered for the last few years because the railroads were unequal to the volume of traffic. The country holds its hands up in horror, and justly so, at the disastrous railroad wrecks. Under present conditions railroad wrecks are likely to increase rather than to decrease. Railroad wrecks are mainly due to the volume of traffic being in excess of the facilities of the road, to the low physical condition arising from lack of money to make improvements or to the inefficiency of men who have been taught during the last few years to seek to get as much as possible and give as little of faithful work in return as possible. In other words, they have drunk of the deadly poison—get something for nothing—which is now sapping the sturdy self-reliance and independence of so many of the American people. While railroad employees generally are faithful to their trust, some inefficient men, without a sense of their responsibility, have eagerly grasped at this teaching and feel that the railroads and the world at large owe them a living whether they earn it or not. The anti-railroad agitation is largely responsible for this.—*Richard H. Edmonds, in the Manufacturers' Record.*

American Institute of Chemical Engineers.

The committee appointed at Atlantic City last June to consider the formation of an American Institute of Chemical Engineers has found a strong sentiment for bringing together into closer relationship men who specialize in chemical engineering. A decisive vote has been received in favor of the formation of the society. For the purpose of organization, a meeting will be held in Philadelphia about the middle of June.

An Error Corrected.

The statement in the *Railway Age* of April 24, to the effect that Mr. H. H. Sessions had resigned his position as Vice-President of the Standard Coupler Company of New York, was an error. Mr. Sessions' connection with the Standard Coupler Company continues, as it has for many years, his official and personal relations with that company being entirely harmonious and satisfactory. His connection with another company, which conducts a business confined to the repairs of old or bad order cars exclusively, in no way interferes with his duties in the Standard Coupler Company, nor does it bring him in competition in any way with builders of new car equipment, either freight or passenger.

Manila and Cavité Line Open.

The first passenger train was run on May 2 between Manila and Cavité. Up to the present the only connection between Cavité and Manila was by a sea trip of six miles across the bay. The opening of the line means that stores and men can be quickly moved between these points in all weather.

The University of Colorado Engineering Shops.

On April 25 the new engineering shops of the University of Colorado were formally opened. President James H. Baker gave a short review of the growth of the engineering department from one instructor, one student, one drawing board and no room, in 1893, to the present faculty of 27 members, student enrolment of 271, and the full shop, laboratory, drawing and recitation room equipment.

The shops are 93 ft. x 122 ft., the building being in three sections, with modified saw-tooth roofs. The front section is two stories, the upper part being used by the general engineering drawing department. Below are rooms for wood turning and wood bench work. To the rear are the lathes and other heavy machine tools for working steel and iron. Across the hall are the forge and foundry rooms, equipped with all the appliances required in modern shop practice

The Retort Courteous.

Street Railway Superintendent—"I don't think we can use you any longer. Your cash register doesn't ring often enough."

Conductor—"I have got rheumatism and can't reach up to the register cord."

Superintendent—"All right. I think you need a long vacation."

Conductor—"I am much obliged to you for allowing me to run the car as long as you have."

Superintendent—"Don't mention it. I'm much obliged to you for bringing the car back."—*Judge.*

Medals for Bravery.

Upon recommendation of the Interstate Commerce Commission the President has awarded railroad life-saving medals to Frank Larson and Charles Bennett. On January 19 last, at Exeter, Neb., Larson, a fireman on the Chicago & North-Western, distinguished himself by crawling out on to the pilot of his engine and saving the life of a three-year-old child who was in the center of the track, and who but for Larson's heroism would have been run over and killed by the moving train. Bennett was a brakeman, also on the Chicago & North-Western. He rescued a woman who was in imminent danger of being struck by a fast passenger train at Waukegan, Ill.

Tug Boats in Straits of Magellan.

It is reported that a Danish company will establish a line of tugboats to tow vessels through the straits of Magellan. It is estimated that 3,000 sailing vessels under all flags pass around from the Atlantic to the Pacific yearly. It frequently takes weeks to round the Horn, while vessels could ordinarily be towed through the strait in 36 hours. It is proposed to station 10 powerful tugs at Punta Arenas in the straits.

INTERSTATE COMMERCE COMMISSION RULINGS.

Value of Testimony Concerning Past Secret Rates.

Frye & Bruhn et al. v. Northern Pacific and Chicago, Burlington & Quincy. Opinion by Commissioner Harlan.

The complaint alleged that the rate of $170 per car for the transportation of live hogs in 36-ft. single-deck cars from Missouri river, St. Paul and points intermediate to Seattle is unreasonable; that from branch-line stations west of the Missouri river the local rate to main line junctions is added to the $170 rate, making an unreasonable combination through rate; and that defendants unlawfully fail and refuse to publish rates for the transportation of live hogs in double-deck cars. The Commission held that the $170 rate is not shown to be unreasonable; that there is not sufficient evidence in the record to warrant a finding that the combination rate applied on shipments from branch-line stations is excessive, but it seems that the local rate on the branch line ought to be absorbed; that the record does not justify requiring defendants to furnish double-deck cars and re-establish double-deck carload rates; and that claim for reparation must be disallowed, except on certain 10 carloads shipped in 1904 under an excessive rate of $240 per single-deck car.

The Commission holds that evidence of rebates allowed in the past when offered by a shipper who unlawfully received them is not competent to show that the published rate is unreasonable.

The fact that defendants accepted, and complainant actually paid, less than the published rates, in violation and in defiance of law, raises no presumption that the published rate is unreasonable, but tends rather to raise a presumption that the defendants somewhere in their rate structure exacted from shippers of other commodities rates that were unreasonably high.

TRADE CATALOGUES.

Corrugated Steel Bars.—The 1908 catalogue of the Expanded Metal & Corrugated Bar Co., St. Louis, Mo., is a 112-page book, 8 in. x 10 in. Besides the regular squares and flats, it gives sizes and weights of the new round bars, just being placed on the market. The contents are subdivided into Building Construction, Foundations, Railroad Structures and Miscellaneous Structures. In each division, there are numerous photographs of reinforced concrete structures using corrugated bars. At the back of the book is a chapter on the strength of reinforced concrete beams, including a lot of tables for use in designing such beams.

Bolsters.—The Pittsburgh Equipment Co., Pittsburgh, Pa., has published a portfolio of blueprints, showing perspective views of different styles of truck and body bolsters, including draft carriers suited to different draft gears, combined cast steel and pressed steel underframes, cast steel end sills, cast steel side frames, spring planks and oil boxes.

Large Steam Engine Tests.—Bulletin No. 1,502 of the Allis-Chalmers Co., Milwaukee, Wis., describes tests of the steam engines furnishing power for the Interborough subway in New York. They are rated at 8,000 h.p., but the actual capacity is 12,000 h.p. The bulletin gives full details and information regarding the tests.

The Union Pacific passenger department is distributing a folder entitled "Homes in the West." It tells of free government lands in western Nebraska and in the South Platte valley, Colorado, and of the resources, climatic conditions and agricultural opportunities. It also explains how the government lands may be obtained.

Air Compressors.—The National Brake & Electric Co., Milwaukee, Wis., is distributing a card showing a halftone view of a single-step motor-driven, type 3 V S, three-cylinder air compressor. These are built in capacities from 50 to 225 cu. ft. of free air per minute.

MANUFACTURING AND BUSINESS.

A. L. Whipple has been appointed Sales Manager for Forsyth Brothers Co., Chicago, with headquarters in New York.

The offices of the American Steel Foundries, New York, have been removed to the Hudson Terminal buildings, 30 Church street.

The New York office of the Ajax Manufacturing Co., Cleveland, Ohio, has been moved to the Hudson Terminal buildings, 50 Church street.

The New York office of The Railway Materials Co., Chicago, has been moved to the new Singer building, Broadway and Liberty street.

The district office at San Francisco, Cal., of the Allis-Chalmers Co., Milwaukee, Wis., has been moved to the Phillips building, 599 Mission street.

Walter H. Baldwin, for eleven years Chicago Sales Manager of the Lidgerwood Manufacturing Co., New York, has been made Assistant General Manager of The Adams & Westlake Co., Chicago.

The Imperial Steel Works, operated by the Japanese Government, recently placed their orders for vise equipment, consisting entirely of double swivel vises, with the Pittsburgh Automatic Vise & Tool Co., Pittsburgh, Pa.

H. G. Perring, Secretary of the Engineers Club of Philadelphia, Pa., and formerly engineer with the Keystone Fireproofing Co., has gone to the General Fireproofing Co., Youngstown, Ohio, as District Manager at Philadelphia, with offices in the Drexel building.

W. R. Burrows, formerly Purchasing Agent of the Norfolk & Southern, has taken charge of the railroad department of Topping Brothers, 122 Chambers street, New York, manufacturers of ball bearing jacks, track drills, tool grinders and Totten's brake beam clamp.

The General Railway Supply Co., 922-23 Marquette building, Chicago, is agent for the metallic sheathing, "National" steel trap doors, "Schroyer" friction curtain rollers and "National" standard roofing, recent orders for which were noted in this column two weeks ago. An error in printing made the name read General Railway Specialty Co.

C. H. Spotts, for some ten years manager of the paint department of the Joseph Dixon Crucible Co., Jersey City, N. J., has resigned. Mr. Spotts has made no definite plans for the future, but has in mind identifying himself with building a new plant in the vicinity of New York for making paints especially adapted to railroad use. Mr. Spotts' address is in care of Engineers' Club, 32 West Fortieth street, New York.

W. G. Smith, Dr. Edwin Lodge and Herbert E. Boynton have resigned as Directors of the New York Car Wheel Co., Buffalo, N. Y. and are succeeded by Frederick L. Colby, Oscar C. Shimmel and Herbert E. Payne. Bernard Ginsburg has been elected Vice-President, succeeding W. G. Smith, resigned, and Edward W. Pendleton has been elected Secretary, succeeding J. A. Venable, who is now Treasurer and General Manager.

Paul R. Brooks has been appointed General Manager of the Machine Sales Co., 68 William street, New York. After leaving the Chicago, Burlington & Quincy, Mr. Brooks represented the Quincy, Manchester, Sargent Co., Chicago, and later went to The Otto Gas Engine Works, Chicago. The Machine Sales Co. has a plant at Peabody, Mass., and builds presses, machine tools, commercial automobiles and special machinery complete, on contract.

The Goldschmidt Thermit Co., New York, has established a branch office and works at 103 Richmond street west, Toronto, Ont., under the management of E. C. Rutherford. Mr. Rutherford is a Canadian by birth, and has been for several years Manager of the Magann Air Brake Co., Ltd., Toronto, and also of the Canadian Brake & Supply Co. A complete stock of Thermit and appliances will at all times be carried at Toronto, and a fully equipped repair shop will be in operation for the repair of steel castings up to 1,000 lbs. in weight.

Robert W. Hunt & Co., Chicago, have established an analytical chemical laboratory in connection with their St. Louis office, 1445 Syndicate Trust building. In addition to general analytical work, particular attention will be given to analyses of and advice on iron foundry mixtures. This work and the laboratory will be under the direction of J. B. Emerson, who for several years past has had charge of the metallurgical part of the wheel foundry of the Mt. Vernon Car Manufacturing Co., Mt. Vernon, Ill., and previously was in the employ of the Illinois Steel Co., Chicago.

The Technical Publicity Association at its annual meeting, April 30, 1908, elected the following officers to serve during the ensuing year: President, C. S. Redfield, advertising manager Yale & Towne Manufacturing Co., New York; First Vice-President, Rodman Gilder, publicity manager Crocker-Wheeler Co., Ampere, N. J., Second Vice-President, C. N. Manfred, manager advertising department, H. W. Johns-Manville Co., New York; Secretary, H. H. Kress, publicity department, A. S. Cameron Steam Pump Works, New York; Treasurer, H. M. Davis, advertising manager Sprague Electric Co., New York; Members of Executive Committee, F. H. Gale, in charge of advertising, General Electric Co., Schenectady, N. Y., and C. W. Beaver, special representative Yale & Towne Manufacturing Co. Twenty new members have joined the association since the last annual meeting.

Iron and Steel.

Bids for structural steel and iron for the first section of the Fourth avenue subway, in Brooklyn, were received on May 8.

The Maine Central has ordered 6,000 tons of rails from the Lackawanna Steel Co. An Australian road is in the market for 4,300 tons of rails.

OBITUARY NOTICES.

Frederick W. Huidekoper died at his home in Washington, D. C., on April 30. Mr. Huidekoper was born in 1840 at Meadville, Pa. He graduated from Harvard University in the class of 1862 and in 1877 was elected President of the Chicago & Eastern Illinois; from 1881 to 1882 he was also President of the Evansville & Terre Haute. In 1885 he was elected First Vice-President of the Richmond & Danville, the Richmond & West Point Terminal Railway & Warehouse Co., and the Virginia Midland, all now part of the Southern Railway. He became President of the Pittsburgh, Shenango & Lake Erie, now part of the Bessemer & Lake Erie, in 1889, and later Receiver of the same road. From 1892 to 1894 he was Receiver of the Richmond & Danville, and from 1893 to 1894 also Receiver of the Georgia Pacific and the Charlotte, Columbia & Augusta, now part of the Southern Railway. From May, 1896, to August, 1897, he was President of the Chicago, Peoria & St. Louis.

L. P. Farmer, Commissioner of the passenger department of the Trunk Line Association, died at his home in New York City on May 2. Mr. Farmer was 59 years old. He was born at Ellington, Conn., and entered railroad service in 1863 as a clerk in the treasurer's office of the Bellefontaine Railroad, now part of the Big Four. In 1864 he was transferred to the general ticket office of the same road, and in January, 1868, he was made chief clerk in the general ticket office of the Indianapolis & St. Louis, also now part of the C., C., C. & St. L. He served this company until 1871, when he became Assistant General Passenger Agent of the Missouri Pacific. In 1877 he was promoted to General Passenger Agent. In 1882 he became New England Passenger Agent for the Pennsylvania and five years later General Passenger Agent of the New York, Lake Erie and Western, now the Erie. On August 1, 1890, he was made Commissioner of the passenger department of the Trunk Line Association.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

International Railway General Foreman's Association.

The fourth annual convention of this association is to be held at the Lexington Hotel, Chicago, beginning May 25.

Franklin Institute.

At a section meeting of the Institute, May 7, there was an address on "The Construction of the Walnut Lane Bridge," by Moriz Bernstein, Philadelphia, Pa., illustrated by lantern slides.

New York Railroad Club.

At the next regular meeting of this club to be held May 15, a paper on "Reinforced Concrete, with Special Regard to Its Use in Railroad Work," by Alexander Crawford Chenoweth, will be presented.

American Society of Civil Engineers.

At a regular meeting of this society May 6 a paper on "Substructure of Piscataquis Bridge and Analysis of Concrete Work," by G. A. Hersey, was presented for discussion. This paper was printed in "Proceedings" for March, 1908.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atchison, Topeka & Santa Fe.—Paul Morton has been elected a Director and a member of the Executive Committee. Mr. Morton was Second Vice-President of the Atchison in 1905, when he was appointed Secretary of the Navy. He is now President of the Equitable Life Assurance Society.

Beaumont, Sour Lake & Western.—R. C. Duff, President, has resigned. It is announced that A. J. Davidson, President of the St. Louis & San Francisco, is to be elected President in Mr. Duff's place. Mr. Duff has been connected with the B., S. L. & W. since 1903, when it was incorporated. For two years he was one of its general attorneys and in 1905 he was made President. He has not as yet made any announcement of his plans for the future.

See Colorado Southern, New Orleans & Pacific.

Colorado Southern, New Orleans & Pacific.—J. W. McCullough has been appointed Auditor of this company, and of the Beaumont, Sour Lake & Western, succeeding H. M. Hood, with office at Beaumont, Texas.

Delaware, Lackawanna & Western.—A. D. Chambers, Assistant Treasurer, has been appointed Secretary and Treasurer, succeeding the late F. F. Chambers. R. F. Schofield succeeds A. D. Chambers.

Missouri Pacific.—Stuyvesant Fish, formerly President of the Illinois Central, resigned as director of the Missouri Pacific on May 2.

New York Public Service Commission.—John Barstow Olmsted, of Buffalo, N. Y., who has been appointed to the Commission for the Second district succeeding C. H. Keep, was born at LeRoy, N. Y., in 1854. He graduated from Harvard in 1876, and afterward studied for two years in Germany, at Heidelberg University. He was admitted to the bar in New York State in 1879. He has since been practising law and has been prominent in politics at Buffalo. In 1880 he was President of the Garfield and Arthur Club, at LeRoy, and in 1884 Secretary of the Cleveland Republican Club at Buffalo. Since 1885 he has been attorney for the Buffalo Pitts Company, and since 1884, Treasurer of the Buffalo Civil Service Reform Association. He is an ex member of the Civil Service Commission for the city of Buffalo, is President of the Twenty-third Ward Good Government Club, and President of the Buffalo Municipal League. He was Dean of the Saturn Club in 1898 and 1899, President of the Liberal Club in 1900 and 1901, President of the Harvard Association of Western New York in 1901, and Vice-President of the Buffalo Municipal League in 1905. He is a Trustee of the Elmwood School and the Buffalo Seminary and a member of the council of the University of Buffalo.

John B. Olmsted.

Operating Officers.

Chicago & Alton.—C. F. Smith, Trainmaster at Dwight, Ill., has been appointed to the new office of Inspector of Transportation, with headquarters at Bloomington, Ill.

Chicago, Milwaukee & St Paul.—J. T Gillick, Superintendent of the Chicago & Milwaukee division, has been appointed Superintendent of Terminals at Chicago, succeeding P. C. Hart. L. R. Clausen, Superintendent of the Prairie du Chien and Mineral Point divisions, succeeds Mr. Gillick, with office at Chicago. F. H. Myers, Assistant Superintendent of Terminals at Chicago, succeeds Mr. Clausen, with office at Milwaukee, Wis. P. L. Rupp, Trainmaster at Minneapolis, Minn., succeeds Mr Myers.

Mr. Clausen is 31 years old, having been born in October 1877. He is a graduate of the University of Wisconsin, class of 1897, in electrical engineering, and entered railroad service in 1899 as baggageman on the C., M. & St. P. A year later he was put in charge of the maintenance of storage batteries and electric lighting equipment at the Chicago passenger yards. At the end of eight months he left railroad service and went to the Pacific coast, but soon returned to the C., M. & St. P. as a signal inspector. In September, 1903, he succeeded W. H. Elliott as Signal Engineer. Last November he was promoted to Superintendent of the Prairie du Chien and Mineral Point divisions, from which he is now advanced to the Chicago & Milwaukee division. Mr. Clausen is Vice-President of the Railway Signal Association.

Chicago, Rock Island & Pacific.—The position of Trainmaster of Omaha terminals has been abolished, and the territory of A. B. Ramsdell, heretofore Trainmaster at Des Moines, Iowa, has been extended to include Council Bluffs, Iowa, and Albright, Neb. Mr. Ramsdell's headquarters have moved to Council Bluffs.

Delaware, Lackawanna & Western.—Frank Cizek, Trainmaster of the Morris and Essex division, has been promoted to Superintendent of the Bangor and Portland division, a new office, with headquarters at Easton, Pa.

Illinois Central.—C. B. Fletcher, Superintendent of the Cherokee division, has been appointed also Superintendent of the Omaha division, his office remaining at Cherokee, Iowa.

Missouri Pacific.—H. G. Clark has been appointed Superintendent of the Colorado division, with headquarters at Pueblo, Colo. J. E. Snedeker Superintendent of the Southern Kansas division, has been appointed Superintendent of the Central Kansas division, with headquarters at Osawatomie, Kan., succeeding J. F. Simms, transferred. P. A. Buck Superintendent at Chester, Ill., succeeds Mr Snedeker, with office at Coffeyville, Kan. W. E. Merrifield, Trainmaster of the Northern Kansas division, has been appointed Superintendent of the Illinois division, with headquarters at Chester, Ill. D. H. Robinson, Trainmaster at Nevada, Mo., succeeds Mr. Merrifield, with office at Atchison, Kan.

New York Central & Hudson River.—Seth R. Payne, Superintendent of the Buffalo division, has been appointed General Superintendent of the Western district, with office at Syracuse, N. Y., succeeding L. H. Van Allen, resigned. Isaac H. McEwen, Assistant Superintendent of the Mohawk division, succeeds Mr. Payne, with office at Buffalo, N. Y.

Seaboard Air Line.—H. C. Grimshaw, Superintendent of the Fifth division, will move his office from Americus, Ga., to Savannah, on May 10. J. B. Glazier, Superintendent of Terminals at Savannah, has been appointed Trainmaster at that place, effective the same date, and the office of Superintendent of Terminals at Savannah has been abolished.

Southern Railway.—R. W. Hunt, Assistant General Passenger Agent at Atlanta, Ga., has been transferred to the auditing department and appointed Superintendent of Train Collectors. J. L. Meek, division passenger agent at Knoxville, Tenn., succeeds Mr. Hunt.

Traffic Officers.

Illinois Central.—E. K. Bryan, Acting Assistant General Freight Agent, has been appointed Assistant General Freight Agent, succeeding John Dwyer, who resigned to engage in other business.

Kalamazoo, Lake Shore & Chicago.—F. L. Comstock has been appointed General Freight Agent, with office at South Haven, Mich.

Lake Shore & Michigan Southern.—W. F. Carter, traveling passenger agent at Toledo, Ohio, has been appointed General Agent, passenger department at Toledo.

Missouri Pacific.—L. D. Knowles has been appointed General Agent at Denver, Colo., succeeding M. C. Post, resigned.

Philadelphia & Reading.—J. F. Auch, Assistant General Freight Agent, has been appointed General Freight Agent, with office at Philadelphia, Pa., succeeding B. H. Ball, who was made Freight Traffic Manager.

San Antonio & Aransas Pass.—J. B. Brooks, General Agent at San Antonio, Tex., has been appointed Assistant General Freight Agent, with office at the same place.

Southern Railway.—See this company under Operating Officers.

Engineering and Rolling Stock Officers.

Boston & Albany.—Everett E. Stone has been promoted from Engineer of Maintenance of Way and Structures to Chief Engineer, with headquarters at South Terminal Station, Boston, Mass. Mr. Stone was born at Leicester, Mass., in 1865, and graduated from Worcester Academy in 1885. He entered the service of the Boston & Albany two years later as a surveyor. The next year he was made assistant roadmaster, and in 1890 was promoted to roadmaster. He held this position for four years and was then appointed Assistant Chief Engineer, in which position he served until 1907, when he was appointed Engineer of Maintenance of Way and Construction. He began his duties as Chief Engineer on May 1 of the present year. Mr. Stone was for two years Mayor of Springfield, Mass., having before that been for five years President of the Common Council.

E. E. Stone.

Illinois Central.—W. Renshaw, Superintendent of Machinery, has resigned. J. G. Neuffer, Assistant Superintendent of Machinery, succeeds Mr. Renshaw.

Peoria & Pekin Union.—Stanley Millard, Chief Engineer, has resigned. Walter E. Emery, formerly Engineer of Maintenance of Way of the Chicago & Alton at Kansas City, Kan., succeeds Mr. Millard.

LOCOMOTIVE BUILDING.

The Chicago & Alton has ordered five locomotives from the Baldwin Locomotive Works.

The Chicago, Milwaukee & St. Paul, as mentioned in the *Railroad Gazette* of May 1, has ordered 50 locomotives from the American Locomotive Company.

The Delaware, Lackawanna & Western, as mentioned in the *Railroad Gazette* of May 1, has ordered from the American Locomotive Company eight hard coal ten-wheel passenger locomotives, five hard coal six-wheel switch engines, 15 soft coal six-wheel switch engines, 14 soft coal consolidation engines, five soft coal Mogul freight engines and two soft coal Mogul pusher engines.

CAR BUILDING.

The Washington Railway & Electric Co., Washington, D. C., is in the market for one interurban car.

The Salt Lake & Mercur has ordered one combination passenger and baggage car from the American Car & Foundry Company.

The Minneapolis & St. Louis has ordered two combination baggage and mail cars from the American Car & Foundry Company.

The Diamond State Rapid Transit Co., Smyrna, Del., it is said, will buy a number of interurban cars. This item is not yet confirmed.

The Brownsville, Masontown & Smithville Street Railway, McKeesport, Pa., under construction, W. J. Shelden, President, expects to ask bids on cars in about 30 days.

The Northern Pacific has ordered from the American Car & Foundry Company 10 combination mail and baggage cars, 10 combination passenger and baggage cars and 10 combination baggage and express cars. It is expected that an order for more passenger cars for use on new lines in the northwest will be placed within a month.

RAILROAD STRUCTURES.

ABILENE, TEXAS.—The Texas Railroad Commission has ordered the Texas & Pacific to put up new stations at Abilene, Lambert, Dothan and Judkins.

BLOOMINGTON, ILL.—The shops of the Chicago & Alton were recently destroyed by fire; loss $50,000.

CHIHUAHUA, MEX.—W. W. Colpitts, assistant chief engineer of the Kansas City, Mexico & Orient, is in charge of the work on the 850-ft. steel bridge now being built over the Conchas river, about 85 miles east of Chihuahua. Six of the concrete piers are finished and 12 more are to be built.

EVANSTON, WYO.—The Union Pacific, it is said, is arranging to make improvements here including a 43-stall roundhouse, and enlarging the present shops, at a cost of $250,000.

NEW ORLEANS, LA.—The New Orleans Terminal Company expects to open the new Union Passenger Station about June 1.

NEW WESTMINSTER, B. C.—Mayor Keary is quoted as saying that the Dominion Government will spend $2,000,000 for harbor and dock improvements here.

RANDALL, OHIO.—The Erie, it is said, has started work on a new ore trestle to be 2,800 ft. long, and to have a capacity of 250,000 tons. The cost of the improvement is to be about $60,000.

SPIRIT LAKE, IDAHO.—Contract is reported let to Westinghouse, Church, Kerr & Co., of New York, at about $200,000, for putting up brick shops, also a nine-stall roundhouse here, for the Idaho & Washington Northern. Work is to be started this month.

WESTPOINT, OHIO.—The Youngstown & Ohio River Railroad, it is said, is putting up a power house here to cost $285,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ABERDEEN & TOMBIGBEE VALLEY.—Building from Okolona, Miss., southeast to Pickensville, Ala., 65 miles. Grading finished on 32 miles. President Reynolds announces that the entire line is to be in operation by Jan. 1, 1909. W. T. McKee, Chief Engineer, Aberdeen, Miss. (March 27, p. 461.)

ARKANSAS, LOUISIANA & GULF.—Announcement is made that this company has opened its line for freight traffic from Monroe, La., north to Bastrop, 23½ miles. (March 13, p. 389.)

ATLANTIC, QUEBEC & WESTERN.—J. N. Lavoie, Second Vice-President, is quoted as saying that this company has built 20 miles on the extension toward Gaspe, and that an additional 80 miles is under contract. About 850 men are at work, and this number is to be at once increased. The work includes piercing a tunnel at Cap l'Enfer, 850 ft. through limestone rock. This is expected to be finished in June. It is expected to have the entire work finished through to Gaspe in the latter part of 1909. There are to be 26 concrete and steel bridges on the lower section. Terminal arrangements are being made at Gaspe. The passenger station is to be at the foot of Fort Ramsey, and the freight terminal at Sandy Beach, about four miles from the town, where there are good port facilities. (March 13, p. 395.)

Atlanta & St. Andrews Bay.—This company has started operation on the extension of its road from Fountain, Fla., south to Youngstown, eight miles.

Bessemer & Lake Erie.—The Western Allegheny, affiliated with the Great Lakes Coal Company, it is said, has finished connections with the Baltimore & Ohio at New Castle, Pa.

Bids, it is said, will shortly be asked for building the extension from Kaylor, Pa., northeast to Reidsburg, where connection is to be made with the projected Franklin & Clearfield line of the Lake Shore & Michigan Southern. (March 13, p. 390.)

Bingham Central.—Organized to build an ore line from Salt Lake City, Utah, south to Bingham, 10 miles. The company has given a mortgage to carry out the work. There will be a long tunnel. A. C. Ellis, Jr., President, Salt Lake City.

Canadian Northern.—Contract is reported let by this company to James Cowan for work on about 18 miles of line on the Rossburn branch.

Canadian Northern Ontario.—See this company under Railroad Corporation News.

Canadian Pacific.—An officer writes that the contract for building the new line from Lethbridge, Alb., west to McCloud has been let to Janse & McDonald, of McLeod. The work includes two bridges, one over the Belly river, 5,327 ft. long, and the other over the Old Man river, 1,890 ft. long. (April 3, p. 492.)

It is said that this company will spend $125,000 improving the Esquimalt & Nanaimo.

Canadian Roads.—According to reports from Fernie, B. C., arrangements are being made by D. C. Corbin to build a line from the Crows Nest Pass branch of the Canadian Pacific, to coal mines near McGilvrey, B. C., about 14 miles. It is expected to have the line in operation this summer. Address George Butler, Chief Engineer, Spokane, Wash.

Cananea, Yaqui River & Pacific.—See Southern Pacific.

Champlain & Sanford.—Incorporated in New York with $600,000 capital to build a line from Addison Junction, N. Y., northwest to Sanford Hill, on the east shore of Sanford lake, about 35 miles. The directors include C. M. Hyatt, J. M. Thompson, L. R. Parker, G. D. Hills, A. B. Jones, and MacNaughton Miller, all of Albany.

Colorado Roads.—Preliminary surveys, it is said, have been made, and construction work is to be started in July on a line, to be operated either by steam or electricity, from Ouray, Colo., northwest via Montrose and Olathe to Delta, 60 miles. J. Carmen Layton and B. A. Lockwood, of Des Moines, Iowa, are promoting the project.

Eastern British Columbia.—Incorporated with $750,000 capital, in Canada, to build a line from the south fork of Michel Creek, B. C., on the Crows' Nest branch of the Canadian Pacific, south 14 miles. Also to build branch lines. The provincial directors include D. C. Corbin, A. T. Herrick, J. A. Harvey and J. K. Osherwood.

El Reno, Red River & Pacific.—Incorporated in Oklahoma with $5,000,000 capital to build 145 miles of railroad from El Reno, Okla., southwest through Caddo, Washita, Kiowa and Jackson counties. The incorporators include H. C. Bradford, G. G. Lewis, L. B. Pennell, F. E. Gillette and M. D. Libby, all of El Reno.

Esquimalt & Nanaimo.—See Canadian Pacific.

Evansville Terminal Railway.—This company is offering $200,000 of bonds to secure funds to build a line from Evansville, Ind., east to Newburg, nine miles. It is proposed to use both steam and electric motive power. The company expects to lease the property of the Evansville & Eastern Electric Railway, operating a line from Newburg east to Rockport, 21 miles, and to operate the lines as one system, together with the line west to Mount Vernon, Ind., a total of 48 miles.

Georgia & Florida.—Sub-contracts are reported recently let for work on a connecting link from Nashville, Ga., south to Valdosta, 30 miles. Grading on this section is expected to be finished by the middle of July. This is part of the work intended to include about 150 miles of connecting links between existing lines to complete a through line from Augusta, Ga., south to Madison, Fla. A new line, it is also said, is being built from Willachoochee south to Nashville, which will shorten the line about three miles. (March 13, p. 391.)

Grand Trunk Pacific.—W. C. Chambers, of Harrison, Ont., it is said, has been given a contract for building 75 miles of railroad for this company near Lake Nepigon.

Grand Valley (Electric).—This company now operates 21½ miles of electric line connecting Brantford, Ont.; Paris, Glen Morris and Gault. It is said that the present rails will be replaced with 80-lb. sections. (April 21, p. 591.)

Kansas City, Mexico & Orient.—It is said that the Government of Mexico has offered this company a subsidy of $600,000 in bonds of the state of Chihuahua, Mex., for building its line through this state.

Los Angeles Harbor Company.—See Los Angeles Harbor Railroad Co.

Los Angeles Harbor Railroad Company.—An officer writes that the Los Angeles Harbor Company and the Los Angeles Harbor Railroad Co. are being organized, the former to retain a controlling interest in the railroad company. A charter has been granted in California, but no physical work has yet been undertaken. Application has been made to the cities of Los Angeles and Wilmington for franchises. The Harbor Company owns water frontage at the west basin of Wilmington with sufficient land adjoining for terminals. The purpose of the company is to develop the big west basin, dredging and building docks and wharfs, and to establish a trading company, operating ships on the west coast as far south as Panama. The Los Angeles Harbor Railroad is intended as an annex to the harbor enterprise and an outlet to the city of Los Angeles, also as a terminal line for other roads which may build into Los Angeles. It will be about 20 miles long, and will be located about half-way between the Pacific Electric Railway Company's line and the Los Angeles Interurban Line from Los Angeles south to San Pedro. The officers of both companies are: A. C. Bird, President; F. C. Wintrode, Secretary; J. W. Oakley, Treasurer, and A. H. Koebig, Consulting Engineer, Security Building, Los Angeles. (March 27, p. 461.)

Mountain Home & White River.—Rights of way have been secured and options taken on a large tract of timber land by this company. It is proposed to build a line from Mountain Home, in Baxter county, Ark., south 10 miles to a connection with the St. Louis, Iron Mountain & Southern. W. L. Marshall, Mountain Home, is the principal promoter.

Nashville & Huntsville.—According to reports from Huntsville, Ala., this company has given a contract to the American Construction Co. (L. L. McCord, President), to build the first section of its proposed line from Nashville, Tenn., south to Huntsville, 105 miles. The line is projected south to Birmingham, an additional hundred miles. The project is thought to be backed by Illinois Central interests.

New York Central & Hudson River.—According to a statement made by George W. Kittredge, Chief Engineer, before the Public Service Commission at Albany this company contemplates the following important improvements: Five million dollars for Gardenville yards near Buffalo, N. Y.; $1,326,000 for improvements in Buffalo, including grade crossings; $150,000 for Depew shops; $1,000,000 for grading and repairs to West Shore Railroad, $75,000 improvements to service at Fairport; $150,000 improvements at Syracuse; $400,000 improvements at Dewitt; $150,000 improvements at Oswego, $3,500,000 improvements at Utica, including grade crossings, yards and stations; $200,000, Little Falls; $500,000, West Albany; $300,000 improvement in the signal system.

New York Subways.—The New York Public Service Commission First district, will open bids May 8 for the construction of the Fourth avenue subway in Brooklyn. The contractor will have two years from the date of the delivery of the contract to complete the work. (April 3, p. 493.)

Ocean Shore (Electric).—This road has been extended from Pedro Valley, Cal., to Farallone, 5½ miles.

Ohio Electric.—The city of Bellefontaine, Ohio, has extended an old franchise for 25 years, and this company can now extend into Bellefontaine the line building from Lima, southeast, and which is finished to within three miles of Bellefontaine. It is expected to have cars in operation on the new line in June.

Ohio River & Northern.—Grading, it is said, is under way at Midland, Pa., on a line projected from that place west through East Liverpool, Ohio, and Wellsville, thence north via Westpoint to Lisbon, where connection is to be made with the Erie. Franchises have been granted at East Liverpool and at Wellsville. (Sept. 13, p. 307.)

Oklahoma-El Reno Interurban.—An officer writes that preliminary surveys have been made and work is to be started about July 1 on this projected line from Oklahoma City west to El Reno, 24.5 miles. H. M. Hyatt, Kansas City, Mo., may be addressed.

Orange & Northwestern.—See St. Louis & San Francisco.

Pacific & Southeastern.—Organized with a capital of $15,000,000 to build a line across the state of Washington, with a western terminus at Tacoma, with branches to Spokane, Seattle and British Columbia. Some surveys are being made, and construction, it is said, will be started this year. The incorporators include Gen. T. V. Hubbard, George Crocker, New York; Charles Lathrop, California; A. D. Shepard, General Manager of the Pacific Improvement Company, of California, and General Ashton, of Tacoma.

Pan-American.—J. M. Neeland, Vice-President and General Manager, is quoted as saying that work will be finished to the Guatemalan border this month, and through trains will be put in operation about July 1 from San Geronimo to Ayutala, 285 miles. The line was recently put in operation as far south as Tapachula, about 25 miles from the Guatemalan border.

Pennsylvania Lines West.—The rights of the old Canton & East Liverpool project, it is said, have been transferred to this company and preliminary work has already been done. The projected route is from Smith's Ferry, Pa., about eight miles east to East Liverpool, west across Columbiana county, Ohio, to Bayard, about 35 miles, where connection is to be made with the main line of the Cleveland & Pittsburgh.

St. Louis & San Francisco.—It is said that the Orange & Northwestern is to be extended from Newton, Tex., north to Hemphill, 40 miles. The line connects with the Colorado Southern, New Orleans & Pacific.

St. Louis, Brownsville & Mexico.—Trains are now being run by this company into Houston, Texas, using the freight and passenger stations of the Houston Belt & Terminal Company. (Nov. 1, p. 542.)

Southern Pacific (Mexico).—Important changes in the concessions held by this company, it is said, have recently been given by the Mexican Government for building the Cananea, Yaqui River & Pacific through the states of Sonora and Sinaloa. The construction of the branch from Tonichi, Sonora, north to the international boundary is to be started as soon as the section from Corral north to Tonichi is finished. Track laid from Corral north to Cumuripa, 11 miles. Grant Brothers Construction Company, of Los Angeles, Cal., contractors. According to the terms of the concession 50 miles must be built annually, and the entire line finished by March, 1914. The line when finished will be 386 miles long. (April 24, p. 591.)

Southwestern Railway of Texas.—This company was incorporated last year in Texas to build a line from Henrietta southwest to Graham, about 60 miles. It is said that it now has most of the surveys made and has work under way from Henrietta south. Grading is done for 22 miles and track laid for half that distance. H. J. Bradshaw, General Manager, and W. S. James, Chief Engineer, Henrietta.

Terre Haute, Robinson, Olney & Southwestern.—Incorporated in Illinois with a capital of $10,000, and office at Robinson. The company proposes to build a line from a point on the Wabash river at the Indiana boundary, southwest through the counties of Crawford, Richland, Wayne, to Mt. Vernon, in Jefferson county, about 100 miles. The incorporators and directors include H. C. Pugh, W. H. Moss, H. T. Taussig, W. H. Cisne, C. S. Wilson, and G. M. Barker.

Texas & Pacific.—The Texas Railroad Commission, on May 5, ordered improvements on the Texas & Pacific between Fort Worth and Sierra Blanca, a distance of 500 miles, which it is estimated will cost $2,000,000. This is in addition to the $2,000,000 previously ordered to be spent for betterments.

Union Industrial.—Incorporated in Oklahoma with $15,000 capital to build a connecting line between the Chicago, Rock Island & Pacific, and the Kansas City, Mexico & Orient, at Aline, Okla. The incorporators include George W. Graham, W. J. Woodliff, and J. A. Hartshorn, of Aline; H. L. Noah and H. A. Noah, of Alva, Okla.

Washington, Patuxent & Drum Point.—This company was incorporated last year to build a line from the Chesapeake Beach Railroad along the east side of Patuxent river to Drum Point, Md., about 30 miles. Contracts for the work are to be let next fall. There will be four bridges. Address C. N. Mayer, Washington, D. C.

Westchester & Wilmington (Electric).—A contract is reported let to the Eastern Railway Construction Company of Delaware for building this proposed line. The contract includes the erection of a power house and the installation and equipment of the entire line. The projected route is from West Chester, Pa., south to Wilmington, Del., 17 miles. There will be two bridges. (March 13, p. 395.)

Western Allegheny.—See Bessemer & Lake Erie.

Youngstown & Ohio River (Electric).—This company is now running cars to Salem, Ohio, and to Lisbon. Grading, it is said, has been nearly finished on an extension to East Liverpool, and it is expected to have the line finished to the Ohio river this fall. (Sept. 13, p. 308.)

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—Moffat & White and Clark, Dodge & Co., of New York, and Lee, Higginson & Co. of Boston, offer the unsold portion of $4,000,000 general mortgage 4 per cent. bonds of 1895-1995. There is outstanding $152,155,000 of an authorized issue of $165,490,500.

Canadian Northern Ontario.—The government will guarantee an issue of $2,500,000 40-year 3½ per cent. bonds, of which $1,000,000 will be issued to build 50 miles of new line at $20,000 a mile, including a proposed line to the Moose Mountain iron deposits and the Garson mines. The remaining $1,500,000 is to be issued for terminals in Toronto.

Idaho Northwestern.—This property, controlled by the B. R. Lewis Lumber Co., of Coeur d'Alene, Idaho, has gone into the hands of a receiver, together with the lumber company.

Missouri, Kansas & Texas.—H. W. Poor & Co., of New York and Boston, offer at 75½ a block of "first and refunding mortgage" 4 per cent. bonds of 1904-2004. There are $5,182,000 of these bonds outstanding and $4,797,000 held in the company's treasury. These bonds are a first mortgage on terminals at Kansas City, locomotive shops at Parsons, Kan., and equipment valued at $18,530,000.

The order of the Texas Railroad Commission, requiring the Missouri, Kansas & Texas to purchase 165 new locomotives and 6,000 freight cars during the years 1908 to 1910, has been indefinitely suspended.

National Railways of Mexico.—It is said that the deposit of various classes of securities of the Mexican Central and the National Railroad of Mexico has already reached a point insuring the success of the plan to merge these companies.

New York, New Haven & Hartford.—It is said that the bonds about to be issued to meet maturing obligations between now and January 1, 1910, consist of Harlem River & Portchester first mortgage bonds and Air Line and Northampton division first mortgage bonds, and in addition there are to be issued $2,000,000 short term notes. The bonds have been underwritten on a basis of between 4¼ and 4½ per cent., as compared with a 5 per cent. interest rate upon the obligations which they will retire.

Pennsylvania.—A semi-annual dividend of 3 per cent. was declared on May 1, thus reducing the annual rate from 7 per cent., established in November, 1906, to 6 per cent., the rate prevailing from May, 1900 to 1906. This means a present annual saving in dividend charges of a little over $3,000,000.

Subscribers for the $40,000,000 4 per cent. bonds offered last week by Kuhn, Loeb & Co. have been allotted only 5 per cent. of their subscriptions.

Southern Railway.—The Virginia & Southwestern, whose capital stock was purchased by the Southern Railway at $200 a share, has taken over the Virginia & Southeastern, a projected line, the Houston River railroad, and the Black Mountain railroad. The two latter roads, 40 miles and 30 miles long, respectively, with the Virginia & Southwestern, make about 210 miles of road, with equipment. The Virginia & Southwestern has authorized $7,000,000 fifty-year 5 per cent. bonds of April 1, 1908-1959. Of these bonds $2,000,000 will be issued to pay back the Southern Railway for money spent by it on the Black Mountain and the Houston River roads. There will be reserved in the treasury $3,000,000, and the proceeds from the remaining $2,000,000 will be used to complete building the Houston River road and to take care of equipment obligations.

Union Pacific.—According to a statement made by E. H. Harriman the financial requirements of the Union Pacific have been much exaggerated. The maximum amount needed at this time to put the company in funds does not exceed $25,000,000, but the company wants to resume developments and put its people to work. While the stockholders were asked at their meeting on May 5 to authorize an issue of $100,000,000 bonds, not more than $50,000,000 of the bonds are to be issued against property now owned. Instead of mortgaging new lines as built or acquired, a general mortgage will be provided for further extensions and new lines.

United Railways of St. Louis.—The Mississippi Valley Trust Co., and Francis, Brother & Co., both of St. Louis, Mo., are offering $800,000 collateral trust 5½ per cent. notes of 1907-1909. The total authorized issue of these notes is $1,200,000, secured by $1,500,000 general, first mortgage 4 per cent. bonds of the company, and $500,000 of its preferred stock. The notes are offered at 99.45, yielding 6 per cent.

Virginia & Southwestern.—See Southern Railway.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York, the following announcement is made of the office of publication, at 83 Fulton St., New York N.Y., and the names of the officers and editors of the Railroad Gazette.

OFFICERS:

W. H. BOARDMAN, *Pres't and Editor*
E. A. SIMMONS, *Vice President*
RAY MORRIS, *Secretary*
R. S. CHISOLM, *Treas.*
I. B. RINES, *Cashier*
L. B. SHERMAN, *Western Manager*

EDITORS:

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BRAMAN B. ADAMS
CHARLES H. FRY
FRANK W. KRAEGER
GEORGE L. FOWLER
HUGH RANKIN
BRADFORD BOARDMAN

CONTENTS

VOL. XLIV., No. 20. FRIDAY, MAY 15, 1908.

Beginning with the issue of June 5, the *Railroad Gazette* and *The Railway Age* will be issued as a single, combined periodical under the name *Railroad Age Gazette*. The business of a railroad paper is to collect from all parts of the country and all parts of the world, a current record of all that is best in railroad practice; to comment on what is noteworthy and, from its plentiful sources of information, to develop the truth. The *Railroad Gazette* has been doing this for more than 52 years; *The Railway Age* for 32, and each paper has worked hard and has built up a staff of editors and established lines of communication that make the facts sure and the comment easy. Besides this specific task, it has been the duty of these two papers to make railroad men more useful to their companies and to themselves by giving a broader aspect to the work of highly specialized departments; by making the mechanical engineer know what the traffic man was thinking about, and the division engineer and the auditor alike realize that they could not attain their highest usefulness in working for their departments unless they were working for the company as well. But there has been much duplication in this work. The principal office of one paper was in New York; the principal office of the other was in Chicago, and each office force had to hunt in the territory of the other. A consolidation with strong editorial forces in each city and with mutual co-operation instead of antagonism will leave for new work all the time formerly spent in overlapping. This, from the standpoint of the editor. The reader will have even more reason to be satisfied. He will get more valuable material, carefully selected, than the sum of the previous totals, and will not have to search two papers for it. It is surely not a vain expectation that with the combined organizations, working in Chicago and New York with full vigor, a railroad paper can be made a good deal better than any that has ever existed before.

The simple and direct way to settle the question whether the coal railroads shall be forced to sell their coal properties and confine themselves to the business of transportation would be to proceed against them in the courts at once; but the rational way is to do as the President and the Interstate Commerce Commission have done—to try to suspend the law until its constitutionality can be settled by an amicable suit. This course will be sharply criticized, of course; for the public officer who refrains from enforcing a plain statute can have no satisfactory defense except unanimous public opinion. Congress, which made this crude law, ought now to suspend it; but unfortunately the only considerations receiving attention in the Senate are those of personal jealousy or supposed political expediency. The Commission, in its reply to the Foraker resolution calling for information, said that the receiver of the Western Maryland (which road was specifically inquired about) had not observed the law, but the extent of its violation and the conditions which made it impossible to comply are points which are not yet explained. The receiver promises to send the information. As to other violations the Commission has not had time since the law went into effect (May 1, 1908) to get information as to whether its provisions are being observed or not. The commissioners declare that in recommending that the penalties of the commodity clause be suspended they acted with the approval of the President. The financial depression has rendered it impossible for railroads to convert their coal properties into money. "The Commission believed and still believes," says the report, "that it is in the public interest, as well as a matter of fairness to parties directly concerned, to suspend penalties for violation of this provision—penalties not specially imposed by its terms, but resulting from the general provision of the regulating statute—for a sufficient time to test in the courts the validity of the enactment." Not only fairness, but expediency also, demands that the matter be sent to the courts; for the ownership of coal mines, timber lands and other great properties is, in many railroad companies, so divided among stockholders and old and new bondholders, that to devise an equitable basis of segregation may be impossible. When the settlement of a question is impossible, only the Supreme Court can settle it—if the reader will pardon the paradox. The question whether Congress will do anything must wait, apparently, until the multifarious political questions now uppermost shall have been settled, which means probably the last day of the session. Congressmen now expect to adjourn next week Saturday.

THE MASSACHUSETTS TROLLEY DECISION.

A law of the state of Massachusetts enacted more than 30 years ago provides that "no railroad corporation, unless authorized by the general court, shall directly or *indirectly* subscribe for, take or hold the stock or bonds of or guarantee the bonds on dividends of any other corporation" except certain corporations named in five following sections of the act among which are not street railway companies. In those far away days at the time of the passage of the law no serious question of the relation of the old horse railroads to the steam roads had arisen. When, with electricity supplanting horse-power the question became acute especially in connection with long distance electric parallels, the New Haven company began, through its holding corporation, the Consolidated Railway Company, an active policy of acquiring trolleys in Massachusetts. Under President Hall, with legislative assent, it took in a trolley line in that state connecting with its system in eastern Connecticut. By President Hall's successor, President Mellen, the same policy was pushed swiftly under the legal theory that the Connecticut holding company was well within its legal rights. Opposition arose in Massachusetts and the trolleys were transferred to a "voluntary" holding corporation at Boston. The Attorney-General of the state brought suit under the quoted statutory phrase alleging that the New Haven Company was "indirectly" holding the trolleys and should surrender them. The Supreme Court of the state, consisting of five judges, in a unanimous opinion has now sustained him.

The opinion, which lies before us in its full text, is of the most sweeping character. It asserts, in the first place, that the device of a holding company constitutes an "indirect" holding of the Massachusetts street railways not less real in its influence and control than that of the New Haven Company over its steam lines. But the finding apparently goes ever so much further. Although the New Haven Company owns but six miles of track of its own in Massachusetts under its old charter—between the state line and Springfield—the responsibility of the corporation, which is chartered in both states, to Massachusetts is asserted, and asserted apparently almost without qualification where the corporation's acts conflict with Massachusetts policy as expressed in the statutes of the state. It is true that the court waives consideration of acts the results of which are specifically localized to Connecticut. But it does not exclude them; and where the acts affect both Massachusetts and Connecticut the court, by strong implication at least, includes them. The decision thus becomes far reaching. It hits so far as one state can do it, many of the numberless acts of President Mellen and his predecessors done under Connecticut law in pursuance of the policy of consolidation. Such matters as the issue of new stocks and bonds, purchase or lease of trolleys, guarantees, acquisition of navigation properties—not transatlantic—valid under the laws of Connecticut and Rhode Island, become illegal under Massachusetts statutes. Pressed home the decision would apparently disrupt the whole New Haven system and invalidate the Boston & Maine purchase. And, in its narrowest aspect, there arises a very grave question of state jurisdiction in the case of a doubly chartered corporation. Questions are raised in the finding of vital importance to every railroad or other transportation company in the land holding charters in two or more commonwealths.

But limiting the decision to the Massachusetts street railways held "indirectly" by the New Haven Company the case becomes sufficiently impressive. That corporation now holds no fewer than 16 street railways in Massachusetts taken in mainly as a protection against threatened long distance parallels. Saying nothing of the various holding companies the 16 lines are represented by \$11,626,200 of stock, \$6,360,000 of funded debt and \$3,234,924 of floating debt—a total of \$21,221,124. The 16 lines include 565 miles, the Worcester system alone having 158 miles, the Springfield system 99 miles and the Berkshire system 80 miles. They represent one-fifth of the total mileage and about one-sixth of the total capital of the Massachusetts street railways. They reach 56 Massachusetts towns and cities with a population of about 250,000. If this vast interest is to be surrendered under the logical decree of the court where is it to go? Is it to be sold out to a new holding company not under the New Haven's control? Is the state to take it and try again the not too halcyon Fitchburg venture in terms of street railway? Is it to pass by auction at forced sale either as a whole or in disintegration? To whom is it to go and is the acquiring interest likely to be more friendly to public interest than the New Haven; and where, in the final adjustment, are the holders of what have been conservative securities sustained practically by the guarantee of a great railroad corporation to come out? But it is certain that its Massachusetts trolleys, which happen to be the most prosperous and promising group of its street railway system, will not be parted with by the New Haven, save in the last extremity.

The situation is interesting, acute and not a little confusing. In its foreground is the question of state jurisdiction raising the vital legal point whether the state of Massachusetts or the New Haven Company is *ultra vires*. It seems very likely now that this must go to the highest federal court to which apparently it can readily be taken in the case of an interstate road like the New Haven or by a stockholder non-resident in Massachusetts. For the general interests of the railroads of the country and, as determining certain new questions in "double charter" jurisdiction as well as the scope of holding companies, such an outcome is not undesirable. In that connection it is to be remembered that the New Haven Company is now acting under and vested with the enormous powers, so far as Connecticut can bestow them, granted by a recent legislature of that state in the "omnibus" charter of the Consolidated railway corporation. The alternative of an appeal to the federal court is that the railroad company and the Massachusetts legislature get together, recognize that the case is one of conditions and not theory, and reach a final settlement and permanent arrangement—perhaps with the disputed trolleys vested in a new corporation with the state strongly represented in the directorate. It would be a natural and sane outcome of the present confusion of laws, interests and policies. But in the existing strange temper of Massachusetts, not less remarkable as exhibited in a state highly capitalized and of conservative traditions, no man can predict the sequel.

STARTING PIECE WORK.

The piece work experiences which were printed in the *Railroad Gazette* last week, show pretty well that railroads which run their shops on this plan are abundantly satisfied with the result, and that individual workmen are pretty sure to earn higher wages than they have been earning on the day wage plan. The difficulty comes in installing piece work in shops where it has not before been tried. The arrangements have a way of failing entirely if they are not made right, and there are plenty of railroads to-day which would be only too glad to start in on piece work Monday morning if they were not afraid of a bitter conflict with their workmen. Within the last three months two large and important railroads have failed signally in an attempt to institute piece work, and the failure in each case was apparently largely a diplomatic one.

The statement can be made without much fear of contradiction that in the present temper, piece work cannot be introduced by placard and by public announcement that on a certain day a certain arbitrary scale of prices will go into effect. One railroad system that has had great success with its piece work and now does a large part of its shop work on that basis, has devoted much thought to the diplomacy of the problem. Its methods are something like this. The superintendent of motive power has a series of conferences all along the road with the best men in his shops. He invites them up to a room of his hotel, gives them cigars to smoke and tells them how much they could earn on the piece work plan. That is all that he does on the occasion of his first visit. The next time he comes, he gets two or three steady men to figure out how much a certain job is worth on the piece plan, but he is in no hurry to establish the plan and there are no placards. By and by, after he has gotten what he calls the piece work feeling running strongly, he starts in by allowing a few of the best men to start working on this basis. There is no compulsion about it at all. They do not have to work on this plan unless they care to, and the day wage is guaranteed them in any event (as long as they remain in the employ), whether they earn more or less on the piece work plan. Consequently, it does not take long for a \$2.50 man to decide to take a chance on earning \$3.25, since he is sure that if he can hold his job at all he can earn \$2.50 at it.

It may be said that this road has laid down two cardinal principles of action in piece work shops. One is that the piece work price shall be established by the workmen, and not by the bosses; the other is that the piece price, when once established, is just as sacred as the day wage; that is to say, it will not be juggled about to reduce the earning capacity of able men and to act as an unfair goad to men who are less able. The plain intention of the company is that the men shall be able to earn the day wage at which they are classed and something more. In one case, under piece work, one man was able to produce so much above the ordinary day work output that he saved the company exactly and definitely the installation of an $11,000 machine. If the interest and depreciation of this machine be figured at $1,100 a year (and this is rather low), it is clear that the company could very well afford to let the machinist earn a good deal more than his day wage. After a couple of months' time, during which this man had been earning $125 a month for himself, the superintendent of motive power said to him:

"George, how do you like piece work; would you rather go back to the day wage basis?" The machinist replied:

"No sir, my wife wouldn't let me!"

Guaranteeing a day wage and making the piece work plan operative only above it and not below it, is an arrangement that produces very important benefits and, in the long run, costs nothing. If the large majority of men in the shop cannot earn more than their rated day wage when working piece work, there is something wrong with the piece work price. As a recent speaker before the New England Railroad Club said: "If you establish an irritating policy of rate cutting, the result is that the workman is afraid to work at his best speed, and it often pays to have a relatively high labor cost if it will increase production, because with large production all forms of fixed charges tend to decrease—interest on the cost of plant and machinery, and superintendence as well—and the total expense cost with high production is apt to be reduced faster than the labor cost goes up. A railroad shop, like any other kind of a shop, gets a bad name with its neighbors very quickly if it is in the habit of reducing piece work prices periodically by the standard of the fastest worker, and there is no surer way than this of creating an organization within the shop that makes it its business to see that nobody works too fast, and is detrimental to the interests of the company and of the able workmen alike. Of course, when new tools are installed or a radical change is made in old tools, enabling unit production to be greatly increased, it is necessary and fair that prices should be revised; but the people to do the revising ought to be the expert machinists, and they ought to be trusted. In one shop the piece work price for boring locomotive cylinders had been fixed at $3.50 for years. With the installation of a very much larger tool, it became necessary to revise the price, and a steady, reliable man was given the tool for a week and told to figure out the price at the end of that time. The price he figured was $1.20, and it made money both for the workmen and for the company.

One difficulty which occurs to everybody in connection with piece work is that it reduces the inclination of a man to help his neighbor and to lend a hand at times when time and money can be saved thereby. The solution for this is to install gang piece work. A case has been cited where one plant employed seven men in its shipping room. This gang was reduced to five men and put on piece work, the members of it being paid in proportion to their day wage rating. The result was that an increased number of shipments were handled and that the total cost of handling was reduced. It is possible to extend this co-operative gang principle to the entire shop, and in some cases this has been done with considerable success, but it is usually necessary, in order to make the gang plan successful, that the work be pretty well unified and that there be enough repetition about the daily output so that standards can be definitely and clearly known. There are cases, however, where shops doing work of the greatest diversity will tackle jobs, new or old, just as they come along, on the gang piece work plan, and keep the men satisfied and the work done cheaply, the price for each new job being established by guess work from its relation to the established day wage ratings.

It might be supposed in a case like this that it would make a good deal of difference who did the guessing, but it does not take the men long to find out whether or not the intention is fair. If they believe that the boss really means to have them earn more than their day wage, they are not disposed to criticise occasional errors in judgment; if they believe he is trying to drive them and have the company make all the profit, he is going to have his hands full. Of course, it is obvious that in making calculations of this sort the day wage ratings must be kept alive whether anybody ever works on that basis or not, and it must be clearly understood what the normal daily earning capacity of a man is before he can be rewarded for increasing that capacity to the mutual advantage of himself and his employer.

One superintendent of motive power, whose division was located in a district where labor union control was very strong, had for some time been unsuccessful in his efforts to establish piece work. The organizers told his shopmen that men who worked under piece work disliked it and had to work a good deal harder than the day wage men to earn the same amount of pay. To settle this bugaboo the superintendent of motive power picked out a delegation of six men who were reliable and carried weight with their neighbors, and sent them down to the head shops of the company, where piece work had been in effect for a great many years. After they had spent a week there and had abundant opportunity to talk with the workmen, they changed their views entirely and went home quite anxious to be allowed to earn as much as the piece work men were earning. In another instance where a large road was endeavoring to install piece work in a certain shop, the attitude of the union bosses became very threatening, and the superintendent of motive power had a long talk with them without evasions or subterfuge. "I don't mind your calling the men out in the X shop, where the piece work is going in," said he, "so long as you don't call men out all over the rest of the system at the same time. I don't think that's fair. There is no trouble anywhere else, and no shops are involved in this but the X shop."

The union delegate agreed that this was the case, and, with the rules of the game thus laid down by both sides, piece work went on in the X shop. The delegate tried to call the X men out, but they would not come, and the road kept the piece work without a strike—in fact has had no general machinists' strike since it began working piece work.

Some roads which do not guarantee their men their prevailing day wages right along, make a brief guarantee when piece work is first established, with very good success. One road says that when starting the men on the piece work basis they are always assured that if they do not in the first thirty days earn as much as they have been earning on day wage, they will get their day wage anyhow, but this guarantee has never yet cost the company anything. The men have invariably earned more than their guaranteed basis.

One road replies that the opponents of piece work are continually advancing theories against the inauguration of any shop system which tends to depart from the day wage basis on the ground that it results in specialization—in doing away with the all-around mechanic and in making it impossible to secure a desirable line of apprentices, but the company does not find that these claims are well founded. It has a list of applications for apprenticeship far in excess of requirements, and is enabled, without difficulty, to select what it considers good prospective mechanics. The company believes that with the proper apprenticeship system there is no reason why the apprentice should not have as good an opportunity to learn his trade throughout under the piece work system as he has under the day work system, although it is true to some extent that men, after completing their apprenticeship and working under the piece work system, are more inclined to remain on a particular line of work, in which they have acquired dexterity and facility. But this company has never had trouble in filling any position, nor have its apprentices created difficulties by leaving the company after completing their apprenticeship, although it is surrounded by shops working under the day work plan.

The union delegates claim that when it is desired to make a good showing under a piece work system, extra supervision is given and extra care is taken to select new and efficient tools and machinery. They claim, also, that quality under piece work suffers. But the widest experience, extending over a very large group of railroad shops, demonstrates clearly that these objections are theoretical rather than practical. While it is necessary under the piece work system to employ inspectors whose duties consist of taking the men's time and making a list of the work done, and also seeing that the work is properly done, the foreman does not have to watch his men as much as he does when working day work, because the piece work man is directly interested in seeing to it that he has enough work on hand to keep himself busy—an interest which has never been conspicuous under day work. As far as quality of work turned out is concerned, it is true that instances occasionally arise where piece work cannot be used with the highest advantage. One road has a corps of English and Scotch machinists employed in tool making, and pays them a high day wage—although almost all the work of the shops is done by piece work—because it wants them to devote substantially all their attention and interest to quality, the quantity of their output being entirely a secondary consideration. But cases like this are relatively scarce, and sometimes even such a situation is handled by figuring quality as well as quantity in the piece wage plan. A case has been cited of a leather plant, where the ends of leather strips for belts are cut off and the strips matched. On day work, the waste in this operation was $4\frac{1}{2}$ per cent.; a piece work rate was fixed around 28 cents per hundred strips for $4\frac{1}{2}$ per cent. waste, and ran up to 42 cents per hundred when 2 per cent. was reached. The result to-day is that the average waste is $2\frac{1}{2}$ per cent. In other words, it is perfectly feasible to pay men a special price for being careful as well as for being quick.

From the experiences of an important group of railroads, the following conclusions about piece work can be reached:

1. It gives the officers, all along the line, far better control of their men than is the case under day work.

2. It increases the efficiency of shop output and saves the company money.

3. It makes money for the workmen, and they are usually well satisfied with the piece work system after they have had experience with it.

4. The men are sure to be encouraged in hostility to the introduction of piece work by their union leaders.

5. Piece work cannot be introduced successfully by placard, but must be worked out by diplomacy and by fair and intelligent co-operation with the men.

6. There must be no juggling of piece prices after they have once been established on a equitable basis, and they should be as sacred as the day wage, and the men allowed to earn all they can.

Although the practice is not universal, it may also be added that in introducing piece work excellent results can be obtained by guaranteeing the day wage.

Texas & Pacific.

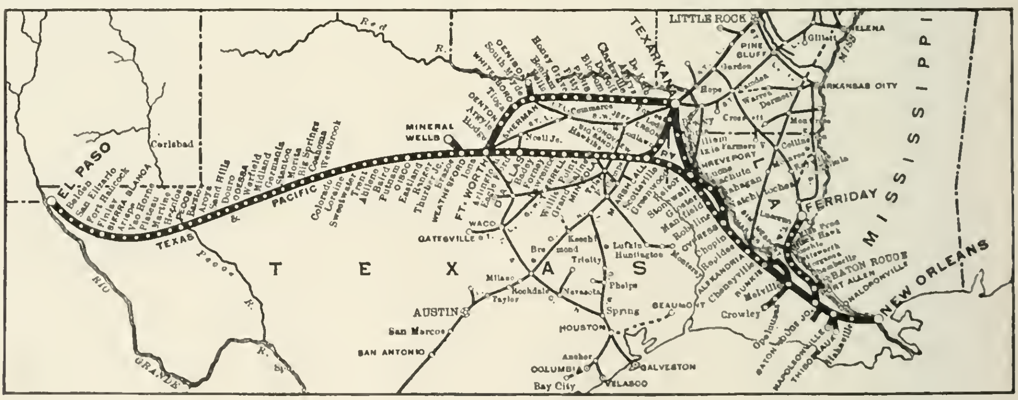
The company at the beginning of 1907 had a particularly bright outlook for a prosperous year. It had spent comparatively large sums on additions and betterments in 1906, and for the first time in its history, the Rio Grande division added materially to the gross earnings of the company. The road is divided into three divisions: the Rio Grande division, from El Paso, Tex., to Fort Worth, 613 miles; the Central division, or Eastern division, as it is called, including the direct line from Fort Worth, Tex., to Shreveport, La., together with the lines from Marshall, Tex., north to Texarkana, and the line from Fort Worth north to Sherman and east to Texarkana; the Louisiana division consists of the main line from Shreveport, to New Orleans, with a number of short branches in the sugar cane and rice districts, and also includes the line from Baton Rouge, north along the east bank of the Mississippi to Vidalia. It was the development of cotton raising on the Rio Grande division, the increased passenger traffic on this division, due to the rush of emigration to the Pecos river region, and the increase in the tonnage of products of agriculture shipped over the Rio Grande divisions, which made 1906 so successful a year for the company, and seemed to promise so much for 1907.

To a certain extent these promises were carried out. Freight earnings were $11,300,000 in 1907, an increase of $1,370,000 over 1906. Passenger earnings were $4,000,000 in 1907, an increase of $490,000 over the previous year, but the total cost of operation was $11,580,000 in 1907, increasing $1,700,000 over the previous year. Thus, in 1907, the operating ratio was 69.4 per cent., as compared with 66.08 per cent. in 1906. The increases in operating expenses can be largely accounted for by the $1,246,000 increase in the cost of labor, and the $456,000 increase in the cost of fuel consumed. The cost of conducting transportation was $7,146,000 in 1907, an increase of $1,068,000 over the previous year, and beside this increase there was $100,000 charged to traffic, as prescribed by the Interstate Commerce Commission. These traffic expenses were included in transportation in 1906, so that the actual increase in the cost of conducting transportation was $1,168,000. Some details of the increased cost of labor are as follows: Station employees were paid $876,000 in 1907, an increase of $180,000 over 1906; yard conductors and brakemen were paid $349,000, an increase of $64,400, and road trainmen were paid $827,000, an increase of $180,000 over 1906. The fact that the Pecos valley region was being rapidly developed and settled was probably one of the causes of the increased cost of labor. On the Rio Grande division the increase in cost of conducting transportation was more than twice as great as the increase on the Louisiana division, and almost twice as great as the increase on the Eastern division. On the other hand the company handled its freight and passengers more efficiently. The average number of trains run daily in freight service was from 105 in 1906, and 132 in 1907. The train load in 1907 was 215 tons, a decrease of only two tons from 1906. Revenue from local freight carried was $1.86 per ton in 1907, an increase of 2 cents per ton, over 1906, and the revenue from other freight was $2.31 per ton, an increase of 8 cents per ton over 1906. The revenue per local passenger was $1.19 in 1907, an increase of $3\frac{1}{2}$ cents over 1906, and the revenue per through passenger was $3.07 in 1907, an increase of $5\frac{1}{2}$ cents over the previous year.

The real causes of the company's unsatisfactory showing for 1907 is to be found in the bad cotton crop, and the large sums necessarily expended for additions and betterments. The revenue from carrying cotton was 10.7 per cent. of the total freight revenue in 1906, while in 1907 it was but 6.6 per cent. In 1906 the road carried 879,325 bales of cotton, while in 1907 it carried only 712,617 bales. On the other hand, the cost of transportation of this cotton was almost as great in 1907 as in 1906, because the movement of freight west on the Texas & Pacific increased, and as cotton moves east the road had increased facilities for carrying cotton at the very time that there was a decrease in the amount of cotton offered for shipment. The year of 1907 was one of short farm crops in Texas. Wheat and small grain crops were nearly an entire failure owing to the depredations of the green bug. This is the same pest that visited the state in 1901. The fruit crop of eastern Texas was also cut short by early spring frost. To add to the company's difficulties taxes on the property for the year 1907 were $555,000, an increase of $215,000 over the previous year, and the average tax paid per mile of road in Texas in 1907 was $306, an increase of $186 per mile over the previous year. With the exception of the decreased tonnage of cotton already mentioned, and the very slight decrease in tonnage of flour and grain and miscellaneous animal products, the tonnage of all classes of freight carried in 1907 increased over the previous year.

Maintenance of way cost $878 per mile operated in 1907, against $821 in 1906. Unit cost of maintenance and renewals of equipment were $2,429 per locomotive in 1907, against $2,184 in 1906, and $1,624 in 1905; $1,096 per passenger car in 1907, against $1,176 in 1906 and $955 in 1905; $72 per freight car in 1907, against $75 in 1906 and $17 in 1905. The company also spent for new equipment $1,128,000 in 1907, which is about double the amount spent for new equipment in 1906.

The company assumed obligations of $2,620,000 due from 1909 to 1917 for equipment. Total current assets on December 31, 1907, amounted to $2,700,000, while current liabilities at the same time amounted to $8,500,000. The current liabilities have increased during the year from $6,560,000 to $8,500,000. This current liability



Texas & Pacific.

in 1907 included $5,180,000 bills payable. In 1906 it included $4,550,000 bills payable. During the year 1907 the company added to the securities in its treasury $1,143,000 Opelousas, Gulf & Northeastern 5 per cent. bonds of 1906-1956, and $94,372, or 70 per cent. of the stock. The Opelousas, Gulf & Northeastern, a 57-mile line, was completed in 1907, and is now in operation. The Texas & Pacific also spent $1,098,000 for improvements during the year. Of this, $264,000 were for ballast, $104,000 for bridges and culverts, and $182,000 for shops and roundhouses, and $48,000 for double track; also $72,000 for steel rails, since the state of Texas compelled the railroad company to relay part of its tracks with heavier rails. For the period of seven years ended December, 1907, the company has spent $2,000,000 on new 75-lb. steel rails and fasteners. In addition to these improvements and since the annual report was completed the Texas Railroad Commission has ordered improvements which it is estimated will cost about $4,000,000. Half of this sum will be necessary for improvements between Fort Worth, Tex., and Sierra Blanca, a distance of 500 miles. The cost of the betterments ordered is variously estimated at from $800,000 to $2,000,000. The problem before the company now is one of financing these improvements and of financing its floating debt.

The following table shows the results of operation for the year:

	1907.	1906.
Mileage worked	1,885	1,848
Freight earnings	$11,273,331	$9,901,702
Passenger earnings	4,088,132	3,602,006
Gross earnings	16,671,668	14,914,608
Maint. way and structures	1,655,856	1,522,081
Maint. of equipment	2,245,957	1,838,040
Conducting transportation	7,145,760	6,077,626
General expenses	430,334	417,176
Traffic	100,033	....
Operating expenses	11,577,940	9,854,923
Net earnings	5,093,728	5,059,685
Net income	5,204,281	5,115,702
Fixed charges and taxes	2,286,214	1,981,724
Improvement and equipment	2,226,736	1,518,575
Sundry items	87,517	51,160
Surplus for the year	603,814	1,564,243

NEW PUBLICATIONS.

Standard Examination Questions and Answers for Locomotive Firemen. By W. G. Wallace. Chicago: Frederick J. Drake & Co. 343 pages; 4½ in. x 7 in.; illustrated; flexible covers.

This book is a reprint from the same plates and on thinner paper of the volume on the same subject that forms a part of the Art of Railroading, or the Technique of Modern Transportation, Vol. IV, reviewed in the *Railroad Gazette* Oct. 11, 1907.

Report of the United States Fuel Testing Plant at St. Louis, Mo. Washington Government Printing Office. 6 in. x 9 in.; 299 pages.

This report covers the work of the plant from Jan. 1, 1906, to June 30, 1907, and includes the results obtained in 214 tests of coals taken from the states of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Indian Territory, Kansas, Kentucky, Maryland, Missouri, Montana, New Mexico, Ohio, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wyoming and a few miscellaneous samples. The work done was divided into coking, steam and briquetting tests, to which a chemical analysis is added. The data are in the form of tables to which a few words of comment are usually added, so that any information that may be contained is instantly available. Of the value of such a report as this and of the work that is being done by the plant, nothing need be said, as it stands for itself, and can be appreciated by any who are called upon to decide in the matter of the probable values of different coals for the purposes set forth. It is information that has long been needed, and is appreciated accordingly.

Standard Handbook for Electrical Engineers. Written and compiled by a staff of specialists. New York: McGraw Publishing Co. 1283 pages, 4 in. x 6½ in. Illustrated; flexible covers. Price, $4.00.

As indicated by the title page, this book is a compilation by a number of specialists who have written the several sections into which the book is divided. These sections are as follows: Units; Electric and Magnetic Circuits; Measurements and Measuring Apparatus; Properties of Materials; Magnets; Transformers; Electric Generators; Electric Motors; Batteries; Central Stations; Transmission and Distribution; Illumination; Electric Traction; Electrochemistry; Telephony; Telegraphy; Miscellaneous Applications; Wiring; Standard Rules and Tables and Statistics. These 20 sections are written by 11 different authors.

The book differs from the usual handbook in that it offers a wider range of treatment than is usually met in works of this kind. Each section of the book is complete in itself, and though there is a great deal of condensation there is still a thread of connection between the successive parts. In treatment the text differs from the ordinary hand book, giving a discussion of the subject and some further information than the bare statement of a fact or the citation of a formula with the author's name as a credit and as a warrant of its value.

It is of course impossible to review in detail the contents of a book of this magnitude. It can be commended freely for the completeness of its general scope and the method of presenting the matter contained. Mechanically, it is presented in a very attractive manner. The covers are perfectly flexible and can be turned back to back without in the least straining the binding, and the paper is of the best India Bible quality; thin and yet so opaque that the printing does not show through. There is an elaborate index, containing more than 6,000 headings, arranged alphabetically with topical references, so that the searcher is brought as near as possible to the point for which he may be looking, thereby increasing the value of the work as a means of quick and convenient reference.

Directory to the Iron and Steel Works of the United States. Seventeenth edition. Philadelphia, Pa. The American Iron & Steel Association. 6 in. x 8½ in.; 516 pages; cloth. Price, $12.00.

This edition of the Iron and Steel Works Directory is corrected to March 1, 1908. It is compiled in the same way as the 1904 edition. Part 1 describes the United States Steel Corporation and controlled properties and the more prominent independent companies, including mines, railroads, furnaces, mills, steel car builders, etc., arranged alphabetically under the names of the operating companies. Part 2 describes all other iron and steel works in the United States, and, for the sake of completeness, the names and addresses of those described in Part 1 are also here included. The arrangement is by states and districts. Part 3 describes all rolling mills and steel works arranged according to products. Part 4 gives information of changes in officers and ownership which occurred while the rest of the book was in press. This edition of the directory is larger than the previous edition, the increase in size being in proportion to the growth of the industry. It lists 448 furnaces, as compared with 428 four years ago, the annual capacity having increased from some 28,000,000 tons to over 34,000,000 tons. There are now 598 completed rolling mills and steel works, as compared with 572 in 1904. The value of the book is due not only to the fulness and accuracy of the information, but also to the classifications of the descriptions and the indexing system, which makes it easy to quickly find the information wanted.

Concrete. By Edward Godfrey. Published by the Author, Pittsburg, Pa. 118 pages, 3¾ in. x 6½ in. Illustrated; semi-flexible cover. Price, $2.50.

The opening sentence of the Introduction announces "that the book is written to point the way to sound engineering in concrete by enunciating the principles thereof and by laying bare the falsity of much that passes for good engineering in this comparatively new branch of construction." And throughout, the author manifests the confidence that he has in his own ideas, with a vigor that must hold the attention of the reader, while he shows but little respect for the ordinary methods of handling concrete. The book resembles a series of separate essays on the subject in which each chapter is complete in itself and can be read in that way. The idea of the individuality of the several parts is emphasized in the method of handling formula in a way that will be appreciated by every one who has occasion to use the book for reference. This can best be explained by a quotation from the introduction:

"No attempt has been made to carry through the book a uniform nomenclature. Values needed for any equation will be found close to it in the reading matter. The author has found attempted standard nomenclature extremely annoying. A practical engineer has not the time, when he wishes to make use of a formula, to read an entire book in order to make sure of the meaning of the values in the formulas, and he is only wasting time when he must refer back to other chapters for their meaning. It is one of the greatest faults of books of reference and text books that must often be used for reference, that formulas are set down with a view of their correctness, solely, the convenience of the user in applying them being ignored."

Every engineer will say an amen to this statement, and unite in a prayer that others may follow the example that is here set down.

In dealing with the subject itself the author does not offer the same number of examples of construction that are to be found in most books on the subject, but he treats it in the manner of a teacher who wishes to inculcate the fundamental principles of the matter in hand to his readers. For example, in the chapter on the steel that is to be used in reinforced concrete the quality of the metal is discussed and the kind for use recommended. Its ultimate strength is set aside as immaterial, provided that it and the limit of elasticity are such as to indicate a uniformity of structure. The reasons for preferring a high steel to a mild one are stated and the tests that it should be able to withstand are given. The author goes through the matter of welds, shapes, bends and other items of the details of construction by dealing with them in a general way that will convey an idea to the designer that will be of value but which will be of little use to the man who is acting as a mere copyist and who is willing to blindly follow others' designs, regardless of the principles involved.

The same method is pursued in the treatment of cement, lime stone, sand and the other ingredients that are used in concrete construction. Especial emphasis is placed on the proper construction and handling of the forms that are to be used, and caution upon caution is uttered that they be not allowed to bend or be injured before using.

In the later chapters there are the reprints of a number of articles that have been written for the technical press by the author in which he has criticised, and has been criticised for opinions expressed. Here both sides of the controversy are printed and the reader is favored not only with the ideas of the writer but of those of men who disagree with him.

Of course examples are given of various types of construction and there are formulas for the calculation of the stresses that the material can be made to sustain, and these are especially full for beams and plates or slabs for floor construction. All this is interesting from the manner of its presentation and valuable because it does not content itself with a bare dogmatic statement of fact that must be accepted, but backs up each statement with the reasons for it.

Foreign Railroad Notes.

By building eight miles of railroad from the Chinese Eastern at Changchun westward, a connection is made for the first time from the Siberian Railroad to Pekin, and China proper—that is, China south of Manchuria.

During some labor troubles in Milan last October, in which the railroads were not involved, a mob was fired on in the streets. To show their indignation at this, a large number of railroad men struck work. Of these 180 were arrested for violation of an article of the criminal code which renders liable to a fine of $100 to $600 and to dismissal from the service public servants who abandon their duties in groups of three or more. The preliminary examination, which decides whether these men shall be held for trial, was held recently for a group of 60 of these men, of whom 55 were indicted, as we should say.

The Hungarian State Railroads in ordering 126 new locomotives of the State Engine Works specify that ten of them shall be of the prairie type, which is bringing the American language pretty well to the East.

The aggregate earnings of all railroads in the German Empire in January, 1908, were 0.4 per cent. more from freight and $4\frac{1}{4}$ per cent. more from passengers than in January, 1907, or $1\frac{1}{3}$ per cent. more in all. For the ten months ending with January their increase was 4.4 per cent., nearly nine-tenths of it in freight.

The opening of the Chilean section of the tunnel under the Andes on the Arica & La Paz Railroad is reported by telegraph recently, and has been taken by the newspapers generally as on the trans-Andine Railroad between Chile and Argentina. Actually Arica is 1,000 miles north of the Pacific terminus of the trans-Andine Railroad at Valparaiso, and only about 50 miles southeast of Peru, to which it formerly belonged. The Arica & Tacna Railroad, built by Americans, was famous in its day. It is on an extension of this line over the mountains into Bolivia that the new tunnel is made.

Heavy Tank Switching Locomotive for the Great Central Railway.

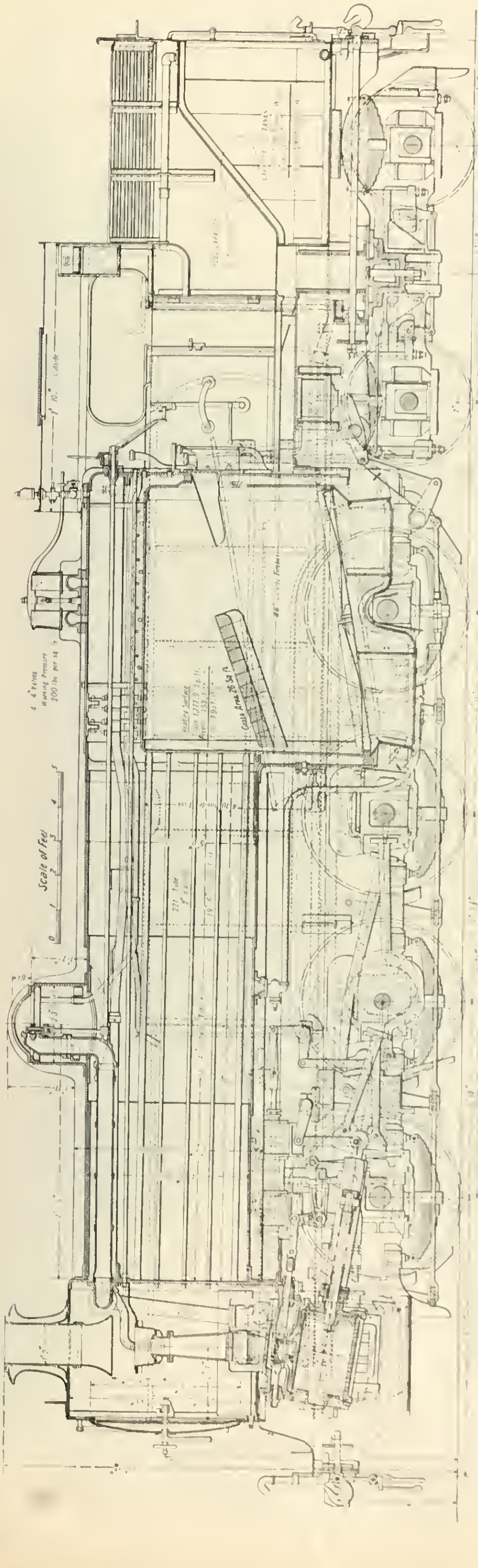
The heavy tank switching locomotive shown herewith ranks as the largest and heaviest of its class that has, up to the present time, been put into service on English railroads. It was designed by J. G. Robinson, the chief mechanical engineer of the Great Central, and is intended for service on the hump grades of the gravity yards of the company at Wath, near Doncaster. It was built by Beyer, Peacock & Co., Ltd. of Gorton. In fundamental principle it is based upon the Forney type wherein the main portion of the engine and the short tender or tank at the rear are carried by a single continuous frame. There is no leading truck but the bogie at the rear serves the purpose of the guiding truck when the engine is running with the cab to the front, which was the original intention in the Forney design. This truck is a compound of a front and rear engine truck. It has the inside bearings of the usual front truck, but with a spring and equalizer arrangement that secures the effect of the one usually put at the rear. The equalizer arrangement is one that is practically unknown in American practice though common abroad. Instead of the deep bars with strength enough to carry the load imposed by the springs between the axle boxes, the springs are set directly over the axles and taking hold of the frame at their outer ends, they are attached to bell cranks at the inner ends, and these latter are connected by a comparatively light tension rod. This makes it possible to obtain all of the advantages of a perfect equalization, with inside bearings, without the use of heavy bars and without interfering with bolsters or brake rigging. This equalization, however, stops abruptly at the truck and does not extend to any of the driving wheels. Here the semi-elliptic springs are underhung and each takes its load direct from the frame.

Heavy Tank Switching Locomotive for the Great Central Railway (England).

The boiler is of the same type and proportions as those fitted to the standard express locomotives of the Atlantic pattern on the Great Central Railroad. It has the Belpaire firebox and slightly extended smokebox. Four safety valves of the Rambottom type are mounted over the firebox, these being adjusted to a working pressure of 200 lbs. per sq. in. The firebox is fitted with a brick arch carried on side brackets, and a deep deflector above the fire door by which the air entering at that point is carried well forward towards the arch before rising and is thus heated to a high temperature before reaching the tubes.

The blow-off cock at the bottom of the shell is fitted with a discharge pipe that carries the water back to a point beneath the ash pan, thus avoiding the wetting of the machinery that so frequently occurs. In this case the pipe is a necessity because of the location of its point of connection to the shell immediately above the cranked axle. The throttle is of the sliding type commonly used abroad and the smokebox has the usual arrangement of English engines.

The characteristic feature of the engine is to be found in its use of three high-pressure cylinders, an arrangement not in use in the United States. They are all of 18 in. diameter with a common stroke of 26 in. The two on the outside are connected to pins in the third pair of driving wheels, while the single inside cylinder drives the cranked axle of the second pair of wheels. All the cylinders are slightly inclined, and each is controlled by a separate link motion. The links are of the Stephenson shifting type and they are operated by a single reversing gear. The lifting shaft for the



Heavy Tank Switching Locomotive for the Great Central Railway (England).

outside cylinders is of the usual type and is worked direct by the connection from the steam reversing cylinder. This is of the ordinary design of a steam cylinder having a piston stroke of 8⅝ in., with a water cylinder for checking the motion and locking in position. The two links are of different forms, and though they have the same throw the lifting shaft arms are of different lengths; probably for constructional reasons.

The engine is equipped with automatic vacuum, steam and hand brakes, and the shoes are fitted to all wheels including those of the truck. The work is on the hump of the Wath yard, where the grade is at the rate of 48.4 ft. per mile.

The following are some of the principal dimensions of the engine:

Tractive effort	38,359 lbs.
Cylinders (3), diameter	18 in.
Piston stroke	26 "
Wheels, coupled, diameter	4 ft. 8 in.
Wheels, truck, diameter	3 " 7 "
Wheel base, fixed	17 " 1 "
Wheel base, total	30 " 8 "
Boiler, diameter	5 ft.
Boiler, length	15 "
Heating surface, tubes	1,777.9 sq. ft.
" " firebox	133.1 "
" " total	1,911.0 "
Grate area	26.0 "
Working pressure	200 lbs. per sq. in.
Weight on drivers	165,760 lbs.
Weight, total	215,488 "

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 4.32$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 5.61$$

$$\frac{\text{Tractive effort} \times \text{diameter of drivers}}{\text{Heating surface}} = 1124.67$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 72.72$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 86.71$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 112.76$$

$$\text{Volume of three cylinders, cu. ft.} = 11.18$$

$$\frac{\text{Total heating surface}}{\text{Volume of 3 cylinders}} = 165.41$$

$$\frac{\text{Grate area}}{\text{Volume of 3 cylinders}} = 2.26$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 1.36^*$$

*Per cent.

Mountain Railroad Location.*

The first requisite for a successful locating engineer is a good party. However capable any man may be he can work only with the materials at hand, and while a good man may secure results with poor tools he can get better results with better tools. Hence the necessity of the best possible party and instruments.

As to the personnel of the party, the common idea that any one who can turn and read an angle correctly is a transitman, he who can read a rod and keep a level book a levelman, while as for the topographer, any son of some prominent railroad official, who never saw a located line, is competent to take that most important place, and the boy who has done the blue-printing at headquarters will answer for draftsman—this idea should be gently but firmly discouraged by the man who finally bears the burden of all their derelictions. Instead, the transitman should be able successfully to take charge of the party in the absence of the locating engineer. The levelman should be capable of running the transit and doing it well, and the rodman should in that case be able to run the level. High priced men? To be sure. But every dollar of extra pay will return tenfold in results, and, after all, are not results what the party is sent out for? The topographer should be able to run either instrument and be a fair draftsman, for if he has at some time been a draftsman he will not bring in a book full of weird, wonderful marks that may mean anything except a representation of the country run over. The draftsman should be a rapid and accurate worker, capable of doing fairly neat work and should have had some field experience. If he has he will be able either to make out the notes turned in to him or be able to call on the field men for such additional data as may be absolutely essential, while not calling for anything that he can calculate in less time than it would take the party to get for him.

As to the rest of the party it should be made up of the best

*From a paper presented to the Pacific Northwest Society of Engineers by J. J. Cryderman, Civil Engineer, Bellingham, Wash.

men obtainable and plenty of them. There is no economy in working short-handed. * * * Usually the engineer in charge is furnished with all the men asked for, though too often the wages paid are grossly inadequate. Why any man who has worked his way up to the position of chief engineer should try to force wages down is beyond me. Of course we understand that a payroll presents a real and tangible thing that can be cut down, but why not pay decent salaries on location and cut down the cost of construction? In other words, hire men who can locate a better line that costs less money to build and operate. This does not advocate paying uniform wages nor salaries, but get good men and pay them decent wages, and not ask them "what is the least money you will take to do this work?" Know what they are worth and pay for it.

After a party is organized the writer has a certain amount of discipline in camp and on line. Seats at table and assignments to tents are made according to rank. If one wishes to talk shop at meals or at night he wants the men he is talking to near. The writer has found as soon as the men understand the arrangement they prefer it. The writer also believes it pays to let the men know as much about the work as you feel justified in telling. In experience the men have taken a more intelligent interest in the work and a caution to them not to talk outside of camp has nearly always been sufficient. In a few cases it has not succeeded, but if you cannot trust a crowd of bright, intelligent young men, such as comprises the average locating party, you had better get rid of them as soon as you can, for whether you tell them anything or not they will talk to outsiders.

In the matter of instruments the writer has used every standard make and many that were not standard and has never yet found the perfect instrument. However, any standard make of mountain transit with stadia wires, full vertical circle, reversible bubble tube and extension tripod, all in first class condition, will answer. The writer wishes to emphasize the requirements: The transit must be light, compact and convenient. When a transitman is hanging on the end of a rope 150 ft. long down a 70 deg. slope he does not want a 35-lb. transit, nor when it is necessary to give levels or read a vertical angle both backwards and forwards does he want to turn his instrument through 180 deg. to do so. As for an extension tripod, the writer has known good engineers who would not have them, but it seems to him to be the rankest kind of folly. We have heard men say, "I don't want a transitman who can't set up a stiff tripod anywhere." The ordinary location party costs from $5 to $10 an hour, and why waste that good money showing ability to do something that does not need to be done? They might as well want a transitman who could set up a transit while standing on his head. No stiff tripods should be made for mountain transits.

For the level, any standard make not exceeding an 18-in. will answer, though a 16-in. is better, and there should be at least one extension leg in the tripod, especially if a supported grade line is being run, where the levels need to be kept close up to the end of the line. In such cases the levelman must have every show that can be given him. All the reasons given for a light-weight transit apply to the level also. The writer uses a 12 or 13-ft. Philadelphia rod. Take a light, thin, narrow board 5 or 6 ft. long, and mark the top plainly as a sort of target. With the rod measure off and mark each half-foot down from the top, then measuring with a steel tape place the target mark at some exact even foot above the foot mark on the rod, fastening it on the back of the rod by means of small brads or screws. You now have a 16, 17 or 18-ft. rod, as you may desire, with the top marked to half feet, which answers for intermediate stations and on turns. The levelman reads and sets the target precisely as he would the target on the regular level rod and can add from 25 to 50 per cent. to the speed of the level party over rough country.

Besides the regular 100-ft. steel tapes always carried I have a 400 or 500-ft. steel tape to use on slopes, using the vertical circle and reducing to horizontal and vertical measurement. When the distance is too great for the tapes, or it is impossible to get them across, use the stadia wires and level rod, reducing the readings by the table given by Allen or Lavis. For mending tapes the writer prefers sleeves and solder, with the set-screw sleeve for temporary repairs. It takes less than three minutes to mend the tape with a piece of candle and the writer has never had one pull apart, preferring it to the punch and rivets.

For lining rods the best are the wide rods with a line struck down the center, stagger painted. With such a rod, if the transitman can get even a foot of the rod he can plumb it so he knows his tack is where it belongs.

The writer has the rear chainman carry a rod which he uses instead of the plumb bob for chaining, and also for helping the axman keep line. At first the average chainman has to be watched to see that he does not plant the rod on the ground instead of holding it clear, but he soon gets broken in and it is less bother than a plumb bob and has the advantage spoken of as to keeping the axman in line.

Camp Equipment.—In mountain work, as everything must be packed on horses or men's backs, equipment must be cut to a minimum, and made in convenient form to be packed.

The writer has found a modified form of the sheet iron Klondike stove fairly satisfactory for cooking and it can be packed and even a heavy form of it moved on an aperejo or Humboldt. For tables use the canvas lath arrangement. For any one who has not used them it may be explained that they are made of a strip of canvas of the desired width and length with lath tacked or nailed across them, spaced ¼ in. apart, and are unrolled on side poles fixed on posts and covered with oilcloth, as with the common plank camp table. They are very light, fairly strong and quite convenient, and can be rolled up and packed like a roll of blankets. They can be used for dining table and cook table in the kitchen, and a small section is convenient for the office.

In the way of dishes, use granite ware, but cut them down to the fewest your cook can conveniently get along with. As that depends on the cook, no rule can be made; however, take along two dozen miner's tin cups with open handles and let each man carry his own cup on line for lunch.

Within the past year the writer has experienced the two extremes as to the facility with which supplies can be obtained or delivered, in one instance being camped beside a trunk railroad and in the other, being in the interior of Alaska, in the one case being able to get everything in the market, and in the other—well we did not starve but beans 21 times a week grew monotonous, however, the men were as well in one case as the other and seemed to work as well, and some of the same men were in both parties.

In these days, with evaporated fruits and vegetables and concentrated extracts, it is easier to supply a party fairly well, and still cut the weight to a minimum. In the party this summer the daily weight only ran about 2½ lbs. per man per day, which is about as low as it is possible to get any variety for a party. As it is impossible in a paper of this length to give many details, supply lists of all sorts are omitted, referring any one to the works of E. H. McHenry and F. Lavis for all such information, merely cautioning any one who has had no experience that no two parties ever use the same quantities of any article and McHenry's parties must have had fearful and wonderful appetite for some things, judging from his supply lists—codfish and soap for instance. Likewise the list of Lavis. With the McHenry list is supposed to go fresh meat and vegetables, and if you are where they cannot be had the evaporated vegetables and sugar must be at least doubled, and the salt meats increased one-half. Fruit and flour will over run.

For office supplies take everything you can and keep within weight limit, using the knock-down drafting table and set it up like your kitchen table. The stationery chest should not exceed 12 in. x 12 in. x 31 in. in the clear, and even then is awkward to pack. Take tin map cases for maps and profiles, and when moving camp it is well to roll them in blankets to prevent battering up.

Medicines.—A few simple remedies, but no drug store, are needed. Most of the men carry some favorite remedy for themselves and all that is needed in the company chest are some pills, Sun cholera cure, quinine, some surgeon's needles and sutures in glass tubes, needles and silk thread in envelopes, gauze, rolls of bandages, surgeon's plaster, absorbent cotton, antiseptic tablets and some arnica. The latter is the writer's panacea for all cuts and bruises; one-half teaspoonful in a coffee cup of clear water is the best antiseptic he has ever used, and most cuts thoroughly washed out and sewed up and then kept wet with the mixture will heal without inflammation or suppuration.

If any one in charge of a party has never sewed up a big gash in some man's foot or leg, he had better go to some surgeon of his acquaintance and take a few lessons; he will be apt to get the necessary practice in the mountains.

There should be plenty of room in the tents for the men and they should be supplied with Sibley stoves which can be flattened out when packed on horses. Men come in wet and cold too often to economize on room and warmth. Wherever, as in Alaska, mosquitoes are bad, the company should furnish mosquito bars for the men and the engineer should see that they are used, for the man who fights mosquitoes all night cannot work well all day. As any undertaking succeeds in proportion to the attention given to its details, the writer considers the foregoing remarks as to the party, its personnel and equipment, of first importance.

We now come to the active work of preliminary and location with the methods used. Ability, or the lack of it, is shown by the preliminary an engineer runs. Should it not fit closely to the route followed by the location it is time and money thrown away. Do not understand by this that all preliminaries do, or should, follow such line. Many lines are run where the engineer knows them to be worthless, but he does so to show why the line was not located on that route. But to run random lines to develop the country shows a lack of ability that should transfer the engineer from locating to some other branch of the profession. Given the proper preliminary with good topography, and the final location is a question of mathematics. The skill consists in placing the preliminary not only where the location will go, which any one can do, but where the location should go, which sometimes is vastly different.

Usually in mountain work the preliminary is for a supported grade line. In such case the writer estimates how much curvature per station he is likely to have (commonly compensating .04 per degree of central angle) and then reduces it to a uniform grade per station. For example, we are running a 1 per cent. grade compensated .04 per degree. We judge we will have equal to a continuous 5 deg. curve, or a compensation of 0.2 per cent. per station, or equal to a straight 0.8 per cent. grade. Now make out a table of grades for 0.8 per cent. for the use of the transitman and levelman so they can tell just how they are for grade, whether the engineer is with them or not. Each night the line is platted up and a rough projection made, and the compensation figured to the end of the line and the trial grades corrected up. After the second day the topography is platted and the projection made more carefully and the grades re-checked and carried ahead to the end of line on rough projection. By this means the preliminary should be almost where the located line should run and the topography should cover the country desired.

As to the methods of field work on preliminary, there is really little difference among the general run of engineers. With the writer the transit notes are kept in the usual way, except that he always has the magnetic courses taken and recorded. It hardly ever checks with the angle, but if out over 1 deg. the angle is re-checked, and it will always save the transitman from making any serious errors in angle, though the writer has had men who made the same error in reading their angle and checking the course. The writer uses a hand level, or clinometer, and directs the head chainman, dodging obstacles as much as possible, and still keeping as near grade as can be done. In case of deep cuts, high trestles, or tunnels, follow grade around them, then run a line where the located line must go. This for the topography and for the reason previously given, to show why the line must go where it does.

The levels are kept up as closely as they can be, and the levelman leaves the elevation of stations and angle points for the topographer, usually on a stake, or piece of paper, every 400 or 500 ft. The writer tries to have the topography kept right up to the work so that the draftsman is only one day behind and the projection can be kept up.

When leaving the party to be gone over an hour the transitman is called to take the place of the engineer and the levelman runs the transit, for no man can run a party while standing behind a transit. In speaking of the levelman running transit, reference is made to the ideal party. The writer has had the rear chainman run transit and he did good work too, but some one must be ahead and some one must run transit. The principal thing is to get it done and done right.

Having the elevation of the station and angle points, the topographer, where he can, locates the 10-ft. contour above and below the line, and then takes the ground by slope measurement and distance, using a clinometer, measuring the distance with rod or tape where he can, estimating distance where he cannot measure. Besides entering these notes in his book, he also sketches in the general features of the line, showing stream and gulch crossings with their course or angle to the line, also character of the country, and any other information he can secure.

In reducing the topography to the map the writer uses a piece of celluloid about 6 in. x 12 in., out of which are cut slits running across, being about ⅛ in. wide and 4½ in. long, reaching to within ¾ in. of the edge. On the edge of these slits is marked 1-ft. contour intervals, with the 5-ft. x 10-ft. prominently shown, for each degree of slope up to 20 deg. Then by 5-ft. x 10-ft. contours and for each 2 or 3 deg. of slope up to 35 deg., then by 5 deg. intervals up to 60 deg. The one the writer uses is on a scale of 200 ft. to the inch and can be used for the 100 or 400-ft. maps by interpolating values. Any draftsman can use it at once and it is a very convenient labor saving device. The writer has not mentioned locating the contours on the ground and entering them in the book, as it is generally out of the question. The preliminary map is generally made on the 400-ft. scale, as it is most convenient, and on this is laid the trial location. Taking the table of grades worked out from the rough projection, step off 500 ft. with hair-spring dividers set as carefully as possible, following direction of the probable location and marking grade in pencil with a rivet pen, carrying these grades if possible for at least a mile of line. Now at a glance you have your grade line. Some men connect these points by a dotted line, but the writer has never found it necessary. Now try for the best line possible for the ground, as one should always try first for the best possible line, later trying to cheapen where it can be done, or, more truthfully, where it must be done.

For projection the writer uses thin celluloid curves, which he cuts out of a sheet of celluloid with a beam compass, as the manufactured ones are both bulky and expensive, and a dollar's worth of celluloid and a half-day's time will furnish a set.

The set the writer now has is for the curves he uses most, as, like most locators, he has favorite curves whose deflections are easy to figure, and wherever they will fit the ground they are used. The set mentioned is for a scale of 400 ft., but they can be used for any scale by interpolating values. Whether to lay the tangent and fit in the curves, or lay the curves and connect by tangents depends on the ground. Commonly both methods are used on the same sheet. In either case the tangents are drawn to intersect the meridian on the map and the courses are taken by scaling tangent distances from the intersection of the meridian and taking the course from the table of natural tangents, in the same way you would plat from tangents. The courses are marked on the tangents and the angles computed by differences in courses.

The writer might remark here that all his maps are platted by latitude and departures, and in the office copy of the field notes the co-ordinates to each angle point are recorded. The transitman calculates the traverse of his line, being checked by the draftsman, or, on rainy days, by other members of the party. The angles on the map are roughly checked by a protractor. The projected tangents are scaled from apex to apex and the tangents for the curves are taken directly from Butts' Field Book. On each curve is marked degree of curve, central angle, semi-tangent and length of arc, and it is penciled in on the map. Now for stationing scale distance to P. C. of first curve, P. C. plus arc equals P. T. Then apex distance, minus semi-tangent of curves 1 and 2, equals tangent length between curves; P. T. plus tangent length equals P. C. of curve No. 2, and so on. Now use stepping dividers and lay off stations, checking by the P. C.'s and P. T.'s on line. While stepping line take off your trial profile; usually you see at a glance the line must be shifted, which you do at once, re-check your angles and stationing and continue till you get a line that looks about right. Now using your table of grades, lay a temporary grade line and make a preliminary estimate, using a table of cutting on transverse slopes. You will almost always find your line must now be shifted once more. In doing all this use a soft pencil with as fine a point as possible, and even then the map looks disgraceful, but it does not look any worse than you feel after you have worked over it awhile. When you have exhausted yourself and the map you are ready to run in the line, but the writer only calls for and uses it as a trial location not marking the stakes L, but any letter not previously used, and not running in nor using spirals.

This line as run in is platted in on the preliminary map, also on a new map of 200 ft. to the inch, and in very bad country 100 ft. to the inch. As the line is run in, co-ordinates are figured to the apex of each curve and ties are calculated and made to the preliminary at frequent intervals. The writer does not run tangents to intersection as he does not think the value equal to the work required, but depends on ties to the preliminary to take its place. On this work the writer has a small tracing showing a mile or so of the projected line and preliminary with the ties, showing some topography but not much. The writer carries in a book bag a thin board, 8 in. x 12 in., smoothed on one side, some thumb tacks, a small protractor which has been checked and known to be accurate, a small triangle, a 6-in. pocket scale in case, and a pair of pocket dividers, also some loose sheets of scratch paper tacked on the board. If the projected line does not fit, use this small drawing outfit and tracing and project a line that does fit.

Sometimes, but not often, the writer backs up, sometimes makes offsets. In fact what is done with the line depends on what can be shown by levels and topography. If to get them we must back up we do so, if not we go ahead. On this trial location the levels are checked with the preliminary, as are the courses of the transit lines. The topography is taken with as much care as possible and platted on the new map, but no effort is made to try and fit it to the preliminary map.

On the new map is now projected the revised location, using some of the methods used on the first projection, but with many modifications. This time instead of carrying the tangents to meridians and scaling them for the course, latitude and departures of the apex points are scaled from the meridian, entering the co-ordinates on a traverse sheet. From these is found the latitude and departures for each course and from these is worked out course and distances. In other words, it is the traverse of the projected line worked backwards, and by frequently using some course or apex of the trial location the work is checked and rarely is out more than 5 min. on courses. On the revision, spirals are calculated for all curves exceeding 3 deg., and unless on some road that insists on some other the writer always uses Talbot's, as it is the simplest and most flexible of all spirals. The writer also runs the spirals in on the revised locations as it is the only way to secure the profile of the true line.

Some good engineers do not use spirals on location, leaving them for the construction parties, but the profile is incorrect and, of course, the estimate also. Besides, when left, it means an equation at the end of every curve, a thing every engineer abhors. Where there is an equation it should be carried to a tangent and then only marked on map and profile, short or long station, giving the length. If there is anything detestable it is to find a profile marked 139 + 10 = 138 + 72, and to the end of time one will wonder whether the man lost a station or found one.

The methods used in running in the revision are much the same as on the trial location. In running in curves in brush the writer uses long chords and offsets the stations. It means watching the chainmen to see that they hold off the correction. The table of long chords given in Shunk's Field Book are usually correct to within two-tenths up to 100 ft. for 6 deg. curves and it saves calculating them.

Some engineers object to offsetting stations on curves, but all the use you have for them in brush is for levels, topography and clearing, as the line must be re-run for cross-sectioning, and the man who cannot get them close enough for purposes mentioned had better try some other work. Personally, the writer has never felt called upon to slash the right-of-way to set a few stakes, and for that matter, many stakes must be left unset in the mountains, the best you can do, and left for the construction parties, who have both more time and ropes than the location parties. The writer has found, where there has been nothing to tie the lines to, that it is well to take an observation on polaris about every 10 or 15 miles. It corrects up the courses and catches an occasional error in courses that has slipped by. * * *

The amount of work that can be done by a party depends on the character of the country and the kind of line run. What might be a fair season's work expressed in miles in one locality would be poor in another. In 1903, from March to September inclusive, the writer ran 110 miles of preliminary at a total cost of $10,500, an average of $75 per mile. This included all expenses of every kind, including transportation for a full party and outfit from Bellingham, Wash., to Brewster, on the Columbia river, and the return of the party from Ruby creek, a branch of the Skagit, to Bellingham, besides the line run; but included in the cost was the building of 20 miles of trail by the party in the Cascades, a pack train, move of the camp and outfit 70 miles (requiring one week on account of rain and snow) to cover a gap four miles between the end of the trail being built and the one building to, as the four miles would have taken 30 men six weeks with a half ton of powder; also two months extra work of the writer and a draftsman completing all data in regard to the line. As a basis for comparing costs the following list of monthly salaries is given:

Transitman	$90	4 horse team and driver, 2 mos., Includes feed for team and board of driver	$125
Draftsman	85	Pack train, 20 horses, 5 mos.	150
Level and topographer	75	Packer, 5 mos.	75
Rodman and head chainman	45	Packer, helper	50
All other men, except cook	40		
Cook	75		

The company shod horses in pack train and furnished feed when required.

In 1906 the writer re-ran a portion of the location of the Washington & Great Northern from Wenatchee to Oroville. The work was revision of location as covered in the description of projecting and running in such work. There cannot be given so close a statement on this, but the average was 25 miles of location per month at a cost of $62 per mile; wages were about the same, as given above. These examples show how worthless, for purposes of comparison, tables purporting to give cost per mile of surveys can be, the preliminary of less than 100 miles costing much more than location. This would be shocking were it not that the same man did both, and both parties were equally good. As a further example, without going into details, the cost per mile of preliminary and location this season on Copper river, Alaska, will run over $350 per mile, and in the Alaska work, on location, the average was eight miles per month, as against 25 on the Columbia and a pack train of four horses cost $800 per month. The real basis of comparison should be for like work done under like circumstances, though that is hardly a possible condition.

DISCUSSION.

The following written discussion was offered by G. A. Kyle, Principal Assistant Engineer of the Chicago, Milwaukee & St. Paul Railway of Washington:

Regarding instruments, the older companies do not, as a rule, furnish as good instruments as smaller and newer companies, as their stock is generally antiquated. Perhaps there is some reason for their backwardness in this matter, owing to the fact that there is not enough attention paid to the care of instruments by the men using them.

The author's methods for running preliminary line on supported grade lines are very good, and the writer usually follows them quite closely, with the possible exception that in addition to taking needle readings the transitman always takes double sights with the transit, reversing the instrument for the second sight to average both the personal and the instrument's errors. This can usually be done without loss of time, especially in timber country when the speed of the party is determined by the ability of the axemen to clear the line; and the delay, if any, in clear country is more than counterbalanced by increased speed of the locating party in running out the projected location line on the ground, as this added accuracy in preliminary line insures the close fitting of projection, and saves backing up, which is expensive and has a tendency to discourage the members of the party.

As to keeping close to the proper grade in running the preliminary line, the writer has often adopted the method of keeping the level party up close to the transit and setting the head chainman in timber country or head flagman in prairie country for the sight ahead with the level allowing for the grade at the point ahead where man is stationed. He has often kept the level notes himself, to enable the levelman to run the level in order to keep up close to transit, in fact, the transit was not allowed to get ahead of the levelman to any extent. The preliminary line can be run almost exactly to fit the grade, and the tangents almost in their proper place by keeping close track of curvature to be used on location.

Topography.—The writer prefers to locate the contours on the ground, whenever possible, with a hand level, and take actual measurements from the center line with a chain or tape and plat same on sheets in the field. The topographer is allowed two men, one to run the hand level and the other the rod, both measuring the distance, measurements to be taken from each station each side of the center line to the first or second 10-ft. contour. At every 200 to 500 ft., depending on the character of the country, they take measurements to each 10-ft. contour to an elevation of say 100 ft. vertically in steep country, and take clinometer readings where the measurements leave off; in lighter country they take contours out from 500 to 1,000 ft. if necessary to locate some prominent point or object, all intermediate objects such as creeks, roads, etc., being noted, and the contours intermediate to the measurements can then be sketched in by the eye by looking at the shape of the ground. Wonderfully close work can be done by an experienced topographer, as with this system he has only to record the notes and sketch in the contours, and is relieved of the measurement by his assistants. At some points on the right-angle-lines he may take right angles to bring his line parallel with the main line, and measure along that to locate contours when irregular. In order to get a right-angle line to the center, he can use the board that is used to hold the topography sheets, mentioned below. The topographer sights one side of the board along the center line and the assistant sights along the end of the board, marking a tree or other object in the distance, or setting up a pole close to the center line for a sight to run to.

Whenever the line is running parallel with a water course the topographer should carry his levels down to the bottom of same every 1,000 or 1,500 ft., according to the character of bottom, in order that it may be shown on maps and profiles how far the line is above the bottom at any point. The topographer is always from one-half to one day's work behind the transit party by this method. Very good topography, however, can be taken by using a clinometer and one assistant to the topographer to measure the distances.

Topography Sheets and Maps.—The topography taken by hand level as above is plotted on sheets 12 in. x 18 in. to the same scale as the maps, which should be from 100 to 400 ft. per inch, according to the character of the country—easy country, 400 ft., mountainous country, 200 ft., very rough, steep slopes, 100 ft. per inch; but 200 ft. per inch is suitable for very rough steep country. The map should be broken where the scale changes, and the scale marked.

The line on the sheets should be plotted by the draftsman in the office and kept as near the center of the sheet as possible. The sheets should be marked so that they can be replaced in the same position they occupied when plotting the line so that the latter will be continuous on the sheets after the alinement is inked in. Each station should be marked on center line, and every even five or ten stations numbered. Light pencil lines should be drawn at right-angles to the center line at each station and parallel with the center line 100 ft. apart; dividing the paper into squares; then fasten the sheet or sheets on a board 12 in. x 18 in. x ½ in. with thumb tacks, and the topographer is ready to start.

He should note the distances out to all contours and objects such as roads, creeks, rivers, etc., on the edge of the sheet opposite the station where measurements are being taken, and plot the contours as measured with a scale or by the squares on the sheet and sketch in the contours, creeks, rivers, roads, etc., as nearly as possible between the measured points by looking at them on the ground. The topographer should ink the contours in the evening of each day's work (as he is more familiar with his own work than the draftsman) and turn the sheets over to the draftsman. The draftsman should plot the line separately on drawing paper and trace this on tracing cloth, then place the tracing over the sheets and trace the contours and topography shown on sheets. The draftsman should plot section ties on the sheet as well as on the maps. Each sheet should have the meridian shown on it, with magnetic variation shown. The writer has found that the topographer will take more interest in the topography when taken on sheets, as it is interesting to watch the development of the topography on the sheets; and after he gets the shape of the country started it is wonderful how closely he can sketch in the intermediate points between measurements.

Maps should be made of uniform widths generally from 18 to 21 in. wide, as this is half the width of the general run of tracing cloth.

Projecting Line.—The author's method of projecting line is good, and is followed by the writer, except that he uses a continuous dotted line for the grade contour instead of a few circles, as one then has practically a profile of the line on the map. The fitting of the line to the grade contours is then purely mechanical, requiring no thinking to locate the grade contour, and all one's faculties can be concentrated on the balancing of quantities, and the line can be laid nearer the correct place quicker and easier.

Celluloid curves are useful when of large radius, but when the radius can be reached with an ordinary compass with extension joint, the writer prefers this, as the curves are worked from the contour, purely a mechanical instead of mathematical method of locating the limits of the curve. The more the work can be simplified the more time the engineer will have for the proper adjustment of the line. With good topography and careful work on line and maps, and in making projections, figuring quantities from projections and doing the backing upon the maps, the line should be located in the proper place the first time in ordinary country. In other words, the location should be done on the map and duplicated on the ground with proper precautions, and trial locations very seldom used.

Regarding the cost per mile of preliminary line, the author states that he ran 140 miles preliminary at a cost of $75 per mile, and 25 miles at a cost of $67 per mile, which is very cheap indeed, as the general cost of work west of the Cascades is a great deal more. In Alaska the writer ran 185 miles of location costing $475 per mile and 600 miles of preliminary at a cost of $238 per mile, the conditions being very severe.

New Mexican Central Organization.

In the former organization of the Mexican Central, the superintendent had charge of track and transportation. The superintendent of motive power had charge of the shops, of the care of locomotives and practically of the engineers, firemen and mechanics. There was also a material agent who had charge of material over the whole line, and a fuel agent who had charge of fuel over the whole line, and the responsibility was so scattered that it was hard to secure good results. Under the new organization the superintendent is responsible for everything on his division; the master mechanic reports to him, the transportation officers report to him and also the engineer of maintenance of way. The superintendent is responsible for his stock of materials, for his fuel and for everything on his division.

The superintendent of motive power has immediate charge of the general shops of the company at Aguascalientes, but, so far as the other shops are concerned, he exercises only the supervision to secure uniformity of work and the maintenance of established standards. He is not responsible for discipline or the handling of the shops in any other way. The supervision of the chief engineer over the line is similarly restricted to seeing that standards are maintained and that engineering work generally is along the line of adepted practice. President Felton, to whom we are indebted for these details, describes the organization as being practically that of the Pennsylvania Railroad, modified to suit local conditions; that is to say, it is strongly divisional, whereas formerly it was departmental. In spite of the obvious fact that a railroad system cannot expect to find one man who is of really first-class value in all lines, mechanical, engineering and operating, most railroads in this country are getting better results from a strong divisional organization with what may be termed departmental staff officers, reporting to the president or general manager, than they are from a strictly departmental organization, and the Mexican Central is doubtless wise in making the change.

Walter G. Berg.

Walter G. Berg, Chief Engineer of the Lehigh Valley, died suddenly on May 12, of acute indigestion, at his home in New York. Mr. Berg had the unusual combination of executive ability and breadth of view, with the faculty of closest attention to details After designing a yard he could tell the operating officers how to use it. Yet this ability to understand all phases of a problem was not lessened by his habit of working out with his subordinates the minutest details of any design; a habit which destroys the perspective of most men who practice it. In making a report on a subject, he analyzed it exhaustively, and during the later years of his connection with the Lehigh Valley he was constantly called on by other companies and individuals to pass on plans and otherwise act as consulting engineer.

He was born in New York on January 12, 1858, and was educated in that city and in France and Germany. He took his C E degree at the Royal Polytechnic Institute at Stuttgart in 1878 During his course he won a gold medal for a treatise on Spherical Conic Sections; the only time an American has won that medal. He then returned to this country, and for a year was shop inspector of the Delaware Bridge Co., at New York He was then, for four years, in the engineering departments of the Richmond & Allegheny, now part of the Chesapeake & Ohio, and the East Tennessee, Virginia & Georgia, later taken over by the Southern. In 1883 he went to the Lehigh Valley as Assistant Engineer. He was in charge of some railroad construction, and also designed and built roundhouses and other structures at Packerton, Pa., and various other points on the Lehigh division He built the company's creosoting plant, and for a time was Superintendent in charge of it. In 1887 he was appointed Principal Assistant Engineer. In this year he designed and built the Jersey City Terminals of the road. This work was an example of his originality in design, being perhaps the first use in that locality of wooden transfer bridges, while the layout of the piers was also novel. Throughout his service he was always on the lookout for the latest ideas, keeping closely in touch with current practice all over the country. The idea of the circular freight yard built for the Harlem Transfer Company originated with him, when he was consulting engineer for this work, and the design has since been used at various points on the Lehigh Valley.

Walter G. Berg.

In 1898 he was made Engineer of Maintenance of Way, and in 1900, Chief Engineer The Sayre shops were designed and built by him in 1903. Mr. Berg was a member of the American Society of Civil Engineers and many other engineering and railroad associations, being at one time President of the Association of Railway Superintendents of Bridges and Buildings, and at the time of his death President of the American Railway Engineering and Maintenance of Way Association. He was the author of Buildings and Structures of American Railroads, American Railway Bridges and Buildings, Strength of Timber, and American Railway Shop Systems

Among the British possessions in South Africa is a territory extending along the west side of Lake Nyassa, the east side of which is the western border of German East Africa and Portuguese Mozambique, and extending from the southern end of Nyassa southward about 170 miles, and 90 miles from east to west, directly into the Portuguese territory The importance of this is that it contains the valley of the Shire river, which runs from Lake Nyassa to the great Zambesi river, and for part of its course is navigable For 100 miles of the unnavigable part of this river Port Herald north to Blantyre, a railroad has been built, the northern part of which, to Blantyre, was opened March 31 last. Lake Nyassa is about 360 miles long from north to south, so that the railroad will give an outlet to a large territory adjacent to navigable waters. The Germans are building a railroad from the sea westward towards the north end of Lake Nyassa but it will be several years before it reaches the lake.

Railway Signal Association.

The regular May meeting of this association was held at the Engineering Societies' building, West 39th street, New York City, on Tuesday of this week, with President A. H. Rudd (P. R. R.) in the chair. About 150 members were present at both the morning and afternoon sessions.

President Rudd said that in the six months since the annual meeting the committees had done more work than ever before in a similar length of time, and the chief feature of the meeting was the accounts given of what had been done by the principal committees. Mr. Patenall (B. & O.), speaking for Committee No. 1, said that progress had been made toward standardizing colored glasses. A sub-committee had met the manufacturers and had decided on methods of testing. It is proposed to adopt a standard photometer. Specifications for standard glass have been drafted and are now in the hands of signal engineers and manufacturers for criticism. Mr. Mock, reporting for another sub-committee of Committee No. 1, said that some progress had been made toward agreement on standards of signal construction. Agreement has been reached, or nearly reached, on signal posts, ladders and stays; and progress made toward the adoption of uniform specifications for 1 in. pipe and pipe couplings, cranks and pins. A standard semaphore casting has been discussed, but further progress must wait for the association to settle upon what aspects it will approve. Mr. Kelloway (A. C. L.) reported that his sub-committee had agreed on rules for the protection of drawbridges and had made progress on standard specifications for bolt locking, for circuits for interlocking, and for lamps.

Mr. Mann (Mo. P.), for Committee No. 3, on standard specifications for electric interlocking, presented a printed report embodying additions or modifications proposed by the committee. The changes proposed are the result of conferences between the committee and representatives of seven prominent manufacturers of electric signal material. This report was discussed by the meeting at length, especially those parts relating to gas engines, generators and storage batteries. The meeting resolved itself into a Committee of the Whole and gave Mr. Mann numerous suggestions for improving his recommendations for presentation to the annual meeting. Messrs. Stevens (A., T. & S. F.), Elliott (N. Y. C. & H. R.), Denny (L. S. & M. S.) and others gave their views as to the proper size of the gasolene engine as related to the capacity of the electric generator. Mr. Stevens believes that experience will show that for isolated electric interlocking plants a storage battery of 80 amp. hours or larger will be more economical than one of 40 amp. hours, which is the size now most commonly used.

The committee recommended that the electric generator for an interlocking plant should be at least large enough to operate two switches simultaneously; this to provide for the emergency of the storage battery being disabled. It was thought by some that this emergency was too remote to need consideration, but a motion to expunge the paragraph was voted down.

It was the sense of the meeting that storage battery cells should be arranged on the racks transversely instead of longitudinally, as is the practice among users of the storage battery in other than signal work.

In the discussion of bonding of rails, it was stated that copper clad wire is now being used experimentally by a number of roads for this purpose.

The first thing done at the afternoon session was to listen to a paper on the care of storage batteries, by H. M. Beck. The speaker dealt chiefly with the restoration of low cells. He said in part:

The care of a storage battery should have for its object the prevention of low cells, rather than their treatment. The most economical method is to make the expenditure required for the proper care and operation of the cells and this is absolutely essential, if satisfactory results are to be obtained. The tendency is just the reverse to allow the cells to run as long as possible with little or no attention, and it has frequently required a costly experience to bring about the needed reforms.

While the causes of low cells may be varied, the result produced and consequently the treatment required, is not so varied, being in fact, comparatively simple. The general procedure is as follows:

1. Restore the cell mechanically.
2. Renew the electrolyte if there is any question as to its purity.
3. Restore the cell electrically by charging.
4. Determine, if possible, the cause of the trouble.

The mechanical restoration covers the operation of examining the cell and putting it back into its original condition mechanically.

If the electrolyte were renewed in every case the expense would not be great in the small cells used in signal service and this operation would then be purely mechanical.

The electrical restoration has been probably the greatest stumbling block, t o it consists in simply charging the cell unt a maximum voltage and gravity l reached.

The determination of the cause of the trouble is sometimes difficult, but fortunately it is not one of the essentials, and is chiefly of value in preventing a recurrence of the trouble.

Thus reduced to its essential elements, the treatment of low cells consists simply of a mechanical overhauling followed by a prolonged charge, and should not be difficult for anyone to grasp.

Mr. Beck than gave a very thorough, detailed and clear statement of the troubles encountered in the management of accumulators, due to short circuits, sediment, worn plates, lack of care, impurities in the electrolyte, sulphating, lack of ventilation, and every other possible cause and told in simple and forcible language how to deal with each; and closed as he began, with the three essential points: Restore the cell mechanically renew the electrolyte if its purity is questioned, charge to a maximum In many cases the storing charge is all that will be found necessary

There was no discussion on this paper, the general opinion being that the author had treated his subject exhaustively. Following this, Mr. Yocum (P. & R.), for the committee on storage batteries, presented a printed report consisting of a carefully prepared and detailed description of the storage battery, with rules for installation and care. One of the rules proposed was that every two weeks storage batteries should be overcharged for about one hour. This provoked discussion, as some batteries in places not conveniently reached and not much used are overcharged far less frequently than this. Mr. Stevens (A., T. & S. F.) overcharges his batteries every sixth charge, no attention being paid to the number of weeks elapsed. The prevailing opinion was that a rule like this—for overcharging on one of a given number of occasions—would be satisfactory, and that a time limit was not necessary.

Mr. Ames (N. Y. C. & H. R.), for the committee on rubber covered wire, reported that his committee had been divided into sub-committees and that certain changes in the specifications had been drafted. The committee is going to give hearings to the wire makers. A report on copper clad wire has been drafted.

At the afternoon session the secretary announced the sudden death of Walter G. Berg, President of the American Railway Engineering and Maintenance of Way Association, and the meeting passed resolutions of sorrow and esteem and sent a message of sympathy to Mr. Berg's family.

Block Signaling Under the Supervision of the Train Despatcher.*

The A. B. C. Rules on the Northern Pacific have passed the experimental stage. Their value is no longer a matter of speculation. Apparently they have come to stay. They are, without doubt, superior to any single track system of rules and orders yet devised. They are now used on 63 miles of track, from Spokane to Ritzville. On this territory there are 15 telegraph offices and three blind sidings. It is all main line and handles a traffic so heavy that with the ordinary system of train orders it was found impossible to keep trains moving.

With the A. B. C. system no train orders are issued and there are no time-table schedules except for information to the public that passenger trains may be expected at certain times. A train obtaining a clear signal at a telegraph office and obtaining a clearance card from the operator has absolute right to the next telegraph station. There it receives further instruction by means of a three-position semaphore either to stop and wait, to take siding or to proceed to the next station. Clearance cards are delivered to conductor and engineman by means of hoops and no reduction of speed is necessary.

Four months' experience has shown surprisingly satisfactory results. It is difficult to arrive at an exact statement of increase of efficiency, but a comparison of statistics for one month with that of the corresponding period a year previous shows that the average speed of all freight trains in passing over this portion of the track was 11 miles an hour, as compared with 8.6 miles an hour the previous year. This includes all delays and also includes the movement of two way freights. Omitting the locals the record shows an average of 14 miles an hour. * * * The success of the venture is attributed to the hearty co-operation of the despatchers, trainmen and operators.

With the A. B. C. system three men must act simultaneously with each other. No move can be authorized and no signal can be cleared unless the three give their consent. The operator who is to clear the train first examines his own block record, and if the track is clear asks the despatcher for a clearance. The despatcher looks at his train sheet and if found proper issues the necessary authority. The operator then asks permission of the operator at the next station to admit the train to the block. If the latter is satisfied that the track is clear he gives his consent. The duties of each man are so simple, compared with the handling of a hundred or more train orders every day, that from the mere standpoint of clearing the atmosphere surrounding these men the system must recommend itself.

*By H. A. Dalby, in the *Firemen's Magazine*.

Erie Terminal Improvements in Jersey City.

The improvements which are now being carried out by the Erie Railroad at its terminals in Jersey City have in view two principal objects. An ingenious rearrangement of tracks provides for complete separation of freight and passenger business and for the movement of passenger trains to and from the several branches without interference with each other. The plans have been under consideration of the executive and engineering departments for nine years and are now fully worked out and with a view to probable electrification in the near future. Though they involve operations of great magnitude, they are being executed without delay on account of the prevailing financial depression.

West Approach, Lackawanna and Erie Tunnels.

The work now under way naturally divides itself into two sections: The separation of the passenger and freight business and the segregation of the trains from and to the several branches.

All passengers and all freight destined for or originating at Jersey City or New York must now be taken through a double-track tunnel about 4,400 ft. long. The traffic is so great as to occupy both tracks almost continually during the whole 24 hours. The requirements of the road's large suburban business, especially during the rush hours of morning and evening, have seriously hampered the freight business. It has been the custom during morning hours to use both tracks for inbound movement and for a period of about two hours to allow no westbound movement of any kind. In the evening inbound passenger trains are run in this way. In order to increase the capacity of the tunnel some trains with two locomotives are sent out as one. These are separated beyond the tunnel without serious delay.

But the increasing suburban and freight traffic has aggravated increasingly the difficulties of the situation and delays have been frequent. To relieve this congestion a four-track open cut is being made through Bergen hill, on the completion of which its four tracks will be used by passenger trains exclusively and the present tunnel will be used by freight trains only.

Passenger traffic, largely suburban, comes from six different Erie lines. These are the main line, New Jersey & New York Railroad, Northern Railroad of New Jersey, New York & Greenwood Lake, Newark branch and New York, Susquehanna & Western, and are shown in the plan on page 670. The New York, Susquehanna & Western now uses, for passenger traffic, the Pennsylvania station in Jersey City.

At some distance west of Bergen hill these six lines converge into three main stems, each carrying the traffic of two branches. These are known as the Main line, the Newark branch and the Susquehanna line. The New Jersey & New York joins the main line 5.5 miles from the west end of the open cut. At a point 2.1 miles west, the Newark branch and Greenwood Lake line meet. The union of the New York, Susquehanna & Western with the Northern of New Jersey is to be three miles west of the cut.

All lines of traffic therefore now converge at the west end of the Bergen tunnel. The handling of trains involves cross-overs which necessarily cause interference with trains moving in the same direction, and particularly with trains moving in opposite directions. All tracks are on the same grade. This interference will be avoided by a new track lay-out which will obviate, by means of an arrangement known as a "flying junction," all interference between trains. By this arrangement the direction of traffic on the four tracks through the open cut may be varied to suit. It is proposed, during the morning hours, to assign a separate track to inbound trains from each of the three main stems, leaving the fourth track to handle the outbound traffic. In the evening, this arrangement will be reversed. In the middle of the day the normal distribution will be two tracks for inbound and two for outbound service.

The four tracks emerging from the open cut will, as shown on the map, pass under the four tracks of the Lackawanna and under Tonnele avenue. At this point they will diverge into six tracks, two for each group of lines, one inbound and one outbound. One arrangement of the switches will provide for all inbound movements in the morning and another for all outbound movements in the evening. Having set the switches for such movements the operator is thereafter concerned only with handling light traffic to or from the proper lines.

View of Open Cut from Hudson County Boulevard; Erie Terminal Improvements.

The tracks of the Susquehanna line, both eastbound and westbound, rise together from Tonnele avenue on a 1.15 per cent. grade on an embankment and by an overhead bridge across the westbound main line and westbound Newark branch. This line will continue on a viaduct over all the yard and freight tracks. The two tracks continue together thence to the point of separation of the Susquehanna and Northern of New Jersey lines. This will make it possible for the New York, Susquehanna & Western to use Erie terminal instead of the Pennsylvania terminal, as at present.

Of the main line tracks, the westbound track passes under the passenger and freight tracks of the Susquehanna line, and the eastbound track passes under the freight tracks of the Susquehanna. Thence both tracks rise on separate embankments and continue together and parallel on a bridge over the westbound Newark branch and the Newark branch freight connection. The two tracks then

Cable Conveyors for Handling Excavated Material.
Location of present tunnel shown by ventilator.

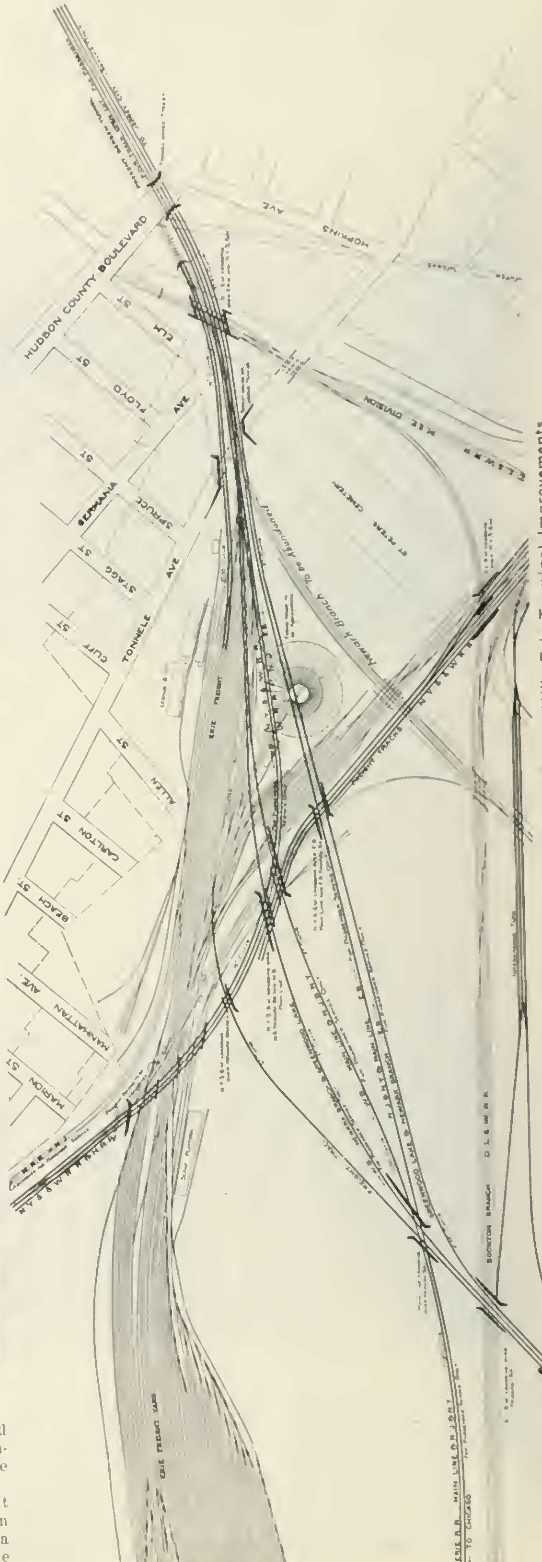
descend on an embankment and run parallel to the point of divergence of the main line and the New Jersey & New York.

The location of the Newark branch line and of the New York & Greenwood Lake line and their point of divergence will be changed. These lines now leave the main line just west of the tunnel and cross the Hackensack river, whence the Newark branch runs westerly, while the New York & Greenwood Lake follows the bend of the river and proceeds northwesterly. The old line of the New York & Greenwood Lake originally crossed the river at a point higher up. Under the rearrangement the tracks of the Newark

Anchor for Cable Conveyor.

branch and the New York & Greenwood Lake will be the same and will follow the old location of the latter road crossing the Hackensack river near Snake Hill on a new bridge now being built. The two lines will diverge just west of the bridge.

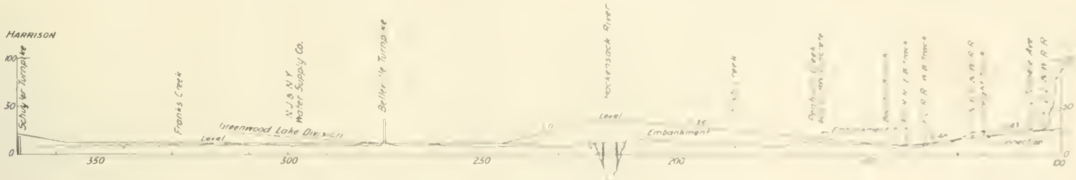
The westbound track of this line will pass under the freight and passenger tracks of the Susquehanna line and under the main line tracks. The eastbound track will pass under the Susquehanna freight tracks, joining the westbound and freight tracks of the Newark branch. All three will pass under the Boonton branch of



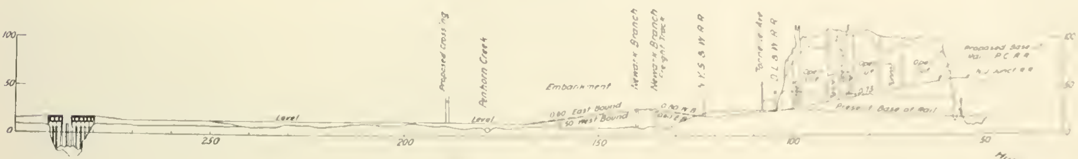
Plan of New Track Arrangement West of Bergen Hill; Erie Terminal Improvements.

the Lackawanna, and by a long curve reach the point of crossing the Hackensack. This rearrangement work is in progress to the extent that the necessary embankments are being built of the material taken from the open-cut excavation. There is required construction of 8.4 miles of new double-track line and partial abandonment of 8.7 miles of existing double-track line, most of which can be used in freight service. Just west of Bergen hill are the Hackensack meadows, where the necessary embankments will require some 530,000 cu. yds. of material, much of which will come from the open cut excavation.

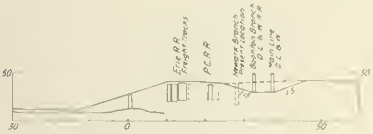
The foundations of the new bridge across the Hackensack river is under way, and it is expected that the steel work will be placed this summer. This bridge will consist of six plate girder deck spans, some 78 ft. and some 79 ft. long, and a draw span of 264 ft., making a total length between abutment backwall faces of 736 ft. The abutments and piers are concrete on pile foundations. The contractors for the substructure are McMullen & McDermott, New York; the superstructure will be fabricated and erected by the American Bridge Company.



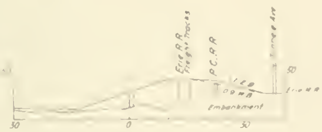
Newark Branch and Greenwood Lake Division.



Penhorn Creek Railroad.



N. Y. S. & W. Freight Tracks.



N. Y. S. & W. Connection With P. C. R. R.

General Plan of Bergen Hill Cut and Proposed Track Arrangement; Erie Terminal Improvements.

The new line through the cut follows the general direction of the existing tunnel 67 ft. to the south. The grade of the existing tunnel is slightly descending from west to east but the grade of the new line will be on an ascent of .73 per cent. from west to east, with a vertical curve of 700 ft. interposed at the east approach and a down-grade thence to the terminal station. The grade was determined with a view to reduce rock excavation to a minimum without too great interference with the track rearrangement west of the hill. Also on emerging from the western portal of its present tunnel the Erie passes immediately under the tracks of the Lackawanna and directly at the eastern portal over the tracks of the New Jersey Junction Railroad (West Shore). At the west side of the hill the portal of the Erie tunnel is almost directly below those of the Lackawanna tunnels; here the necessary room for the four additional tracks will be secured by excavation. This will necessitate the construction by the Lackawanna of a longer span than that now required, and it is understood that a lattice girder structure will replace the present plate girders. At the east side, to avoid the New Jersey Junction tracks, a four-track viaduct will be erected. The floor of the line through the cut was located at the east end about 40 ft. above that of the present tunnel, creating the grade previously referred to. The situation at the west portal of the tunnel is shown in one of the accompanying photographs.

The cut will be 60 ft. wide at the base and about 100 ft. at the top. The section of the cut at the west entrance will be 275 ft.; the next three in order are 700, 190 and 670 ft. respectively; while the east approach, from east of Palisade avenue to the first tunnel is 1,300 ft.; a total length of open cut of 3,135 ft. The whole length of the opening, however is nearly 4,400 ft., for, though known as an open cut, the opening through the hill includes four tunnels aggregating 1,310 ft., as follows: Under Hudson county boulevard, 190 ft.; under St. Paul's avenue and Bevan street, 285 ft.; under Summit avenue, 255 ft.; under Hoboken and Central avenues and intervening property, 580 ft. At the intersection of St. Paul's avenue and Bevan street it was originally planned to build bridges, but it was finally concluded that the tunnel construction would involve less difficulty than bridges at an intersection.

The proportions of material involved in the excavation are about: Rock, $4\frac{1}{2}$; earth, 1, the total estimated quantities being 113,890 cu. yds. earth excavation, and 198,550 cu. yds. rock, of which 79,050 cu. yds. are included in the four tunnels. The contract for the work is held by the Millard Construction Company, of Philadelphia.

The work has been made harder because part of the site of the cut was formerly residence property, and it has been necessary to keep streets open and unobstructed by even a contractor's transportation line. Certain parts of the work, also, are crossed by street railway lines. On account of the need for material for embankments west of the hill and the general nature of the location, it has been necessary to carry most of the excavated material for some distance in that direction, avoiding at the same time Hudson county boulevard, a busy thoroughfare, and the network of tracks on various levels at the west end.

One of the views herewith shows the excavation as it appears looking east from Hudson county boulevard. To avoid crossing this street, the narrow gage line shown is carried through a tunnel under the street and leads thence west to a stone-crushing plant near Tonnele avenue. Another line is carried on a trestle of wooden truss and plate girder spans over the Lackawanna tracks, thence out to the embankments on the meadows, about $1\frac{1}{2}$ miles.

In removing material from the cut the apparatus of the Balanced Cable Crane Company, New York, is used. The cables are supported from heavily counter-weighted shear legs on each side of the cut and from the conveyors the material is dumped into the cars on the track at the south side of the cut. One of the conveyors and one of the anchors for the conveyor line are shown herewith.

The crusher plant comprises one No. 10 and four No. 6 crushers. A belt conveyor carries the crushed stone to a point where it will be stored until required for use in tunnel linings and portals. The power and lighting plant of the contractors is at the same location. The main power plant includes an Atlas boiler and engine of 2,000 h.p. capacity for the crusher plant, and three Laidlaw-Dunn-Gordon compressors which supply power for about 65 drills. A generator forming a part of the same plant supplies current for lighting and for the operation of the conveyors.

This terminal improvement work has been under the general supervision of J. M. Graham, Vice-President of the engineering department, assisted by F. L. Stuart, Chief Engineer. Immediate supervision has been in charge of G. H. Burgess, formerly Engineer of Terminal Improvements, now Principal Assistant Engineer, assisted by A. L. Moorehead, Resident Engineer at Jersey City.

Railroad Regulation.*

BY ROBERT MATHER,
President of the Rock Island Company.

It is not because of the extent of Pittsburgh's commerce, vast as it is, nor because of its historic associations, absorbing as they are, that a discussion here of the subject of railroad regulation peculiarly appeals to me. It is rather because here, where a greater tonnage moves than anywhere else in the country, there is less of controversy between shipper and carrier than anywhere else in the land. I am told that here, in the country's nerve-center of traffic, out of all the multiplied millions of transactions between merchants and railroads, there has never been found a cause of complaint to present to the Interstate Commerce Commission. This does not mean that the railroads have never been wrong, or unreasonable, or exacting, or inefficient, or that the shipper has never demanded what he ought not to have received. I have no doubt that, in the weakness of human nature, many of these things, on both sides, have occurred. But there has been found a way in Pittsburgh to move an unparalleled tonnage in spite of all such discouragements and conflicts, with satisfaction to both shipper and carrier and without the intervention of courts or commissions. I hold that fact to be of great significance in these days of clamor for increased regulation of the business of transportation, and I deem it worthy of our serious thought.

I appreciate fully that, in this respect, no miracle has been wrought in Pittsburgh. I yield to you gentlemen of the Traffic Club high praise for the achievement I am extolling, but I still believe you to be an ordinary lot of men, uninspired except by the spirit of good sense. I understand that you proceed upon the very human and rational theory that the interests of producer, transporter and consumer are alike and mutually dependent, that without production there can be no transportation; and that unless the combined efforts of producer and transporter can lay down your product before the consumer upon a basis that the consumer can afford, your commercial activities are doomed to failure. So when you find that a consumer or a community that in view of all other commercial conditions ought to be taking your product, is not taking it, you look for the cause in the rates or practices of the railroad that carries your product to that place. If you find that a change in rates will secure the customer or the community, or that an improvement in train service or some addition to the carrier's facilities will move the traffic, instead of filing a complaint in Washington, you go to the railroads direct and ask them to help you, and at the same time to help themselves, by making the change that will produce the result. And so willingly have the railroads met and co-operated with you that, in the working out of the myriads of such problems that your teeming commerce has presented, you have not yet been denied a request the denial of which could give you ground for legal complaint.

I believe that this Pittsburgh plan of conference and co-operation between railroads and shippers should be given wider scope before we become finally wedded to the alternative plan of governmental compulsion. What you have done in conducting your manifold and stupendous dealings with the railroads, not only without clamor for additional restrictive laws against them, but without even invoking such laws as exist, can and ought to be done elsewhere. More than this, not only the carrier and the shipper, but the representatives of the regulating power of the government should meet on this platform of mutual confidence and co-operation. It is perfectly feasible in every commercial center like Pittsburgh for the railroad traffic associations to hold open meetings with the representatives of the shippers, to make up their docket of subjects to be acted upon not only from the requests of their members, but from the suggestions of their customers, and to place the docket in the hands of all entitled to attend a reasonable time in advance of the meeting. It is further not only practical, but in my judgment highly desirable that a member or a representative of the Interstate Commerce Commission should not only attend those meetings, but even preside over their deliberations and umpire their disputes, with possibly some provision for appeal to the Commission itself. Thus would we revert to the example of Washington when he and the colonial commissioners met in peace and not in strife to solve by mutual helpfulness the national problem of transportation. And thus the regulating power would get at first hand and through touch with the vital facts, its knowledge of the complicated commercial and social conditions which every contested rate question presents. It would be dealing with the parties at a time when, with open minds, both are striving to reach a point of mutual advantage, rather than when, as opposing parties to a complaint, each is trying to get the better of the other. Under such a plan of co-operation, perfectly consonant with provisions of existing law, the regulating power would become, as it ought to be, an instrument of conciliation, and the fruit of its exercise would be commercial peace. Through such an agency the difficulties in the way of uniform classification would be removed, a national and harmonious system of rates established, mystery taken out of traffic problems, and the path made smooth to the day when a stamp purchased from any carrier and affixed to a parcel of merchandise will carry the parcel to its destination, wherever it may be, as surely and unostentatiously as the postage stamp now performs its lowly task. I believe the railroads would welcome and support such a scheme of co-operative regulation of their rates and their traffic.

I fear that the public but dimly realize the willingness of the railroads to accept and to further the reforms in transportation methods that recent changes in our laws and in their administration have produced. The effective prohibition of rebates and of free transportation, and the elimination of the many forms of discriminations which expressed the subservience of the carriers to the large shippers mark the emancipation of the railroads from a slavery to abuses to which none of them would return. Most of them are not only willing but anxious to co-operate in any policy of reasonable regulation that will maintain their business on the higher plane of morality to which it has thus been forcibly lifted. And I think that spirit of co-operation should be reciprocated by the regulating power.

It continues, however, to be the claim of the railroads that they shall not be so regulated as to be prevented from earning interest on their bonds and reasonable dividends on their stocks. And they insist that not only they and their security-holders and their employees, but the nation at large is interested in their continuing ability to earn those charges and dividends. For, in the absence of such earnings, their securities become discredited, they are in consequence unable to provide the added mileage and increased facilities which the growing commerce of the country demands, and thus they fail to support not only their own normal quota of employees, but millions of others of our citizens who depend upon the many industries that the ordinary activities of our railroads

*From an address before the Traffic Club of Pittsburgh, April 3, 1908.

keep in operation. The dark days through which we are passing lend telling weight to this contention.

The insistence of the railroads upon this position involves no criticism of the policies of the President. Indeed, he admits that the railroads should earn their interest and charges, and concedes that, generally speaking, they are not over-capitalized. His policies, however, do not concern themselves, *primarily*, with the conservation of the revenues of the railroads. I understand his attitude in this respect to be expressed in the Scriptural injunction: "Seek ye *first* the Kingdom of God and his righteousness; and all these things shall be added unto you." The practice of the railroads in the past, it must be confessed, has been to reverse the order of this text; to seek first their revenues, and to await with patience the coming of the Kingdom of God. It is not surprising, therefore, that they take hold of the first part of the program of this new dispensation not only with awkwardness, but with some fear that the promise of the latter part may not be realized. It is a fact, however, that the first enforced steps taken by the railroads on the path of righteousness marked out for them by President Roosevelt have tended to increase rather than to diminish their revenues. The limitation of the pass privilege has clearly swollen the passenger receipts. The enforcement of the prohibition of rebates has not only turned our traffic men—and the traffic men of the shippers, too—from a life of daily crime, but has turned money into our treasuries. So clearly is this true that the chief political opponent of the President makes it his daily taunt that the only regulations the administration has actually enforced against the railroads have added to their revenues—as though that in itself were a crime to make the blood of the people boil.

But the statesmanship that rises no higher in its treatment of this great question than to see good in no regulation save that which takes money from the railroads, either lacks intelligence itself or assumes want of intelligence in the electorate to which it appeals. And I believe that the people could be led to see the essential identity of the prosperity of the country with that of the railroads, and the absolute dependence of the one upon the other, if only a voice could be found to raise that cry.

A program of rational regulation should oppose the regulation of railroad rates through the specious device of a physical valuation of railroad properties. The argument in favor of this suggestion is founded on the assertion that railroad rates are unreasonably high. If, it is argued, a value could be placed by governmental determination upon the physical properties owned by the railroads, that valuation would express the aggregate investment on which the earnings of the roads should yield a fair return, no matter what amount of outstanding securities represent the properties or what those securities cost to original or present holders. Wholesale reduction of rates could then be made to a basis just sufficient to yield this reduced return.

The premise of this argument is false and its conclusion immoral.

Railroad rates in this country are not unreasonably high. As shippers and consumers of freight we pay a transportation cost less than one-half that of Germany, barely more than one-third that of France, and but slightly in excess of one-fourth that of England and the other countries of Europe. Following are the figures for last year:

Country.	Freight cost, per ton mile, in cents.	Country.	Freight cost, per ton mile, in cents.
China	.10	Germany	.015
Japan	.05	France	.019
Russia	.022	England	.026
Italy	.024	United States	.0069
Austria	.0225		

Besides, the cost of transportation to the actual consumer is so slight a quantity as never to disturb his thoughts except when forced upon his attention as a campaign issue. A careful writer has computed the amount which freight charges actually add to the cost at Pittsburgh of necessary articles of wear and consumption, and I give you some of them:

A suit of clothes—three cents;
A pair of shoes—one and one half cents;
A man's hat—less than half a cent;
A lady's hat, trimmed for wear—less than one cent;
Muslin—one-twelfth of a cent per yard;
Flour—less than one fifth of a cent per pound;
Dressed meats—one fourth of a cent per pound;
Fish—one-third of a cent per pound;
Vegetables and canned goods—one sixth of a cent per pound.

We "plead the baby act" as a nation when we cry out against the alleged over-capitalization of our railroad corporations. The state and the nation had their opportunity, at the time of issue, to prevent the sale and consequent validation of these "watered" securities. Why was their issue not prevented? Because, as a people, we were willing to pay the price and to take the chance, in order to get the railroads built and the country developed. Well, the railroads were built and the country was developed because, by reason of this attitude of the people, the states and the nation, it was possible to sell the securities thus issued in the world's markets, and, through their sale, to obtain the money without which the railroads would not have been built and the country would not have been developed. In countless cases, under all sorts of circumstances, it has been attempted to invalidate railroad bonds on the claim that the corporation got inadequate consideration for their issue—that is, that they were issued in excess of the value of the property of the corporation. Against every such attempt our courts have held, with a unanimity that attests the essential righteousness of the holding, that all such securities, no matter how flagrantly over-issued, in the hands of holders for value are the enforceable obligations of the corporation and valid charges upon its properties and their earnings. The movement for a physical valuation of railroad properties seeks to accomplish, by administrative order, the invalidation of these securities which the courts deny. I repeat, such an effort is immoral.

Like all immoral acts, whether of nation or of individual, the movement for physical valuation of railroads is also foolish. The protection that the courts throw around the innocent holder of this class of securities lies, as an essential fact, at the very foundation of the credit of our corporate securities, at home and abroad. The threat that this protection may be nullified by an executive order fixing the ultimate capitalization upon which the railroads will be permitted to earn a return, without reference to the amount of outstanding stocks or bonds, menaces all of our railroad securities. In times like these, when it is generally accepted that the one thing our industrial situation needs is restoration of the confidence of the investing public, here and abroad, in our railroad securities, how foolish it would be, by the adoption of such a policy of regulation, to justify and to confirm the suspicion with which these securities are now regarded in the markets of the world!

To those regulations which seek to place under the control of officers of the government the administration of the internal affairs of the railroads, everyone interested not only in their prosperity, but in the prosperity and safety of the country, should protest. I do not include in this condemnation those regulations effectively designed to protect the safety of traveler and employee, or to secure to the latter fair compensation for injuries suffered through the negligence of his employer. In those questions the public has a direct interest which it may rightly safeguard. But when, under guise of accomplishing these public purposes, government takes hold of the operations of the railroads in such a way as to intrude its authority between the control of the employer and the obedience of the employee, it takes a step not only unjust to the railroads, but unsafe both to the traveling and shipping public and to the state. It is universal experience that nothing tends to good service in any line of employment so much as the realization that continuance in the employment with its consequent pay and hope of promotion, depends upon the character and loyalty of the service rendered.

It is, in my judgment, one of the regrettable effects of modern labor conditions—whatever may be the compensating benefits—that there has been largely substituted for this prop of self-reliance based on good service the all-supporting arm of the union. Intelligent and unprejudiced observers of the operations of our railroads trace a definite percentage of the increased operating costs of the past few years, of the decreased efficiency in service, of the increased casualties with their resulting growth of loss and damage to freight and loss of life and injury to persons, to the slackening influence of this very fact upon the hands and brains that load and make up and move the trains. If to this there be added the assurance to the employee that no longer his employer or his union, but a paternal government prescribes the hours and conditions of his employment, the nation itself will be the sufferer, not only in the diminution of its industrial efficiency, but in the deterioration of the fiber of its citizenship.

Nor should any governmental officer or body be given power to prescribe for the railroads schedules for the movement of perishable freight, or the conditions under which they shall interchange cars with their connections. I do not see how schedules for perishable freight can be made without making schedules for all other trains; and I do not think that government commissions or agents should make the time cards of the railroads. If control of these intricate details of operation and of the relations and practices that shall determine the interchange of cars at every connecting point on our 225,000 miles of railroad, be put in the hands of the commission, what remains of the work of operating the lines will be so unavoidably involved in these regulations that it might as well all be conducted from Washington. If it be answered that the purpose of these provisions is to prevent discriminations in these particulars, the sufficient reply is that existing law prohibits all discriminations, prescribes punishment therefor by fine and imprisonment, and provides pecuniary compensation for the party injured. If, as a cumulative and preventive remedy for these particular species of discrimination, it is necessary for government to take over the operation of the railroads in these particulars, then, for the preventive protection of others who may be injured by other kinds of discrimination, the government should operate the railroads *in toto*.

It is as a citizen, rather than as a railroad man, that I decry the growing tendency toward this kind of railroad regulation. Every such regulation loosens, by just so much, the control of the railroad manager over the property in his charge, and lessens, in the same degree, his accountability to its owners. For the resultant decrease in earnings and increase in expenses the responsibility is shifted from his shoulders to the regulating power—the government. Now, it is established by law and admitted in all discussion, that the owners of the property are entitled from its earnings to a fair return upon its value. There is, therefore, no escape, in logic or in morals, from the proposition that, to the extent that governmental interference with the owner's control of the operations of his railroad diminishes the ability of the property to return the fair profit to which, under the law, he is entitled, the government must make the owner whole. In other words, if the government is to undertake, in whole or in part, the operation of our railroads, a government guaranty must go with the act. And I don't think that is a good thing for the Republic, however soothing it might be to the railroads.

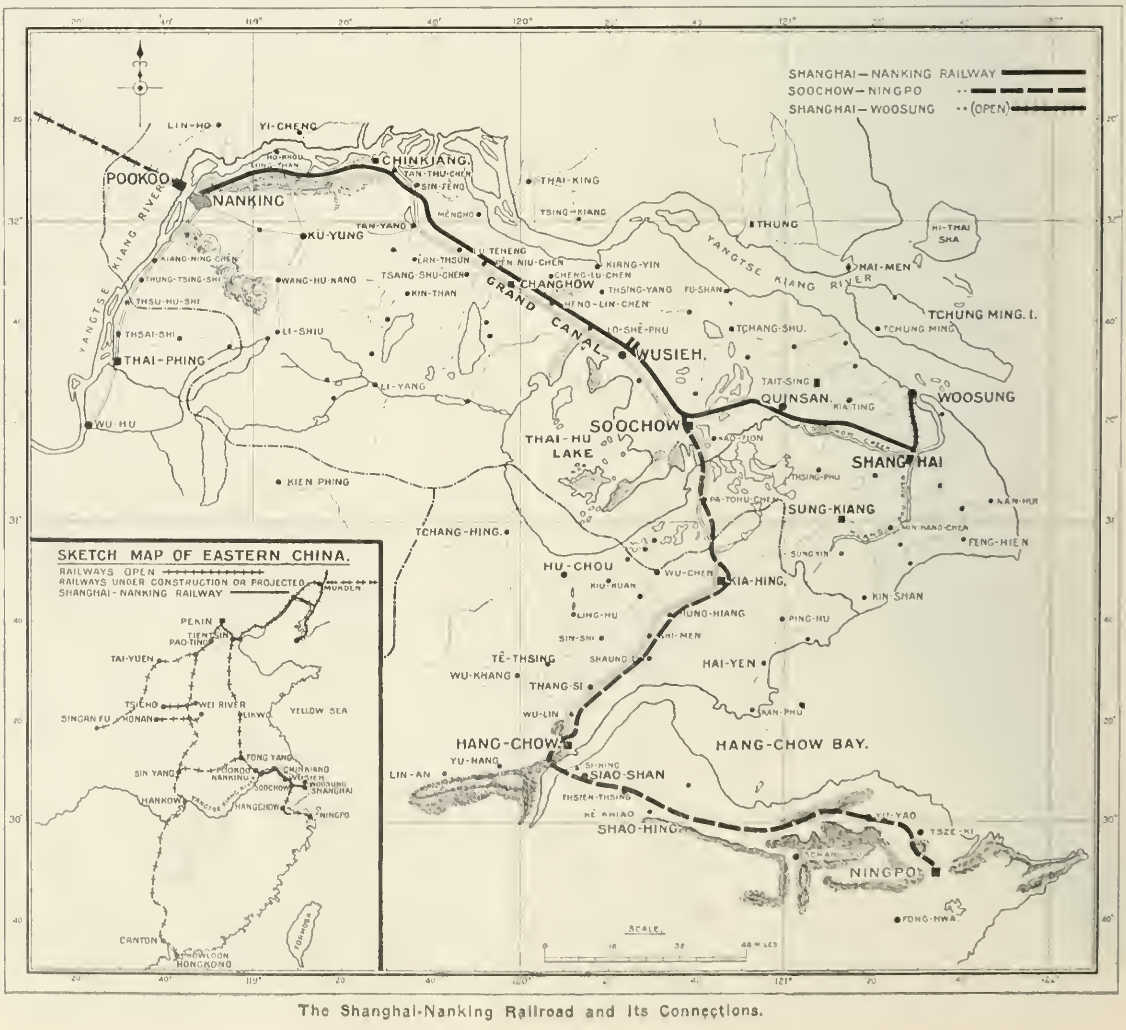
The Shanghai-Nanking Railroad.

The awakening of China after centuries of slumber is perhaps better illustrated by the rapid construction of railroads than by any other evidences of modern civilization. It is only within the lifetime of the present generation that the first line was built—that from Shanghai to Woosung—and destroyed, for a frightened Chinese mob uprooted the rails and threw them with the rolling stock into the sea. Not only, however, has this short 10-mile line been long ago restored, but a very considerable mileage has been built in various parts of the country, and a large addition to this is now in hand. Among these lines is the important connection of the Chinese Imperial lines from Shanghai to Nanking. Preliminary

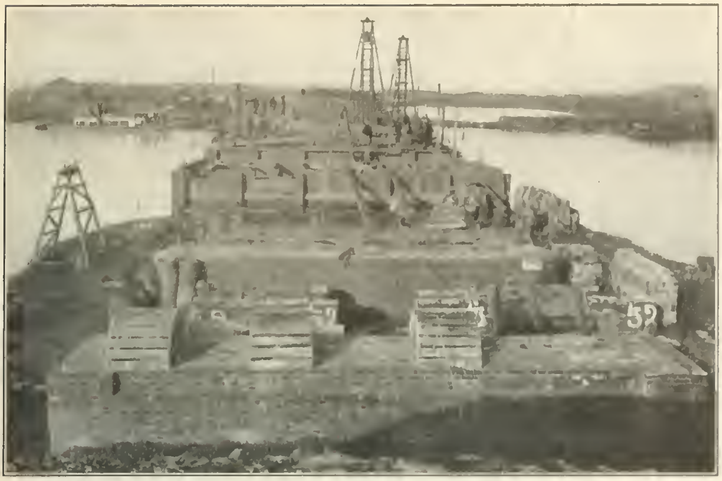
Small Bridge Near Soochow.

agreements were made some years ago by British capital and British engineers to build this line, and four others, the Tien-tsin-Yang-tsze, the Lin-Kwai-Quan-Sinyang, the Su-chan Hang-chau-Ningpo, and the Canton-Hongkong lines. It was not, however, till 1903 that a definite agreement was signed enabling the Shanghai-Nanking line to be started. Its total length is about 200 miles, of which 150 miles from the Shanghai end has been opened for traffic, while the remainder is expected to be finished in July or August next.

The route follows, as much as possible, the natural and artificial waterways, these and their tributaries forming valuable feeders to the railroad. Starting from Shanghai, the line follows the bank of



The Shanghai-Nanking Railroad and Its Connections.



Quinsan Viaduct; Shanghai-Nanking Railroad.

the Su-chan creek, and then that of the Grand canal, up to the important town of Chinkiang on the Yangtse-Kiang river. Following the south bank of this, one of the great rivers of China, Nanking is reached. The line stops here, leaving the river unbridged, the Pookoo terminus of the projected Tien-tsin line being at the opposite shore. The river is not only deep and wide at this point, but its bed is very unsuitable for bridge foundations unless expensive work is done. This important break in the connection between Shanghai and Ningpo and the capital Pekin will have to be dealt with by means of a steam ferry.

The location of the Shanghai-Nanking line, crossing so many waterways with a headway sufficient for sailing junks has entailed a great deal of expenditure on bridge work. On the 57 miles between Shanghai and Su-chan where the canal is reached, there are 111 bridges, and 60 between there and Wusich, which is only 28 miles further, while the Grand Canal is to be crossed by a bridge of three 60-ft. girders near Chinkiang. The country is easy for construction to Wusich, where it becomes undulating, and after Chinkiang is passed, it is fairly mountainous. The only tunnel, which is 435 yards long, is on this portion, and from thence to Nanking

Building a Cofferdam; Shanghai-Nanking Railroad.

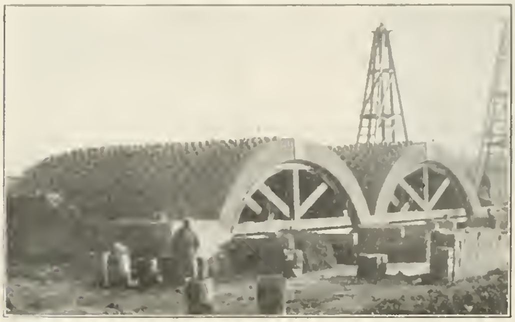
Bridge Arches Under Construction South of Soochow.

Bridging the Grand Canal.

the works are fairly heavy, there being many high fills and deep cuts in the Yangtsze valley. The rails, 851 lbs. to the yard on Jarrah (Australian) ties, are laid for a single track, though the fills and bridges from Shanghai to Su-chan have been built for double track, the road being a first class one, designed for high speeds and heavy freight, while the steepest grade is only 0.66 per cent. The gage is 4 ft. 8½ in.

The passenger locomotives have been supplied by Messrs. Robert Stephenson & Co., of Newcastle-on-Tyne, England, and the freight locomotives by the North British Locomotive Co. The rest of the rolling stock was built by the Metropolitan Amalgamated Railway Carriage & Wagon Co.

The Shanghai-Woosung Railroad, to whose tumultuous infancy we have already alluded, has been absorbed and partly rebuilt by the Shanghai-Nanking branch of the Imperial Railways, and at Woosung completely equipped railroad shops have been erected for the manufacture of rolling stock and for locomotive repairs. These shops are driven and lighted by electricity. The estimate for the line, including the cost of land, is $38,400 per mile. The district is one of the most populous in China, particularly between Shanghai and Su-chan, so that it is expected that this portion of the line will be double-tracked at an early date. The provinces of the Yangtsze valley are the chief centers of the tea, cotton and silk industries, and are the richest and most productive in China, being thickly peopled by a wealthy and industrious population. The length of time occupied by passengers in traveling from Shanghai up to Nanking by steamer is about 28 hours, while that by rail will be reduced to eight hours, and the time in conveyance of freight will be reduced in a still greater degree. Deep water wharfage exists, and is capable of extension, at Woosung, and there are a number of projected railroads with which the new line will be ultimately connected, leading to Pekin on the north, and Hankow, Canton and Ningpo on the west and south. The railroad will be operated by a board of five commissioners, of whom three, including the engineer in chief, will be British, and the remaining two, Chinese. The consulting engineers to the railroad are Sir John Wolfe Barry and Arthur J. Barry, London.



Bridge Arches Under Construction North of Soochow.

We are indebted to the courtesy of the *Far Eastern Review* for the illustrations shown herewith.

A Compact Train Sheet for a Heavy Division.*

On the Northern Pacific the card system has been applied to the despatchers' train sheet. The large and often cumbersome sheet on which the records of train movements are kept has been abandoned and the despatcher's table is equipped with fixtures which admit of the use of the card system in its place. In the center of the desk there is, in permanent form, a column showing the names of the stations, with such other information as usually appears on the central column of the train sheet. On either side of the center, corresponding with the columns for train records, are grooves or slots into which slide the cards, each one to contain the record of a train. These cards are 18 in. long and 1¼ in. wide, and are arranged to contain all information concerning the train, such as delays, tonnage, etc. They fit securely into the spaces and are held so that each line on the card is opposite the name of the station to which it corresponds. Thus it answers exactly the purpose of the printed sheet. When the train completes its run the card containing its record is removed and filed away and the space may be used for another.

The advantages of the card system over the train sheet are many. The despatcher has no records before him except those of trains actually on the road. He may have all trains as near as possible to the central column instead of at a remote corner of the sheet. He is relieved of the inconvenience of handling two sheets at one time, a condition which always exists for several hours after midnight and sometimes continues until noon. The superintendent or other person wishing to examine the records of trains which have passed over the road, can get them from the file without interfering with the despatcher or his work.

Serious results have happened from a despatcher connecting a time with the wrong station on account of its being so far away from the station column. They have been known, also, to overlook a train still on the road, because of the many represented on the sheet with only here and there one still in existence. With the card system all are on the road and all near the center of the table. There is, in fact, a list of the stations printed on each of the slips, so that separation of station and time is impossible.

*From the *Firemen's Magazine*.

Car Surpluses and Shortages, April 29.

The Committee on Car Efficiency of the American Railway Association, Arthur Hale, Chairman, has issued Bulletin No. 21-B, giving a summary of surpluses and shortages of freight cars by groups from October 30 to April 29. The total of surplus cars reaches 413,605 in this report, being an increase of 37,835 cars over the report for April 15. The largest increase is in coal cars, although there is a marked increase in box, and slight increases in flat and miscellaneous cars. The box car surplus, however, is still 1,693 cars below the maximum for this class, which was reached on January 8. The increase is heaviest in Group 2 (Eastern), although Groups 3 (Middle), 5 (Southern) and 6 (Northwestern), also report quite large increases. The increases are slight in Groups 8 (Middle Western), 10 (Pacific) and 11 (Canadian), while Groups 1 (New England), 4 (North Atlantic) and 9 (Southwestern), show some improvement, the greatest gain appearing in the New England Group, which reports fewer idle cars than at any time since March 1.

The summary for 159 roads is shown in the double column table.

SURPLUSES AND SHORTAGES BI-WEEKLY, FROM OCTOBER 30, 1907, TO APRIL 29, 1908, INCLUSIVE.

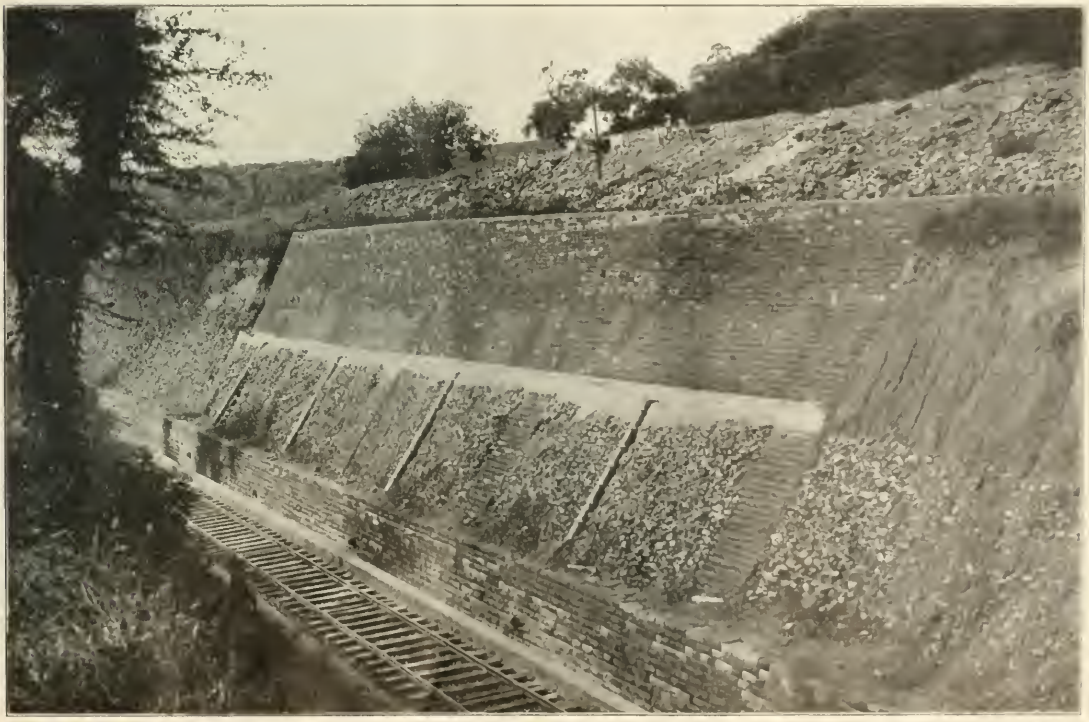
		Surpluses.					Shortages.				
	Number of roads.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
April 29, 1908	159	147,971	24,350	186,742	54,542	413,605	145	42	16	64	267
April 15, 1908	153	138,065	23,811	160,205	53,689	375,770	83	7	1	55	146
April 1, 1908	158	111,748	24,774	120,669	50,316	307,507	319	117	8	84	528
March 18, 1908	160	103,509	25,122	119,205	49,206	297,042	533	151	250	73	1,007
March 4, 1908	162	103,905	27,232	139,223	44,632	314,992	943	19	600	57	1,619
February 19, 1908	161	113,776	30,088	134,217	44,432	322,513	697	141	249	162	1,249
February 5, 1908	158	112,046	30,312	156,634	44,936	343,928	737	281	15	67	1,100
January 22, 1908	161	124,622	27,328	142,338	48,292	342,580	392	132	79	135	738
December 24, 1907	158	87,714	14,740	64,556	42,300	209,310	187	81	191	265	724
November 27, 1907	160	16,246	3,645	10,028	10,429	40,348	11,908	868	2,964	2,224	17,964
October 30, 1907	161	786	600	1,285	1,275	3,946	61,592	3,546	15,987	9,632	90,757

Protecting Wet Cuts in India.

The drainage and masonry protection of cuts through water-bearing ground is carried out on a much more enduring and expensive scale in Europe and some European possessions than in the United States. The photographs show the summit cut in the Durrah hills on the Nagda-Muttra State Railway, India. The maximum depth of the cut is 38 ft. It is through boulder-clay or treacherous yellow clay, mingled with black bottom soil. When it was first excavated, water ran through it for some months in a stream, owing to percolation from the neighboring hills, and a man would sink up to his waist in the slushy soil. Continuous drains 3 ft. x 3 ft., a mile long, have been made through the whole cut, with a ballast wall on one side and a massive revetment wall of dry stone on the other side. Both the revetment walls and ballast walls are amply provided with weep-holes, and are founded on a bed of concrete.

Between the ballast walls there is a deep layer of dry stone

Retaining Walls and Road Bed.



Revetment Wall and Drains in Durrah Hill Cut; Nagda-Muttra State Railway.

below the ballast. Where the soil is most treacherous, a concrete drain has been built half-way up the slope to interrupt the rainfall. Above the drain the soil is revetted with dry stone up to the top of the slope. Below the drain are dry stone counterforts and earthenware pipes carrying the rainfall into the solid masonry drains at foundation level.

We are indebted to *Indian Engineering* for the photographs and the details mentioned.

Transportation on the Great Lakes.*

BY WALTER THAYER,
Eastern Manager, Erie & Western Transportation Company, Philadelphia.

The prominence of the Panama Canal in the affairs of the nation has naturally resulted in greater interest in transportation by inland waterways. This is especially noticeable in the wider interest now being taken in our greatest waterways, the Northern Lakes, and in the conditions under which freight is handled on them.

Although the Great Lakes were originally individually navigable for boats of considerable size, the rapids at Sault Ste. Marie, and the narrow and shallow stretches of water connecting Lake Erie with Lake Huron, and Lake Huron with Lake Superior, through which the greatest volume of tonnage must pass, presented many obstacles to the passage of vessels. An increasing traffic transported, and a consequent decreasing cost of transportation, have accompanied the clearing of these impediments to navigation. The principal natural obstacles have been, and still are, the shallow water over the Lime Kiln Crossing, just south of Detroit, over the St. Clair flats not far above the same place, at the Straits of Mackinac, and, most important of all, the Sault Ste. Marie Rapids at the entrance to Lake Superior. The deepening by the United States Government of the first three stretches, and the building by the United States and Canada of the largest locks in the world at Sault Ste. Marie, where there is a total fall of about eighteen feet in three-quarters of a mile, now permit the passage of practically all the immense tonnage to and from Lake Superior. These improvements have perhaps yielded greater returns to this country than many times the same amount invested in any other character of public improvements.

The aim of this paper is to describe in a general way the origin, character and method of handling the tonnage of the Great Lakes.

TRAFFIC AND VESSEL TONNAGE ON THE GREAT LAKES.

Contrary to the general understanding this traffic consists of relatively few commodities, most of which are products of the mines, the forests and the grain fields, surrounding or lying beyond the Great Lakes. Iron ore and coal constitute the bulk of the tonnage.

The tonnage of ships and traffic passing the locks at Sault Ste. Marie gives the clearest index of the business handled on the lakes, though these figures do not include the tonnage passing between Lake Michigan and the East. Over one-third of the tonnage of ships under the American flag and half the steamers of 1,000 tons and upwards are on the Great Lakes, and last year the total tonnage of freight east and westbound passing over the Lime Kiln Crossing below Detroit, which would include the business of both Lake Michigan and Lake Superior to and from Lake Erie, amounted to over 70,000,000 tons in a season of 230 days. Over 25,000 vessels passed Detroit, an average of one ship every thirteen minutes, and 200 tons of freight per minute for the season. These figures exceed those of any navigable stream in the world. The records taken at the Sault Ste. Marie locks, indicate in a general way the character of this tonnage and the relative importance of the commodities of which it is composed. Last year the total freight through the Soo amounted to 51,751,080 tons, carried in 22,155 boats. It was valued at $540,000,000, and was divided in the proportion about 80 per cent. eastbound and about 20 per cent. westbound. The principal eastbound business was:

Iron ore, 35,357,042 tons; wheat, 84,271,358 bushels; other grain, 54,341,155 bushels; flour, 6,495,350 barrels; copper, 107,633 tons.

Westbound:

Bituminous coal, 7,728,255 tons; anthracite coal, 1,011,275 tons; general merchandise, not comparatively heavy, but of relatively large value.

The larger part of the total is iron ore and coal, and the eastbound movement overshadows the westbound in tonnage, and also in what is known as "bulk" freight; *i. e.*, ore, coal and grain as distinguished from package freight or general merchandise. The relation between the tonnage of the several classes of freight does not correspond with the ratios of the values. In 1905 it was estimated that of the total value of traffic through the Soo during that year, the value of the iron ore and products of iron represented 27 per cent.; cereals, 28 per cent.; copper, 7 per cent.; coal, both anthracite and bituminous, 5 per cent.; lumber, 4 per cent., and all other products, 28 per cent.

*Reprinted by permission, from a paper in the *Annals of the American Academy of Political and Social Science*.

The total number of vessels on the Great Lakes early in 1907, with their gross registered tonnage, was as follows:

	No.	Gross tonnage
Sailing vessels	519	299,136
Steam vessels	1,844	1,811,438
Canal boats	480	90,599
Barges	209	73,259
Total	3,052	2,274,432

Deducting the canal boats, the number of vessels actually engaged in lake traffic was 2,572, and the gross tonnage 2,183,833. The percentage of sailing vessels is decreasing year by year, most of those now running are on Lake Michigan. In 1895 sailing vessels carried 30 per cent. of the tonnage passing the Soo, in 1905 only 15 per cent. The craft on the lakes now range from the old boats of small size to the modern ore carriers made of steel, the latest of which are 605 feet over all, with sixty-foot beam, a depth of thirty-two feet, and a capacity of 13,000 tons. The barges referred to above are generally towed by steamers of the same line.

IRON ORE TRAFFIC.

The principal iron mining ranges are the Mesaba, Vermilion, Gogebic, Marquette and Menominee ranges, located in the territory adjacent to the western end of Lake Superior and in the upper peninsula of Michigan. The principal ore docks are located at Duluth, Superior, Two Harbors, Escanaba and Marquette. The mines, as a rule, are located from ten to sixty miles back from the water, and the ore is hauled in specially constructed cars to the docks. These docks are so constructed that the cars from the mines are run out on them. The hoppers in the bottom of the cars are let down, and ore is discharged by gravity into pockets from the bottom of which iron chutes lead to the vessel lying alongside the dock. Through the hatches of the vessel the ore is chuted by gravity into the hold at as many points as there are hatches. In this way very little manual labor is necessary. A cargo of 9,277 tons of ore has been loaded into the steamer "E. J. Earling" at Mesaba Dock No. 4, at Duluth, in seventy minutes or on an average of 7,288 tons per hour.

Just here we have the keynote of the transportation service on the lakes, which is to secure for each vessel the least possible delay at port of loading or of discharge and consequently the greatest number of round trips possible in a season. The average number of trips that a modern vessel is able to make from the head of Lake Superior to Lake Erie is usually estimated at twenty per season, although with good dispatch at terminals some boats may make twenty-five, and even more. Every additional trip in a season reduces the average cost of transportation, and the entire carrying trade is ever pressing to reduce delay, whether at terminals or en route. To the genius displayed in devising plans to accomplish this result is due in no small degree the record the lakes have made in affording the cheapest transportation in the world.

Based on records at the Soo, in 1905, the average distance that freight was carried was 833.3 miles. The average cost was .85 mill per ton per mile, as against an estimated average cost for rail handling of about four mills per ton per mile. Ingenuity in effecting dispatch of boats made it possible for the steamer "W. E. Corey" to make thirty trips between Duluth and Lake Erie ports during the season of 1906, and in that time to carry the enormous total of 302,000 tons of iron ore.

The chief iron ore ranges, and to a large extent the vessels engaged in this trade, are owned by the larger iron and steel companies of the United States. The United States Steel Corporation, through the Pittsburg Steamship Company, owns the largest fleet on the lakes, 101 vessels with an aggregate tonnage of 368,165 tons gross register, or about 16 per cent cent. of the total gross tonnage on the lakes. Next to them is the Gilchrist Transportation Company, with sixty-two vessels of 190,890 tons gross register; the latter, however, is not allied directly with the iron and steel interests. The chief steel companies, in addition to the United States Steel Corporation, now having ships on the lakes to carry their ore are the Lackawanna Steel Company, the Jones and Laughlin Steel Company, the Cambria Steel Company, the Tonawanda Iron and Steel Company.

The largest steamer on the lakes is the "Wm. B. Kerr," having a capacity of 14,000 tons of iron ore. She is the first of three sister boats, and there are others capable of handling from ten to twelve thousand tons.

The record cargo of ore is held by the steamer "Henry H. Rogers" from Escanaba to South Chicago, 13,333 tons, and over and over again this year greater cargoes of freight have been carried down the lakes than have ever gone out of the harbor of New York. The depth of water in New York harbor does not permit the largest ocean steamers to load to their full capacity, and the largest vessels are the fast passenger ships that carry but little freight.

The rate at which ore is carried on the lakes is practically fixed by the Pittsburg Steamship Company, owned by the United States Steel Corporation, which decides what rates these boats will carry for, and the price they will give others to carry the balance of the ore used by them. In 1907 it was 75 cents per ton from the head of Lake Superior to the ore dock on Lake Erie, and from Marquette 70 cents per ton; while from Escanaba to Lake Erie ports the charge was 60 cents per ton, and from Escanaba to Chicago, a haul entirely in Lake Michigan, only 35 cents per ton.

In 1906 the charge for unloading iron ore was 20 cents per ton, while vessels that required trimming in order to adjust their cargo, paid about 3 cents per ton for that service. A cargo of ore loaded in a modern ore carrier, however, does not require to be trimmed.

The docks for the discharge of ore, unless such ore is for some iron industry located directly on one of the lakes, are generally owned and operated by the railroads leading south and east from Lake Erie to the furnaces of Pittsburg and the Mahoning and Shenango Valleys, a distance of approximately 75 to 150 miles, or even farther, to the furnaces in Eastern Pennsylvania, where the ore is converted into iron and steel by the use of limestone and coke. Were it not for the necessity of using these articles in the manufacture of iron, and for the fact that iron ore, on account of the cheapness of lake transportation, is more economically brought to the coke, rather than the coke to the ore, the center of these industries might be in the neighborhood of Duluth rather than at Pittsburg; and the tonnage handled on the lakes might be comparatively insignificant.

The docks are located at Ashtabula, Cleveland, Conneaut, Buffalo, Lorain, Erie, Toledo, etc., all on the south shore of Lake Erie, and handle about 86 per cent. of all the iron ore carried on the lakes. The above points rank in importance about in the order named, the largest number of tons handled in 1906 being at Ashtabula, with a total of 6,833,852 tons. The amount of ore received at Lake Erie ports was, in 1906, 32,076,757 tons, as compared with only 17,014,076 tons in 1901, a fact which furnishes a clear idea of the increase in the iron ore trade during the past few years. The difference between the total output and the receipts at Lake Erie ports is understood to be in the ore for furnaces at Detroit and South Chicago. Practically the entire success of a dock for receiving ore from a vessel, like a dock for loading vessels, depends on the ability to unload quickly and cheaply, and place in cars the tonnage that is daily brought alongside the docks by the gigantic ore carriers so constructed as to permit the hoisting and dumping by the most modern appliances, both electric and otherwise, of the greatest number of tons per hour in order to accomplish the quickest possible release of the vessel and effect the maximum saving in the cost of operation.

The efficiency of the machinery for unloading is shown by the record of the "George W. Perkins," 10,346 tons having been taken off in four hours and ten minutes, or at an average rate of 2,582 tons per hour. Moreover, this record is being approximated in the unloading of all similar boats, and it is the ambition of the managers of every dock to hold the unloading record. The records are being lowered year by year, and often more than once in a season.

GRAIN TRAFFIC.

Next in importance to the management of the ore traffic is the handling of grain. This trade is participated in by all kinds and sizes of vessels, and consequently there is more fluctuation in grain rates than in those for any other commodity. Grain originates beyond the western lake ports and is brought there by rail and placed in elevators. From the elevators it is shipped by vessel, generally to the ports of Lake Erie, the cost by lake being less than by rail. At the western lake ports elevators in connection with and often owned by the prominent eastern rail lines, receive the grain, and in due course load it into cars for export via eastern seaboard cities or for transportation to interior points. The rates per bushel for carrying grain depend absolutely on the number of boats available for the trade. Charters for the season, such as are made for ore in large quantities, are not characteristic of the grain-carrying trade. When grain is wanted for any particular vessel the rate depends on the supply of or demand for vessels; or, in other words, upon what happens to be the immediate condition or the number of boats available at the time, or upon the desire of the shipper for immediate forwarding. The rate thus made per bushel for forwarding say, to Buffalo, is known as the "going rate," and is a matter of public information on the various boards of trade at the points of shipment and remains the standard until altered by a change in the conditions above mentioned. The average rate on wheat from Chicago to Buffalo was 1.7 cents per bushel in 1906, and from Duluth to Buffalo 2.2 cents per bushel. Grain is the only commodity that is occasionally handled by what are known as the package freight lines, which are engaged in through traffic in connection with railroad lines. The boats of these package freight lines as a rule take grain only when it is necessary or expedient to fill out their freight capacity. At such times they bid for grain in competition with the bulk carriers, none of it handled by the package lines, however, is taken on through rates to interior eastern points, but only to eastern lake port elevators, from which the grain is reforwarded to ultimate destination.

In loading grain from the elevators it is spouted into the holds of the vessels through the hatches, and unloaded by placing an elevator "leg" through the hatches into the vessel. This so-called leg is a contrivance on which is arranged an endless chain of buckets which scoop the grain out of the boat, carrying it up and into the elevator.

The largest grain cargo in number of bushels carried but not in tons, was 417,300 bushels of oats brought into Buffalo by the "Mary C. Elphicke."

The rates on which grain is carried by railroad from the eastern port elevator, if it goes to points east, are known as "At the East rates." This being a term used to indicate that the rate includes the cost of elevation from the vessel at eastern lake port and subsequent loading to cars, which service the ordinary rail rate would not include.

LUMBER.

Lumber is the other item of eastbound bulk freight on the lakes. The largest individual, although small, fleet in this trade is that of the Hines Lumber Company of Chicago. The rates this year have averaged, from Lake Superior to Lake Erie ports $2.25 per thousand feet, and from Lake Michigan to Lake Erie ports $2 per thousand feet. These rates are made by an association, with which practically all the lumber carriers are identified. The trade, however, seems to be falling off.

WESTBOUND COAL TONNAGE.

Coal is practically the only article handled in bulk westbound. This business is peculiar in its method of handling, for coal is the only westbound cargo available for ore carriers, and were it not for coal these ore carriers would go light westbound, as they often do, in order that they may secure as many loads of ore as possible in a season. The result of this is that coal is taken west at rates that would otherwise be impossible. It is hard to estimate the value of this to the people of the Northwest, to whom the coal is a necessity. Coal is handled in and out of the ship without charge to the vessel, and last year the hard coal rate averaged, from Buffalo to Chicago 46 cents and to Duluth 35 cents per ton. Soft coal averaged from Ohio ports to Chicago 46 cents and to Duluth 35 cents per ton. As practically all the ore boats are bound to Lake Superior the rates thence are lowest. Many of the big eastern coal companies have their own facilities and arrangements for handling coal at western lake ports.

PACKAGE FREIGHT SERVICE.

We may now consider the relation of the package freight lines to the traffic of the lakes. These lines are engaged in carrying all kinds of merchandise in such packages and of such size as can be transferred from cars to boats. Practically all passenger steamers on the lakes also carry package freight, although all package freight lines do not carry passengers, and in fact the big package lines, in operation between eastern and western lake ports, with perhaps few exceptions, do not carry any passengers, being made up exclusively of package freight boats. The most modern of these carry about 5,000 tons, and, as a rule, all of this is loaded between decks or in the hold reached through openings in the decks, the freight being handled in and out through gangways in the sides of the boat and up and down gangplanks from and to the docks.

There are several package freight lines, but they may be divided into two large classes:

First.—Those that make short runs between nearby ports or ports on the same lake, or are engaged in carrying freight, generally not of considerable volume, for local delivery at the ports at which they call.

Second.—Those lines that have through rates and prorating arrangements with the larger eastern and western rail lines, with which they connect.

The lines in the first class, on account of the generally local aspect of their service and of the fact that they are not usually a link in a through transportation service, may be passed over without discussion, in order that fuller consideration may be given to the other and more important class of package freight lines.

Although the business carried between ports on the Great Lakes by these lines is considerable in quantity and value, their chief traffic is that turned over to them as intermediate carriers between the rail lines leading east to the western lake ports of Chicago, Milwaukee, Gladstone and Duluth, etc., and west to the eastern lake ports of Buffalo, Erie, Cleveland, Detroit, Port Huron, etc.—this business to be again turned over by the lake lines to rail connections at the end of their route. To illustrate by a concrete example: business for rail and lake shipment may be taken in New York by the Pennsylvania Railroad to Erie and delivered to its lake connection, the Erie and Western Transportation Company, which takes the freight by water to Duluth or Chicago, as the case may be, and again turns it over to connecting rail lines to be delivered by them to consignees at St. Paul or Minneapolis. The same service may be performed in the other direction from Minneapolis, for example, to New York.

As these lines all have their rail connections, they may in turn be subdivided into two classes, according to the efficiency of their service. Some of them have direct routes, east of the lakes, for example, to and from New York, in connection with the big trunk line roads, such as the Pennsylvania Railroad and the New York

Central, while others are dependent on a short water haul, like the National Despatch, which takes business by water from New York to New London, Conn., and there turns it over to the Central Vermont Railroad, which in turn has a long haul in connection with the Grand Trunk to Depot Harbor, Canada, where it is at last delivered to boats to be carried to Chicago and points beyond. Another route is via canal boat through the Erie Canal from New York to Buffalo (requiring from twelve to fourteen days on the canal), where the freight is turned over to lake lines for forwarding west.

RATES BY THE LAKE LINES.

As a result of the different services thus offered there are three kinds of rates via the lakes: (1) westbound, from New York City, known as standard lake rates; (2) differential lake rates, and (3) canal and lake rates. These three are represented by the following rates in cents per hundred pounds, on the various classes, New York to Chicago:

	1.	2.	3.	4.	5.	6.
Standard Lake	$0.62	$0.54	$0.41	$0.30	$0.25	$0.21
Differential Lake	.52	.46	.35	.26	.22	.19
Canal and Lake	42	.36	.29	.23	.21	.18

It will be seen how complicated must be the adjustment of rates by the various routes, and how greatly the charges must vary in accordance with the services performed, particularly when it is remembered that the service between these points is also performed by all-rail routes, differential rail routes, and by an ocean-and-rail route via Norfolk. These routes in turn have the following rates, first class, in cents per hundred pounds, New York to Chicago: all-rail, 75 cents; differential rail, 69 cents; ocean and rail, 65 cents.

During the season of open navigation a shipper in New York who wishes to forward a hundred-pound case of blankets to Chicago, has, among others, a choice of the following routes, in connection with each of which the charge would be in cents the amount mentioned; all-rail, 75 cents; differential rail, 69 cents; ocean and rail, 65 cents; standard lake, 62 cents; differential lake, 52 cents, and canal and lake, 42 cents.

Prominent among the commodities handled by the package lines, westbound, are sugar and cement. The eastbound business, however, is the heaviest and consists almost exclusively of flour, mill feed and copper, with occasional deck loads of shingles, and now and then grain if the vessels are unable to secure a full load of package freight.

OWNERSHIP AND RAIL CONNECTIONS OF LAKE LINES.

As between the standard and the differential lake lines, much the more important are the standard lake lines operating between Lake Erie and Lake Michigan or Lake Superior ports. These lines are, with the exception of the Soo line, generally owned and operated by the eastern trunk lines, as feeders at their eastern lake ports. The railroad-lake lines are:

	Operated To and From.	Owned by.
Erie & Western Transp. Co.*	Lake Michigan—Lake Superior.	Penn.
†The Western Transit Co.	Lake Michigan—Lake Superior.	N.Y. C. & H. R.
The Union Steamboat Line	Lake Michigan	Erie.
Mutual Transit Co.	Lake Superior	Lehigh Valley. D., L. & W. Erie. N. Y. C. & H. R.
Lackawanna Transptat'n Co.	Lake Michigan	D., L. & W.
Lehigh Valley Transp. Co.	Lake Michigan	Lehigh Valley.
Minneapolis, St Paul & Buffalo Steamship Co. (Soo Line)	Lake Michigan	Minn., St. Paul & Sault Ste. Marie.

*Anchor Line.
†The Rutland Transit Company, owned by the Rutland Railroad, runs from Ogdensburg, N. Y., to Chicago.—EDITOR.

None of these, except the Anchor Line, operates passenger steamers. Like the bulk freighters, every effort is made to accomplish as many trips in a season as possible, and the boats are consequently, with the exception of the passenger boats during the passenger season, not operated on any schedule, but are turned as rapidly as possible. To accomplish this large warehouses are maintained at eastern lake ports by these lines, in order that the cargoes of eastbound vessels may be immediately unloaded for subsequent shipment east. These warehouses are equipped with various devices to secure the greatest possible dispatch in the loading and unloading of boats, and in many cases separate houses are devoted to the east and westbound business. At the western lake ports the facilities for through business are provided by the delivering rail lines at whose terminals the package freight lines call for or deliver business routed in their care.

On account of the slower speed of handling and of the increased number of transfers incident to business shipped by rail and lake, as compared with all rail, the rates are lower via the lakes than via the all-rail routes. The present difference is illustrated by the 17½-cent rate per hundred pounds on flour from Chicago to New York, via lake and rail as compared with 19½ cents per hundred pounds all rail, and by the westbound rate of 23½ cents per hundred pounds, New York to Chicago, on sugar via rail and lake, as compared with 26 cents per hundred pounds all-rail. The difference between these figures, in each case, is known as a differential. It represents the amount under the all-rail rate charged by the standard lines, which experience and long custom has established as being considered the difference between the value of the two kinds of service. The retail prices of granulated sugar and flour, per hundred pounds, being $5.50 and $3.50 respectively, it will be seen what a comparatively small part the cost of transportation must play in the price of such commodities to the consumer.

It is difficult to explain the various rates in existence over the several routes between the East and West; but it should be noted that the service via the lakes requires a transfer, where none is necessary when shipments are all-rail, and that there has grown up a fixed relation between the rates all-rail and the rates rail and lake, based on relative speeds, and that when reductions or advances are made in all-rail rates, consequent reductions or advances follow in the rates rail and lake, either eastbound or westbound. These principles of adjustment are further carried out in changes in rates by the differential rail-and-lake lines, and the canal lines.

The various standard lake lines were primarily considered as feeders for their rail connections, and in order that other railroads not equipped with lake lines may not reap the advantage of the tonnage thus provided, through prorating arrangements have been made only between the lake lines and their rail owners, or such other railroads as the owners of the lake line think it profitable to connect with.

SUMMARY—IMPORTANCE OF SERVICE OF PACKAGE FREIGHT LINES.

The foregoing discussion shows that by far the largest part of the tonnage of the lakes consists of ore, coal, grain, etc., handled in bulk by vessels ready to go from port to port for the highest compensation they can secure for their services. On account of the great quantities handled, and the ease with which it is loaded and unloaded, and also on account of the fact that the government has provided a free way and free harbors, the rates for transportation on the lakes are so low as to make unfair a comparison of those rates with average charges per ton per mile via rail lines.

The bulk freight handled on the Great Lakes consists almost exclusively of raw materials which can be moved at such low rates as to exclude competition by all-rail routes. With the package freight business the situation is different and there is active rivalry between the rail and water lines. The charges for package freight made by rail and water lines must be approximately equal because the difference in costs of the services by competing routes is relatively small.

Although the tonnage of package freight handled on the Great Lakes is small as compared with the volume of bulk traffic, the service performed by the package freight steamers is highly important. The package freight lake lines assist their rail connections by adding to the volume and regularity of their traffic, and afford the shipping public the choice between various routes. The shorter and more expensive routes provide a quicker service; the more circuitous, and to the shipper the less expensive routes, a slower service.

There is a business demand for both of these services. The package freight lines on the lakes perform a function of value to the carriers and to the public, and occupy an important place in the elaborate and delicately adjusted system of transportation that has grown up in the highly developed industrial section of the United States lying between the Mississippi River and the north Atlantic seaboard.

Foreign Railroad Notes.

The International Sleeping Car Co. made a profit of about $1,700,000 in 1907 from its cars, and about $240,000 from its hotels and restaurants, which are at winter resorts.

The head of the administration of the Hungarian State Railroads, who has 5,990 state employees under him, besides a small army of laborers, enjoys a salary of $3,000 a year. (To be exact, $3,034.50.) Among these employees are 193 "chief engineers" at $1,000 a year. The salary of the lowest grade of official is $320 a year.

An "abnormal physiological condition," according to Under Secretary of State Dari, is what caused a switchman to neglect to set a signal, for lack of which a serious collision occurred near Milan. A member of Parliament suggested that the abnormality of the switchman's condition was due to the propinquity of a drinking saloon.

To increase the capacity of the Giovi tunnel, which penetrates the Ligurian Appenines a few miles north of Genoa, it was determined to operate the line electrically from Ponte Decimo to Busalla. The more important electrical companies of the world were asked to compete for the installation, and the contract was let to the Westinghouse company, which will establish its power house at Vado, on the sea, about 30 miles southwest of Genoa.

GENERAL NEWS SECTION

NOTES.

The Richmond, Fredericksburg & Potomac has asked the Virginia State Corporation Commission to authorize the collection of an increased fare from passengers who needlessly board trains without having bought tickets.

At Austin, Texas, April 30, the Galveston, Harrisburg & San Antonio and the Texas & New Orleans were fined $200 each for disobedience of the law forbidding passenger trains to wait at junctions more than 30 minutes for connecting trains.

The passenger steamships "Yale" and "Harvard," of the Metropolitan Steamship Line, have resumed their direct trips between New York and Boston by the "Outside Line" around Cape Cod. These steamers last summer made the trip in 15 hours.

The Interstate Commerce Commission, in a report to the Senate, recommends that express companies be prohibited from buying and selling, on their own account, commodities transported by express. The order and commission business done by the express companies is approved, including that feature under which express agents find a market for perishable goods.

At Castle Rock, Colo., May 7, train robbers shot and killed Express Messenger Charles Wright on train No. 4 of the Denver & Rio Grande, and the robbers appear to have escaped before their work was discovered. They secured but little money, being unable to open the larger safe. On May 12 robbers disguised as brakemen overpowered the express messenger on a train of the Great Northern Railway, near Seattle, Wash., and robbed the safe of several thousand dollars.

In the United States District Court at Chicago, May 6, fines of $13,150 were imposed in 95 cases against six railroad companies, charging violation of the 28-hour law for the transportation of cattle. The roads fined were the Chicago, Rock Island & Pacific, 45 cases, fined $6,550; Chicago & North-Western, 26 cases, $3,600; Illinois Central, 9 cases, $1,100; Chicago, Milwaukee & St. Paul, 7 cases, $950; Atchison, Topeka & Santa Fe, 6 cases, $750, and the Chicago, Burlington & Quincy, 2 cases, $200.

It is announced that the Seaboard Air Line will, on June 1, reduce local passenger fares between Jacksonville, Fla., and River Junction, from 3 cents a mile to 2¾ cents. The fare from Jacksonville to Tampa will be reduced from $6.30 to $5.80; from Jacksonville to Tallahassee from $4.95 to $4.55. The company will also sell mileage books, 1,000 miles, at $20, good for the original purchaser; 2,000 miles, good for the purchaser, and four partners or employees, at $40, the ticket to be used by only one person at one time, and a 500-mile family book, good within the state of Florida, at $11.25.

The Arbitrary Depreciation Charge.

It has always been the understanding of railroad officials and has been the accepted practice on the best operated railroads, that operating expenses should show expenditures actually made. To put expenditures into operating expenses which have not been actually made, has been regarded as "padding" accounts. To make a charge for depreciation every month on a purely arbitrary basis, when the money thus charged is not actually spent in replacement, is obviously charging against operating expenses something for which no expenditure has been made. If it is advisable to make a charge for depreciation regardless of the fact that there is, in all probability, a counter credit greatly outweighing it, then that charge should be a charge against income account, to be offset by appropriations from income account when the money is taken from income for renewals or replacement.—*F. A. Delano, in the Wall Street Journal.*

Individual Car Owners' Association.

The Executive Committee of this association held a meeting at Chicago last week and instructed the President and Secretary to attend the meeting of the Master Car Builders' Association at Atlantic City, June 17, and that of the Car Accounting Officers at Niagara Falls, June 23, for the purpose of presenting the wishes of the individual car owners in regard to certain proposed improvements in service. Five resolutions were passed, as follows: First, to request the car accountants to have junction cards sent more promptly to private car owners, and to have train records of such cars sent to owners when asked for; second, to request the car accountants to put private cars on a more equitable basis in relation to their earning capacity. From October 1 the private car owners want 1 cent a mile for their cars. (The usual rate at present is 7½ mills a mile.) Third, that the members of the association should bring claims against and collect from railroads for misuse of their cars; fourth, that private cars ought to be loaded home by their proper route, and the accounting officers are requested to prevent diversion; fifth, the proposed adoption of distinctive marks to be put on private cars (for the purpose of reporting) under the auspices of the Car Accounting Officers' Association is approved, provided each owner is satisfied with the letter or letters assigned to his cars.

Railroad Earnings and Expenses in March.

The railroads shown in the two following tables, together with most of the railroads in the United States, show decreased gross earnings in March, 1908, from the corresponding month last year. The roads in the first table show a decrease in operating expenses proportionately larger than the decrease in gross. The roads in the second table show only as great a proportionate decrease in operating expenses, or a less proportionate decrease in operating expenses than the decrease in gross earnings.

TABLE I.

			Decrease	
National Railroad of Mexico:	March, 1908	March, 1907	Amount.	Per cent.
Gross earnings	$1,345,031	$1,407,974	$62,943	4
Operating expenses	823,547	914,181	90,634	10
Union Pacific:				
Gross earnings	5,345,264	6,200,050	854,786	14
Operating expenses	2,948,462	3,600,797	652,335	18
Norfolk & Western:				
Gross earnings	2,059,373	2,777,455	718,082	26
Operating expenses	1,253,900	1,773,759	519,859	29
Nashville, Chatt & St Louis:				
Gross earnings	924,825	1,139,918	215,093	19
Operating expenses	704,694	909,014	204,320	22
Chesapeake & Ohio:				
Gross earnings	1,946,931	2,250,703	303,772	13
Operating expenses	1,274,156	1,526,866	252,710	16
Philadelphia & Reading:				
Gross earnings	3,068,634	3,701,401	632,767	17
Operating expenses	1,949,226	2,367,654	418,428	18

TABLE II.

			Decrease	
Lehigh Valley:	March, 1908	March, 1907	Amount.	Per cent.
Gross earnings	$2,315,894	$2,976,315	$660,421	22
Operating expenses	1,579,142	1,845,059	265,917	14
Louisville & Nashville:				
Gross earnings	3,548,766	4,317,156	768,390	17
Operating expenses	2,579,484	2,946,913	367,429	12
Central of Georgia:				
Gross earnings	961,842	1,147,185	185,343	16
Operating expenses	*719,720	841,421	121,701	14

*Including taxes.

The Delaware & Hudson is an exception to the general rule. Its gross earnings for March, 1908, were $1,512,865, an increase of $58,979 over the same month last year, while its expenses and taxes were $996,083 in March, 1908, an increase of $38,811. Including a $3,021 increase in net earnings from the coal department the company had net earnings of $622,000 in March, 1908, an increase of $95,000 over March, 1907.

Oklahoma and the Rock Island.

It is stated that the threatened suit to break up the alleged merger between the Chicago, Rock Island & Pacific and the St. Louis & San Francisco has been abandoned by Attorney-General West, and the Rock Island has agreed to readjust its rates from Oklahoma on lumber, live stock and milled products.

Steel Spelerized Tubes.

The railroad companies and the manufacturers of tubes have long been desirous of obtaining a steel tube that will take the place of the charcoal iron tube for locomotive work. For a number of years spasmodic attempts have been made to secure a tube of this character that would have the life of the iron one and would not pit in bad waters. The railroads have used such tubes as have been proffered, but, for the most part, have returned to the iron products after a trial of greater or less duration. The report now comes, however, that in a test of the comparative durability of iron and the spelerized tubes, the latter have shown the greater durability of the two as well as the higher physical properties. Further particulars and details of the work that has been done will appear in a future issue.

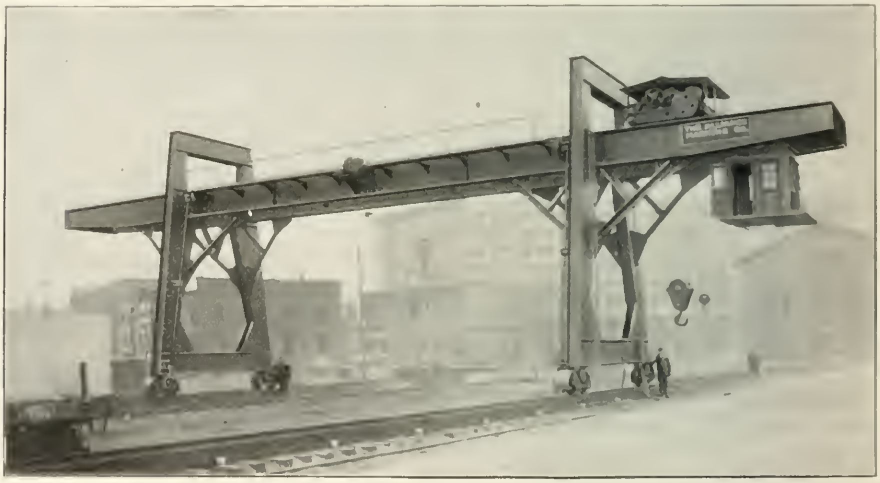
South American Railroad Strikes.

Railroad strikers in South America have had no cause to congratulate themselves on the results of their more recent campaigns in Argentina and Uruguay. The unconditional surrender at the end of January to the Buenos Ayres Great Southern management, over the dispute at the Banfield work shops, was followed last month by the complete failure of the Uruguayan railroad strike. The trouble began with the men staying away from the shops merely out of sympathy with strikers on other railroads. There was no demand for higher wages, shorter hours or improved conditions of service, but the movement threatened to spread and to undermine discipline throughout the system. On this issue the management fought the strikers. Having closed the shops it reopened them again, but not to the ringleaders. Nearly all the old men stood out, but new men to fill their places were gradually obtained, and the indispensable work of the shops was carried out. Finally, the old hands, seeing their places being filled up, about the end of January mustered up sufficient courage to defy the ringleaders, who for some months had been exercising a reign of terror, and asked to be taken back unconditionally. All those for whom vacancies could be found, and on whom the company could reasonably rely for loyal service have been taken back, but they have forfeited their pensions and all other privileges of their past service.

The Alliance Electric Cantilever Gantry Crane.

The accompanying photograph shows a 25-ton electric gantry crane with double cantilever ends, designed and built by The Alliance Machine Company, Alliance, Ohio, for the Lake Shore & Michigan Southern, for use in the freight yards at Toledo, Ohio. Owing to the constantly increasing weights of single pieces of structural material and heavy pieces of machinery, castings, blocks of stone, etc., that railroads are called on to handle, the question of whether a road has, or has not, the proper facilities for quickly unloading these heavy pieces at their destination often determines whether a road gets this freight business or not.

The Alliance crane can unload a car of freight very quickly, and thus tends to relieve congestion in freight yards. When cars and tracks are in great demand and the consignee is not ready to receive his heavy freight, the cars can be unloaded and the contents piled along the tracks until the consignee is ready for it. The entire expense will probably be much less than demurrage charges. This crane should span two tracks between its supporting legs and leave ample room for a wide double wagon roadway between the tracks. These supporting legs should be the shape of the letter A, but with a clear opening between the diagonal members, as shown in the cut, so that the crane operator can pick up a piece of freight from a car on any track, transfer it along the bridge, and, if necessary, through the supporting legs to one of the cantilever ends of the crane and deposit it on the delivery trucks. The cantilever ends should be long enough to reach over one track and one wagon roadway, and the supporting legs of the crane should be designed so that no part thereof projects more than 24 in. beyond the center of runway rails, in order that proper clearance may be maintained between the railroad tracks. Local conditions, of course, may vary the relative location of tracks and wagon roadways. The crane should be supported on not less than eight track wheels mounted on equalizing trucks, so that the crane can accommodate itself to irregularities of the runway tracks. The cranes are built for direct or alternating current.



Alliance Electric Cantilever Gantry Crane.

The crane shown has the following dimensions, etc.:

Lifting capacity—main hoist	25 tons at 12 ft. per min.
Lifting capacity—auxiliary hoist	5 tons at 60 " " "
Speed of trolley	125 " " "
Speed of bridge	250 " " "
Span, center to center of runway rails	55 ft
Length of crane girders, over all	103 "
Distance, under side of crane girders to top track rails	23 "

Prussian Railroad Electrification.

During the past few months various Berlin suburban lines have been electrically operated, in order to provide the State Railway Department with practical working data. These lines are, of course, distinct from Berlin's new privately owned electric railways, such as the High Level & Underground Railway, and are all part of the State system. It is now announced that a beginning is to be made with main line conversion for freight as well as passenger traffic. Two sections are said to have been chosen for experimental purposes —that between Leipzic and Magdeburg, a distance of 80 miles, and Leipzic to Halle, 23 miles in length. It is intended to reduce train length and weight by operating a smaller number of cars per train. The most careful comparisons between the cost of steam and electrical working are to be made in order that the results of conversion may show whether further electrification be commercially practicable and advisable. The sections chosen are admirably suited to this end, owing to the very heavy traffic passing over them, and very valuable data should be forthcoming as the result of electrification.

INTERSTATE COMMERCE COMMISSION RULINGS.

Switching Charges.

Wellington et al. v. St. Louis & San Francisco. Opinion by Commissioner Clements.

Complainants were awarded $84.50 on account of the non-absorption of switching charges at Kansas City, Mo., on shipments of wood.

Special Excursion Rates.

Koch Secret Service v. Louisville & Nashville. Opinion by Commissioner Clements.

Defendant was found guilty of unjust discrimination in refusing a special excursion rate between Nashville, Tenn., and Evansville, Ind., to parties of 10 or more persons, in the employ of complainant, while giving a special rate to parties of 10 or more persons, engaged in other employments, between the same points at the same time. Reparation for $85.50 was awarded.

Charges for Lumber.

Butters Lumber Co. v. Atlantic Coast Line et al. Opinion by Commissioner Clark.

Complainant is entitled to recover from defendants the sum of $51.94, as reparation for unjust charges on certain shipments of lumber from Boardman, N. C., to Pottsville, Pa., and Schuylkill.

Rate on Cattle to Chicago.

Morli v. Chicago, Milwaukee & St. Paul. Opinion by Commissioner Lane.

The carrier's rate of 31 cents per 100 lbs. for the transportation of cattle from Leon, Kan., to Chicago, Ill., was held to be unreasonable to the extent of 2½ cents per 100 lbs., and $38.50 was awarded to complainant.

Rate from Washington, D. C., to Glenndale, Md.

White Water Farms Co. v. Philadelphia, Baltimore & Washington. Opinion by Chairman Knapp.

A rate of 55 cents per ton charged by defendant on gross weight of car and lading for transportation of stable manure from Washington, D. C., to Glenndale, Md., was found unreasonable to the extent it exceeded 40 cents per ton on actual weight of shipment, and $17.54 was awarded to complainant.

Refrigeration Charges on Oranges.

Fain & Stamps v. Atlantic Coast Line and Central of Georgia. Opinion by Commissioner Cockrell.

The parties adjusted the matter without a formal hearing, and consented that the Commission establish a rate for the future and order reparation. Accordingly an order was entered requiring defendants to enforce for two years a refrigeration charge on oranges in carloads from St Petersburg, Fla., to Atlanta, Ga., not to exceed $35 per car. Reparation for $50 was awarded.

Car Shortage.

Wood River Grain Co. v. Union Pacific. Opinion by Commissioner Clements.

Reparation on account of alleged unjust discrimination of defendant in not furnishing complainant with his share of cars for shipment of grain at Wood River, Neb., where competitors at that station were favored with grain cars, was denied, as the testimony disclosed that the time mentioned was during the car-shortage season, and that the business of complainant and his competitors suffered in common during that time.

Correction of Irregularities.

Bannon v. Southern Express Co. Opinion by Commissioner Clark.

The defendant's regulations as to contents of packages of fish from Haines City, Fla., to St. Louis, Mo., shipped under estimated weights have, in the past, been disregarded by the complainant and laxly enforced by the defendant, resulting in charges less than provided in tariff for actual weight shipped. On correction of those irregularities complaint was made that rate was unreasonable and reparation was demanded. The Commission said that the rate is not unreasonable and that where a shipper has in effect received a reduced rate on account of his own and carrier's irregularities, correction of those irregularities cannot be made the basis for an award of reparation. The complaint was dismissed.

TRADE CATALOGUES.

Electric Generators and Motors and Steel Armored Hose.—Bulletin No. 107 of the Sprague Electric Co., New York, describes continuous current, direct driven, type S generators. These are made in standard sizes from 25 k.w. up.

Bulletin No. 310 supercedes No. 301 and describes d.c. motors for operating ventilating fans and blowers. There are two types of these—the round type motors, and type D multipolar motors. The first type is furnished in nine sizes from ¼ h.p. to 7½ h.p., shunt, series or compound wound, designed for 115, 230 or 500 volts. The other type is made in nine sizes, from 10 h.p. to 95 h.p., for standard slow speeds, and from 15 h.p. to 105 h.p. for standard moderate speeds, with the same windings and voltages as the round type. Small exhaust fans and desk and bracket fans are also described.

Bulletin No. 224 describes more fully the type D motors referred to above.

Bulletin No. 507 supercedes No. 505 and is devoted to flexible steel armored hose, which consists of rubber hose covered with a strip of galvanized steel wound spirally and interlocked. This hose is used for steam drills, pneumatic tools, air-brake and train line hose, etc. The bulletin also shows special hose fittings.

Acetylene Lighting and Appliances for Car Heating.—A pamphlet issued by the Gold Car Heating & Lighting Co., New York, describes the Gold improved system of acetylene car lighting. The generator, which may be placed in any convenient part of the car, holds enough carbide for several nights' service. No mantels are used and the burners, it is claimed, last for years without renewal. The pamphlet describes the system and its operation and is illustrated with photographs and drawings showing the piping, location of valves, etc.

Another pamphlet describes the improved temperature regulator and stop valve, which allows just enough steam from the train line to enter the radiators to maintain the proper temperature, the valve being set to give any heat desired. The pamphlet, which fully describes the device, is illustrated with drawings showing its operation and methods of application.

A third pamphlet describes, with illustrations, the improved gravity relief trap, which releases all water in steam couplings as soon as the pressure is released, the valve closing when the pressure is restored.

Electric Motors.—Bulletin 98 of the Crocker-Wheeler Co., Ampere, N. J., describes form L, belt type, d.c. motors in sizes from 0.05 h.p. to 5 h.p., and generators from 0.6 k.w. to 2.5 k.w. Illustrations show the motors driving centrifugal pumps, hoists, fans, various machine tools, and other machinery. Ratings, weights and dimensions of the different sizes are given.

Bulletin 99 describes the Crocker-Wheeler motors in the rail and structural mills of the Bethlehem Steel Co., South Bethlehem, Pa.

Bulletin No. 100 describes form I, belt type, d.c. motors of 5 h.p. to 15 h.p., and generators of 4.5 k.w. to 40 k.w. The motors are fitted for driving heavy machine tools. The usual dimensions, etc., are given.

Bulletin No. 95 describes belt type, a.c., 60 cycle generators, which are built in sizes from 35 K.V.A. to 200 K.V.A., either two or three phase, for voltages from 240 to 2,300 volts.

Electric Headlights and Electric Controllers.—Bulletin 4,579 of the General Electric Co., Schenectady, N. Y., describes a recently perfected arc headlight. The upper electrode is a copper forging, and the lower is an iron tube filled with a composition. It is claimed that this gives more light for the same wattage than the carbon arc, that the cost of operation and maintenance is very low, that the life of the copper electrode is from 2,000 to 3,000 hours, and that the lower electrode need be adjusted but once in 20 hours. Another advantage is that the light may be dimmed or "turned down" when passing through towns by reversing the direction of the current.

Bulletin 4,578 describes, briefly, various standard controllers for different operating conditions, and outlines the Sprague-General Electric type "M" control system.

Air-Brake Equipment.—Instruction pamphlet No. 5,034 of the Westinghouse Air-Brake Co., Pittsburgh, Pa., is devoted to the type L triple valve. This is described, with photographs and drawings, and its operation carefully gone into.

Instruction pamphlet No. T-5,033 of the Westinghouse Traction Brake Co., Pittsburgh, Pa., gives similar information for the type M triple valve.

The air-brake company has published a reprint of a paper on The Effect of Brake-beam Hanging Upon Brake Efficiency, read by R. A. Parke before the New York Railroad Club, in November, 1897. The preface calls attention to the fact that practice has shown the correctness of the predictions and recommendations of this paper.

Turbines, Dynamos, Motors and Pumps.—The De Laval Steam Turbine Co., Trenton, N. J., has issued bulletin No. 501 describing its steam turbines and machinery driven by them. Besides the turbines, the company makes centrifugal pumps, blowers, d.c. and a.c. dynamos to be driven by turbines, and, also, electric motors. The turbine is a single wheel, with milled buckets set radially on its periphery. The steam is directed at the buckets through four nozzles. The disc revolves at high speeds, from 10,600 r.p.m. for the largest size to 30,000 r.p.m. for the smallest. It is geared down about 10 to 1 through helical gears, giving direct shaft speeds of from 600 to 3,000 r.p.m.

Roller Bearings.—Bulletin 31 of the Hyatt Roller Bearing Co., Newark, N. J., describes the construction, application and advantages of Hyatt bearings. These products have now been standardized and the company can furnish them in over 300 sizes, each adapted to a particular condition of speed and load. Each bearing has a capacity rating so that the customer can decide exactly what he wants. The pamphlet referred to gives sizes and price lists and full directions for selecting the style desired. Attention is called to the fact that the bearings are applicable to many special forms of machinery, industrial cars, line shafting in railroad shops, etc.

Power Hammers.—A booklet issued by Beaudry & Co., Boston, Mass., is devoted to the Champion power hammer. The hammer is belt driven and the hammer proper or ram is operated by a device making the blow elastic, and also making it possible for the hammer to deliver its full blow without regard to the size of the metal which is being forged. It is made in sizes from 50 to 500 lbs. weight of ram, taking forgings up to 6 in. bars. Sizes and prices are given and also a list of railroads using the hammer.

Signal Devices.—Reference catalogue No. 5 of the Hall Signal Co., New York, gives full price lists and order numbers of parts of electric motor and electro-gas automatic semaphore signals, iron masts and fittings for automatic disk and semaphore signals, mechanical semaphore and station signals and auxiliary devices, including switch locks, electro-mechanical slots, batteries, etc. The catalogue is fully illustrated, each part on the drawings being numbered to correspond with the lists.

Engines and Centrifugal Pumps.—Catalogue F of the Erie Pump & Engine Co., Erie, Pa., describes centrifugal pumps, either direct connected or arranged for belt drive. These pumps are either single or multi-stage. It is claimed that the pumps can be used for handling any liquid, whether clear or having solids in suspension. The catalogue also describes two-cycle and four-cycle gas or gasolene engines of different types and sizes, and also, vertical steam engines from 4 to 35 h.p.

Reinforced Concrete Bridges.—A 118-page pamphlet issued by the National Bridge Co., Indianapolis, Ind., gives photographs of 85 Luten reinforced concrete bridges designed and erected by the company, or in process of construction. The photographs are followed by sections and dimensions of the same bridges and by illustrated accounts of various structural features and methods of design.

Passenger and Freight Cars.—The Barney & Smith Car Co., Dayton, Ohio, has published a handsome souvenir pamphlet entitled "Cars We Have Built." It contains 31 pages and is filled with full-page half-tone views of passenger car exteriors and interiors, and several types of freight cars. The embossed cover is brown and gold and the whole is tied with brown silk cord.

Steam Gages and Valves.—The full catalogue of the American Steam Gage & Valve Manufacturing Co., Boston, Mass., is a cloth bound volume of 246 pages. It is fully illustrated and describes, with sizes and prices, gages, valves, indicators and other devices for controlling steam pressure, water, air, gas, oil, ammonia and other pressures. These include a wide line of articles.

Flooring.—A folder issued by the J. G. Ellendt Company, 1 Madison avenue, New York, describes Elasto flooring. This is a cement composition, which it is claimed, is silent, not slippery, waterproof, sanitary, fireproof and durable. It is laid in thicknesses from ½ in. to ¾ in. and is furnished in any color or combination of colors desired.

Lehigh Valley.—"Land o' Lakes and Mountains," issued by the passenger department, consists of many excellent photographs of attractive spots reached by the Lehigh Valley in New Jersey, Pennsylvania and New York, with brief descriptions of health and summer resorts. These include lists of hotels at each place, with capacities and rates.

Pipe and Valves.—The April issue of the *Valve World*, published in the interest of Crane Co., Chicago, has an interesting description of 26-in. pipes bent at angles of 90 deg. and 48 deg. on curves of 9 ft. radius. Another article describes and illustrates Crane oil separators for removing cylinder oil from exhaust steam.

Locomotives.—The Baldwin Locomotive Works, Philadelphia, Pa., has published a pamphlet describing, with illustrations, the locomotives built by the firm for the Central Railroad of Brazil. The pamphlet gives briefly the history of the road and describes the locomotives built for it since the first three were built in 1862.

Locomotive Front-End Steam Pipes.—Julian L. Yale & Co., Chicago, have prepared a pamphlet illustrating and describing the locomotive front-end steam pipes with universal joints which they make and sell. The troubles with other kinds of steam pipes are described and the principal advantages of the universal-joint pipe given.

Dust Preventative.—The Barrett Manufacturing Co., New York, has published a booklet showing a number of photographs of roads treated with Tarvia B, a new form of the compound, which can be applied without heating. The pamphlet gives the advantages of the material and quotes reports made of its successful use.

Boiler Compound.—A pamphlet entitled "Magic Methods," issued by the H. W. Johns-Manville Co., New York, describes Magic boiler compound. This is a liquid, which, it is claimed, acts mechanically instead of chemically, working its way between the scale and the metal so that the scale is loosened and drops off.

Reinforced Concrete Construction.—Recent circulars issued by the General Fireproofing Co., Youngstown, Ohio, give photographs and drawings of powerhouses and other buildings erected on the General Fireproofing Co.'s system, with pin connected girder frames, with plain and twisted lug bar reinforcement.

Spokane & Inland.—A pamphlet entitled "Profitable Farming in the Spokane Country" takes up the farming possibilities of the regions served by the Spokane & Inland. Photographs and texts show strikingly what has already been done in raising wheat, fruit and vegetables and cattle and poultry.

Denver & Rio Grande.—A booklet issued by the passenger department on "Camping in the Rocky Mountains" lists with brief descriptions, many camping grounds, giving distances from Denver and information as to nearby hotels. Estimates of the costs of several vacation trips are included.

Roofing.—A pamphlet entitled "Ruberoid Pete," issued by the Standard Paint Co., New York, sets forth the advantages of Ruberoid in the form of a conversation between a prospective customer and an old customer. Copies are sent to those interested on application to the company.

Thermit.—A pamphlet issued by the Goldschmidt Thermit Co. New York, describes butt-welding of wrought iron and steel and of pipes and rods with thermit. The pamphlet also contains revised price lists of appliances used for these welds.

Graphite.—The May issue of *Graphite*, published by the Joseph Dixon Crucible Co., Jersey City, N. J., contains notes on the use of graphite as a boiler scale preventive, and an article on crucible economy in brass foundry work.

Steel Tires.—The Standard Steel Works, Philadelphia, Pa., has published a reprint of the paper on Steel Tires—Causes of Defects and Failures, read by George L. Norris before the Western Railway Club last October.

Brake-Shoes.—A pamphlet issued by the Illinois Malleable Iron Co., Chicago, announces that this company has begun the manufacture of a full line of brake-shoes for steam and electric railroads.

MANUFACTURING AND BUSINESS.

Lawson & Simons, 505 Fisher building, Chicago, have opened a warehouse at 52 West Washington street.

D. O. Settlemire, President of the Mount Vernon Car Manufacturing Co., Mt. Vernon, Ill., died in Litchfield, Ill., aged 81 years.

The Johnson Automatic Refrigerator Co. has moved its Chicago office from the Great Northern building to 209 Western Union building.

The Bettendorf Axle Co., Davenport, Iowa, has moved its Chicago office from 1590 Old Colony building to larger quarters at 1160-1170 Old Colony building.

The Dressel Railway Lamp Works, New York; Adreon & Co., St. Louis, and the L. J. Bordo Co., Philadelphia, Pa., which have joint Chicago offices, have moved them to larger quarters in 209 Western Union building.

Since the death of Mr. H. A. Clark, late President of the Central Inspection Bureau, New York, Mr. John E. Cobaugh has been made President and Treasurer; Mr. Geo. E. Pratt, Vice-President and General Manager, and Mr. T. C. Ashenfelter continues in the office of Secretary as formerly.

The Glacier Metal Co., Richmond, Va., expects shortly to erect a new plant in Manchester, across the James river from Richmond, for making Glacier anti-friction metal, Copper-Tin bearing metal, and other babbitt metals. The works will be about 100 ft. x 40 ft., two stories high, with capacity for 25,000 lbs. of babbitt metal a day.

The Kennicott Water Softener Co., Chicago, has moved its office there from 527 Railway Exchange building to Suite 601 Corn Exchange building. The new forge and plate-forming shop has been completed. With the angle-bending plant recently installed the capacity for tank and steel plate work has been increased over 50 per cent.

The H. W. Johns-Manville Co., New York, is about to open a branch at 72 Jefferson avenue, Detroit, Mich., under the management of Willard K. Bush, who has been connected with the Milwaukee branch of the company for a number of years. A complete stock will be carried at Detroit, so that shipments can ordinarily be made direct from that city.

Willis C. Squire has opened an office at 209 Western Union building, Chicago, as manufacturers' agent for railroad supplies and specialties, gasolene locomotives, turntables, cranes, signaling devices, etc. His line includes rail drills and benders, insulated rail joints, combination tieplate and guard-rail clamps, semaphore blade clasps and adjustable switch-point brackets.

Bids will be received until May 25, 1908, by the Isthmian Canal Commission, Washington, D. C., for the supply of hoisting engines, car-tenoning machine, automatic car-gaining machine, repair parts for steam shovels and flat cars, chain, twist drills, taps, water-closets, saw blades, mauls, hammers, track levels, lining bars, carpenters' braces, steam whistles, polishing paste, bran, cotton-seed meal, etc.

J. G. White & Co., Inc., New York, have been awarded the contract for a complete hydro-electric plant, with transmission lines, sub-stations, etc., for the Central Georgia Power Co., on the Ocmulgee river, about 36 miles above Macon, Ga., supplying power to Macon and to other places in the vicinity. The normal capacity of the plant will probably be 12,500 k.w., generated by water-wheels under a 100-ft. head. The crest of the dam will probably be 750 ft.

At the annual meeting of the stockholders of the General Electric Co., Schenectady, N. Y., on May 12, Vice-President B. E. Sunny, of Chicago, was elected a Director to succeed Frederick P. Fish, resigned. The other Directors were elected for another year, as follows: Gordon Abbott, Oliver Ames, C. A. Coffin, W. M. Crane, T. Jefferson Coolidge, Jr., George P. Gardner, Henry L. Higginson, J. Pierpont Morgan, J. P. Ord, Robert Treat Paine, 2nd, E. W. Rice, Jr., Marsden J. Perry, Chas. Steele and S. L. Schoonmaker.

The Westinghouse Machine Co., Pittsburgh, Pa., has an order for mechanical stokers, aggregating 14,400 boiler horse-power, for one of the large Brooklyn, N. Y., power stations operated by the Transit Development Co. (Brooklyn Rapid Transit). The order comprises 24 stokers suited to 600-h.p. B. & W. water tube boilers. This is the second large order given by this company for Roney stokers, the original 7,200-h.p. installation at the Kent avenue station having been in service for a year.

The Darley Engineering Co., 80 Broadway, New York, has been formed for the purpose of engineering, manufacturing and selling machinery and appliances for hoisting and conveying materials by suction and by air pressure. It has acquired the sole rights, for the United States, to make and sell the suction conveyor heretofore controlled by the Economic Engineering & Construction Co., Chicago, and it has taken over the business of the Economic Engineering & Construction Co., of Chicago, and the Darley Co., of Pittsburgh, Pa. W. W. Darley, President, will have charge of the Pittsburgh office. W. A. Stadelman, Vice-President, and M. D. Chapman, Secretary and Treasurer, will have charge of the New York office. W. A. Sharp, Vice-President, will have charge of the western business, with headquarters in Chicago.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Western Railway Club.

The annual meeting of this club is to be held May 29, at the Auditorium Hotel, Chicago, Ill. The committee was unable to secure suitable accommodations for an earlier date.

Engineers' Club of Philadelphia.

At a business meeting of this club to be held May 16, the papers to be presented are as follows:

"Sand—Its Use and Application in the Various Industries and Processes," by W. S. Reed, illustrated by lantern slides.

"Notes on the Theory of Steam Condensers," by Thomas C. McBride.

Accounting Officers.

The Association of American Railway Accounting Officers held its annual meeting at Washington, D. C., April 29 and 30 and May 1 and 2. The President of the association for the ensuing year is W. J. Hobbs, Fourth Vice-President of the Boston & Maine. C. G. Philips, of Chicago, was re-elected Secretary. The next annual meeting of the association will be held at Cincinnati in April, 1909.

The White House Conference on Natural Resources.

The conference on the Conservation of Natural Resources called by President Roosevelt was convened at the White House, Washington, on Wednesday of this week, being attended by the Governors of forty-four states and territories and representatives from all the rest; and by representatives of about all the learned societies of the country. The principal subjects were introduced by the following prominent speakers: Ores and Related Minerals, Andrew Carnegie; Mineral Fuels, Dr. I. C. White, State Geologist of West Virginia; Soil, Professor T. C. Chamberlin, University of Chicago; Forests, R. A. Long, Kansas City; Public Health, Dr. George M. Kober, Dean of the Medical Department of Georgetown University; Reclamation of Land by Irrigation and Drainage, Dr. George C. Pardee, ex-Governor of California; Grazing and Stock Raising, Hon. H. A. Jastro, President American National Livestock Association, The Public Lands and Land Tenure, Judge Joseph M. Carey of Wyoming. Water Resources: Transportation, James J. Hill, of the Great Northern Railway; Navigation, Professor Emory R. Johnson, University of Pennsylvania; Water Power, H. S. Putnam, American Institute of Electrical Engineers.

Invitations were sent to the chief officer of about every society devoted to the promotion of knowledge which is of national extent and to the heads of many others; for example: The American Association of Agricultural Colleges and Experiment Stations; American Association for the Advancement of Science; American Bar Association; American Federation of Labor; American Forestry Association; American Institute of Mining Engineers; American National Livestock Association; American Newspaper Publishers' Association; American Railway Association; American Railway Engineering and Maintenance of Way Association; American Statistical Association; Brotherhood of Locomotive Engineers; Brotherhood of Locomotive Firemen and Enginemen, Brotherhood of Railroad Trainmen; Farmers' National Congress; General Federation of Women's Clubs; Missouri Valley Improvement Association, National Association of Manufacturers; National Board of Fire Underwriters; National Grange; National Slack Cooperage Manufacturers Association; United Mine Workers of America, and about 40 others.

Railway Storekeepers' Association.

This association will hold its annual meeting at the Auditorium Hotel, Chicago, May 25, 26 and 27. One of the events in connection with this meeting will be the banquet on Tuesday evening, and which has heretofore been tendered the storekeepers by the supply men. This year the storekeepers decided to give this banquet themselves, and on behalf of the supply men, it has been proposed that those attending the banquet aside from the storekeepers pay at the rate of $5 a plate, any excess of the actual cost to go toward providing entertainment for the banquet and a dinner and entertainment for the ladies.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago, Milwaukee & St. Paul.—O. W. Dynes has been appointed Assistant General Solicitor, succeeding John A. Russell, resigned.

Georgia, Florida & Alabama.—J. F. Ingalls, formerly Acting Auditor of the Mobile, Jackson & Kansas City, has been appointed Auditor of the Georgia, Florida & Alabama, with headquarters at Bainbridge, Ga., succeeding W. H. Carroll, resigned.

Interstate Commerce Commission.—Charles A. Lutz, Assistant Comptroller of the Louisville & Nashville, has been appointed Chief Statistician of the Board of Examiners in the division of accounts of the Interstate Commerce Commission.

Kansas City Southern.—W. G. Street has been elected a Director, succeeding Y. Van den Berg, resigned.

Louisville & Nashville.—See Interstate Commerce Commission.

Operating Officers.

Chicago, Milwaukee & St. Paul.—Frank H. Myers, the new Superintendent of the Prairie-du-Chien and Mineral Point divisions, was born in 1872 at Adeline, Ill., and started work with the Chicago, Milwaukee & St. Paul in 1890 as telegraph operator on the Chicago division. Six years later he became agent on the Chicago division, and in 1899 was promoted to assistant train despatcher, and five years later was promoted to chief train despatcher. In September, 1907, he was made Assistant Superintendent of Terminals at Chicago, and was appointed to his present position May 1, 1908.

E. W. Morrison has been appointed Trainmaster at Minneapolis, Minn., succeeding P. L. Rupp, promoted.

Hocking Valley.—R. S. Quigley, Superintendent, has been granted leave of absence on account of ill health, and H. E. Speaks, Superintendent of the Toledo & Ohio Central, has been appointed Acting Superintendent of the Hocking Valley, with office at Columbus, Ohio. The position of Superintendent of Terminals at Toledo, Ohio, has been abolished and C. A. Hoyt, dock agent, will assume all duties pertaining to dock operation. See Toledo & Ohio Central.

Jamestown, Chautauqua & Lake Erie.—Glenn E. Mason, Superintendent, has resigned and the office of Superintendent has been abolished. George F. Asper has been appointed Trainmaster, with office at Jamestown, N. Y.

St. Louis & San Francisco.—H. H. Brown, the new Superintendent of the Eastern division, with office at Springfield, Mo., was born in 1862. In 1893 he was made train despatcher at Monett, Mo., of the St. Louis & San Francisco. He became chief despatcher in 1896 and Trainmaster in 1898. In 1902 he was transferred to Springfield, Mo., and the next year was made Superintendent of the Western division at Neodesha, Kan. In 1904 he was transferred to the Southern division, where he remained until his recent appointment.

Seaboard Air Line.—T. F. Whittelsey, General Manager, has resigned and the duties of his position have been assumed by W. A. Garrett, Chief Executive Officer for the Receivers.

Toledo & Ohio Central.—C. L. Gardner, Assistant Superintendent, has been appointed Superintendent, succeeding H. E. Speaks, transferred. W. F. Elrod, Superintendent of Terminals of the Hocking Valley at Toledo, Ohio, succeeds Mr. Gardner. See Hocking Valley.

Union Pacific.—J. B. Sheldon has been appointed Superintendent of Telegraph, with office at Omaha, Neb., succeeding L. H. Korty, resigned.

Vera Cruz & Pacific.—Clayton Byers has been appointed Superintendent, with office at Tierra Blanca, Vera Cruz, succeeding J. S. Langston, resigned.

Traffic Officers.

Chicago, Rock Island & Pacific.—S. S. Butler has been appointed General Agent at Fort Smith, Ark., succeeding J. L. Reinach, deceased.

Erie.—M. W. De Wolf, General Eastern Freight Agent, has been appointed special agent, with office at 50 Church street, New York. H. S. Stebbins, Manager of the Erie Despatch Fast Freight Line, succeeds Mr. De Wolf, with office at New York.

Engineering and Rolling Stock Officers.

Erie.—George H. Burgess, who was recently appointed Principal Assistant Engineer, was born on June 19, 1874, at Oshkosh, Wis. He graduated from the University of Wisconsin, Civil Engineering course, in 1895, and entered railroad service in 1896 as a rodman on the Pennsylvania Lines West. In October, of the same year, he was made Assistant Bridge Inspector, and two years later was appointed Bridge Inspector. In January, 1901, he became Assistant Engineer, which office he held until September, 1905, when he left the Pennsylvania Lines West to become Assistant Engineer on the Erie. A year later he was made Engineer of Terminal Improvements, and on May 1, 1908, was appointed Principal Assistant Engineer, with office at New York. The Erie is making extensive terminal improvements at Jersey City, N. J., and Mr. Burgess has been in direct charge of these improvements, assisted by A. L. Moorhead, Resident Engineer at Jersey City.

George H. Burgess.

Illinois Central.—R. W. Bell, Master Mechanic at Waterloo, Iowa, has been appointed Assistant Superintendent of Machinery, with office at Chicago, succeeding J. G. Neuffer, promoted.

LOCOMOTIVE BUILDING.

The Fajardo Sugar Co. has ordered one consolidation locomotive from the American Locomotive Co.

The Eastern of France has ordered two Mallett compounds from the American Locomotive Co.

The St. Louis National Stock Yards have ordered one six-wheel switching locomotive from the American Locomotive Co.

The Paris-Orleans has ordered one 10-ft. 7-in. cut scoop wheel type standard gage rotary snow plow from the American Locomotive Co.

CAR BUILDING.

The Northern Pacific will build 500 stock cars at its own shops.

The Milwaukee Refrigerator Transit is considering building 100 refrigerator cars.

The International & Great Northern is asking prices on 750 thirty and forty-ton cars, including 500 box cars.

The Atlanta & St. Andrews Bay is said to be in the market for one combination baggage and mail car. This item is not yet confirmed.

The Western Heater Despatch (Starks Heater Car Co.), 189 La Salle street, Chicago, is in the market for 200 ventilated refrigerator cars.

RAILROAD STRUCTURES.

FREDERICTON, N. B.—Residents of this place have applied to the Minister of Railways for a new passenger station. They want one that would cost about $60,000.

MONTREAL, QUE.—Authority has been granted to the Canadian Northern Quebec to build bridges over the Jordan river, near St. Sophie, and over the river Rouge near Montcalm.

PARKERSBURG, W. VA.—According to reports from East Liverpool, Ohio, the Parkersburg Bridge Company was recently incorporated at that place to build a bridge over the Ohio river; also an interurban railroad, at a cost of $400,000. Joseph G. Lee, of the Knowles Pottery Co.; J. H. Brookes, S. C. Williams, of the S. C. Williams Co., and Charles Newell, of East Liverpool, are interested.

WINNIPEG, MAN.—A second bridge, it is reported, is to be built this year over the Assiniboine river by the Canadian Northern. It is to be of steel on concrete abutments.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA RAILWAY & ELECTRIC COMPANY.—This company proposes to build an electric line from Opelika, Ala., south to Eufaula, 60 miles, and eventually to the gulf. It is said that contracts for some of the work will shortly be let. A. M. Buchanan is President, Opelika, Ala. J. C. Chapman, Atlanta, Ga., Vice-President and General Counsel, will have charge of letting the work.

ALTUS, ROSWELL & EL PASO.—This company proposes to build a line from Altus, Okla., west via Duke and Hollis to Memphis or Childress, Tex., thence southwest via Lubock, Tex., and Roswell, N. Mex., to El Paso, Tex., about 400 miles. Location surveys reported made from Altus to Hollis, 34 miles, and grading work is now under way. Contracts have been given to J. E. Hines, of Altus; A. Key and N. Anderson, of Duke. On this section bids are asked for ties, rails and material for bridges. E. E. Kennedy, President, and E. K. Stimson, Chief Engineer, Altus.

BOSTON & ALBANY.—See New York Central & Hudson River.

BLACK MOUNTAIN RAILWAY.—See Virginia & Southwestern.

BROWNSVILLE, MASONTOWN & SMITHFIELD STREET RAILWAY (ELECTRIC).—An officer writes that contracts have been given to the Pennsylvania Railway Construction Company, and the General Construction Company, of Pittsburgh, Pa., to build this company's proposed electric line in Pennsylvania with terminals at Uniontown, Morgantown, Brownsville and Bentleyville. Work is now under way and track has been laid on $1\frac{1}{2}$ miles. There will be a number of viaducts and a bridge over the Monongahela river. (May 1, p. 623.)

CANADIAN NORTHERN.—D. B. Hanna, Vice-President of this company, is quoted as saying that the improvements to be made on the road during the present year will include relaying the main line between Port Arthur and Winnipeg with 80-lb. rails. The line west and north of Winnipeg is also to be improved. General Manager M. H. McLeod is quoted as saying that ties and rails will shortly be delivered and track laying started on the line to the Goose Lake District, Sask.

This company has built from Strathcona, Alb., into Edmonton, $4\frac{1}{2}$ miles, and 21 miles from Edmonton west to Stony Plain. An extension of this line is projected west to the boundary of British Columbia, passing south of Jasper House, about 200 miles west of Edmonton. An extension is also projected north of this line from Edmonton northwest to the British Columbia boundary, 300 miles, crossing the McLeod, Smoky and Wapiti rivers.

The Edmonton & Slave Lake has been granted a change in location in townships 54 and 55, range 25 west, by the Board of Railway Commissioners. In 1904 plans were filed for the first 50 miles from Edmonton, Alb., northeast to St. Albert, thence north to near Edison and Independent settlements, about halfway to Athabasca landing. The line is in operation to Morinville, 23 miles, and work is reported under way on the completion of the line to Athabasca landing.

The Edmonton, Yukon & Pacific, it is said, has started surveys from Edmonton, Alb., west to the Pacific coast. It is understood that the route will pass through British Columbia about midway between the lines of the Canadian Pacific, and the Grand Trunk Pacific, and will reach the Pacific coast probably at Bella Coola or Bute Inlet. The company has been granted permission to build a branch to Burrard Inlet. Preliminary surveys already made traverse a portion of the coal fields in the northern Cariboo district.

CANADIAN NORTHERN ONTARIO.—The branch lines already built and to be built by this company, and for which the government has granted a bonus of $20,000 a mile, aggregate 50 miles, are as follows: From Sudbury, Ont., to Moose Mountain; a four-mile branch to Garrow mines; a branch to Key Inlet on Georgian Bay, and a branch from near Udney to Orillia, 10 miles. Surveys are made and it is expected that work on the last named line will be started this year. Surveys have been made between Orillia and Georgian Bay, to which point a branch may be built.

CAROLINA, CLINCHPORT & OHIO.—It is now said that this road, formerly the South & Western, will be finished from St. Paul, Va., south to Marion, N. C., by January 1, 1909. The road is now in operation from Johnson City, Tenn., south to Pine Ridge, N. C., 69½ miles; also on the northern section from Dante, Va., south to Fink, 17 miles. The section from Johnson City to Marion, N. C., will probably be put in operation by August 1. A tunnel will be driven through the mountains in Dickenson county, Tenn., which will be the largest on the line and much longer than that through the Clinch mountain at Clinchport, Va., which is being completed by the S. Walton Contracting Company. (See South & Western, Mar. 13, p. 391.)

CHICAGO, MILWAUKEE & ST. PAUL.—According to reports from Tacoma, Wash., this company has incorporated the Port Angeles Railway & Terminal Co., with $1,000,000 capital to build the line to Olympic peninsula in the northwest corner of the state of Washington. The proposed line is to have its upper Sound terminal at or near Gig Harbor, opposite Tacoma, from which point a car ferry of three miles will connect with the St. Paul main terminal. A short branch is also to be built north to Bremerton. W. G. Collins, of Chicago, Ill., former General Manager of the C., M. & St. P., is the principal promoter.

COLORADO & SOUTHERN.—This company, it is said, is making plans to build an extension of the Wichita Valley, now in operation from Wichita Falls south to Abilene, 150 miles. The improvements include an extension from Abilene, south to Uvalde, 200 miles, and eventually from that point southeast to a connection with the St. Louis, Brownsville & Mexico at Sam Fordyce, 225 miles.

COLORADO, HEREFORD & GULF.—Incorporated in Texas with $420,000 capital to build a line from Dalhart, Texas, south via Hereford, thence southeast to San Angelo, about 400 miles. According to reports from Austin the company has notified the Texas Railroad Commission that contracts have been let for building the entire line from a point in Dallam county, and work is to be started at once both north and south of Hereford. The company has been granted a subsidy of $60,000 by Hereford. The incorporators include A. D. Goodnough, G. W. Irwin, Jr., W. M. Knight, C. W. Dodson, C. F. Kerr and J. D. Thompson. The office of the company is to be at Hereford.

COLUMBUS, COLORADO & MEXICO.—Local reports state that this company, which is being promoted by residents of El Paso, Texas, will shortly let grading contracts for about 150 miles of the proposed line. The projected route is from Columbus, N. Mex., northwest to the Mogollon district, with a branch from Tyrone to Silver City. A. A. Bailey, President, El Paso.

DELAWARE & EASTERN.—The Appellate division of the Supreme Court of New York, Third department, has recently sustained the action of the old State Board of Railroad Commissioners granting certificates of public necessity and convenience to the Schenectady & Margaretville, which proposes to build an extension of the Delaware & Eastern from Arkville, N. Y., north to Schenectady, 70 miles. Also to the Hancock & East Branch Railroad, organized to build a southern extension of the Delaware & Eastern, from East Branch, N. Y., southwest to Wilkesbarre, Pa., 160 miles. (Mar. 13, p. 391.)

DENVER, LARAMIE & NORTHWESTERN.—Work, it is said, has been started by this company on its proposed line. The projected route is from Denver, Colo., to the northern boundary of Wyoming, about 500 miles. S. Johnson, President. (Feb. 28, p. 297.)

DENVER, NORTH-WESTERN & PACIFIC.—This company, since January 1, has finished 17 miles of the extension it is building from Yarmony, Colo., towards Salt Lake City, Utah. Contract from Yarmony to Steamboat Springs, 68 miles, let to the Denver-Steamboat Springs Construction Company, of which Col. D. C. Dodge is President. In the line through Egeria canyon there will be two tunnels aggregating 2,400 ft. It is expected to open the line for operation from Yarmony to McCoy, 11 miles, May 15; to Toponas, 29 miles, August 15, and to Steamboat Springs by October 1.

EDMONTON & SLAVE LAKE.—See Canadian Northern.

EDMONTON, YUKON & PACIFIC.—See Canadian Northern.

FRANKFORT, DELPHI & CHICAGO TRACTION.—Incorporated in Indiana with $100,000 capital. The company proposes to build a line from Frankfort, Ind., northwest via Delphi and Monticello, to Hammond, about 125 miles. The Directors are A. S. Strauss, Wm. H. Conee, C. E. Hayman, Edward A. Stonehill, Herbert F. Wills. The headquarters of the company will be at Frankfort.

GREAT NORTHERN.—The Vancouver, Victoria & Eastern, through a consolidation of the Vancouver, Westminster & Yukon and the Victoria Terminal Railway & Ferry Company, now has under construction lines as follows: From the international boundary to Olivers, B. C., 11.32 miles, on which track has been laid for one mile and work is under way on the rest of the line. Line building from Brownsville, B. C., to Olivers, 9.80 miles, track laid on five miles. Line from Cloverdale, B. C. to Sumas at the International boundary, 26.25 miles, track laid on 1.10 miles and work is under way on the rest of the line. At Sumas Junction, B. C. (Sumas, Wash.) there is a connection with the Bellingham Bay & British Columbia Railway, the Northern Pacific, and the Canadian Pacific branch from Mission. Work is also under way on the line from Keremeos west to Princeton, 45 miles, on which grading is finished as far as Hedley. Surveys from Princeton to Sumas have been made, but have not yet been finally approved. (March 13, p. 391.)

This company, it is said, has projected branch lines as follows: Dewey Lake, Minn., north to International falls, about 78 miles, partially graded; Greenbush, Minn., northwest to Warroad, 44 miles, grading finished; Wenatchee, Wash., near where the line crosses the Columbia river, north to Oroville, 140 miles, partially graded.

HANCOCK & EAST BRANCH.—See Delaware & Eastern.

HOLSTON RIVER RAILWAY.—See Virginia & Southwestern.

MARYLAND ELECTRIC.—The proceeds of the remaining $250,000 first bonds of the Baltimore-Annapolis Short Line are to be used in building a terminal station in Annapolis, also for connections for entering Baltimore and other purposes.

MYERSDALE CONSTRUCTION & EQUIPMENT COMPANY.—This company was recently incorporated with $100,000 capital in Delaware to build railroads. The incorporators are H. D. Breen, W. A. Wood, Pittsburgh, Pa.; W. W. Stand, Bellevue, Pa.

NEBRASKA, KANSAS & SOUTHERN.—An officer writes that this company has not definitely financed its proposed line, and no active work will be undertaken until this is accomplished. The company was organized to build from Superior, Neb., southwest through Kansas, via Stockton, Ransom and Ness City, to Garden City, 267 miles. Definite location made from Stockton to Garden City, 167 miles. The work will include two steel bridges and handling about 25,000 cu. yds. per mile, including some rock work. (Mar. 13, p. 392.)

NEW YORK CENTRAL & HUDSON RIVER.—According to a statement of Woodward Hudson, of this company, it is proposed to spend $4,543,753 of the Boston & Albany bond issue for improvements on the road during the present year.

Reports from Buffalo, N. Y., state that this company is about to establish a large gravity freight yard at Suspension Bridge to handle freight coming from points north of Lake Erie. Freight from points south of Lake Erie is to be handled in the extension of the yards now being made at Gardenville, near East Buffalo. When finished the latter yards will have a capacity of 22,000 cars. At present there are 27 miles of tracks in use.

OREGON ELECTRIC RAILWAY.—An officer writes that this company now has its line in operation from Portland, Ore., south to Salem, 50 miles, and is building a branch from Garden Home on the main line, west to Hillsboro, 12 miles. The Willamette Construction Company is doing the work and W. S. Barstow & Co. are the engineers. After this branch is built, work is to be started on other proposed branches and extensions. (May 1, p. 622.)

PEACH RIVER & GULF.—Plans, it is said, are being made by this company to build an extension from its present eastern terminus at Bartle, Texas, east to Beaumont, where connection is to be made with the Galveston, Beaumont & Northeastern. Plans are also under consideration to build an extension south to Anahuac on Trinity bay.

PENNSYLVANIA.—It is said that orders to begin the work on the tunnel at Greensburg, Pa., which was stopped last fall, have been given by this company. About $1,000,000 will be spent cutting down the tunnel, reducing the grade and making a cut wide enough for six tracks.

The northern tunnel of the two which this company has been building under Bergen Hill, Hoboken, N. J., as part of its New York City improvements, was recently driven through. (April 17, p. 559.)

PORT ANGELES RAILWAY & TERMINAL CO.—See Chicago, Milwaukee & St. Paul.

SCHENECTADY & MARGARETVILLE.—See Delaware & Eastern.

SOUTH DAKOTA ROADS (ELECTRIC).—J. A. Cleaver, of Huron, S. Dak., is organizing a company to build an electric line from Huron north to Aberdeen, 82 miles. It is said that the necessary franchise for terminals at Huron has been secured, and application has been made for similar privileges at Aberdeen. Surveys started. Cross & Mack, of Minneapolis, will have charge of the work.

STEUBENVILLE & EAST LIVERPOOL (ELECTRIC).—An officer writes that this road is to form part of the line from Toronto, Ohio, north and east to Vanport. The company now operates a line from Steubenville, Ohio, to Wellsville, including the local lines in the city of Steubenville; and the East Liverpool Traction, which covers all lines in East Liverpool and Wellsville, and Liverpool township, also Chester, W. Va. The lines are run in connection with the Ohio River Passenger Railway, under construction for the past two years, from East Liverpool to Vanport, Pa., and now in operation from East Liverpool to Midland. At Vanport connection is to be made with the Beaver Valley Traction Company's lines to Rochester, Pa. Van Horn Ely is President; Edward McDonnell, Secretary and Treasurer, and J. C. Rothery, General Manager, of all three lines, which, however, are separate and distinct companies. (May 1, p. 624.)

UNION CENTRAL.—This company was organized last year to build a line from Dallas, Texas, southeast to New Orleans, 500 miles, of which 225 will be in Texas, and 275 miles in Louisiana. It is said that a contract to build 20 miles was recently given to the Tenney Construction Company, of Silver City, N. Mex., of which J. A. Sinclair is General Manager. A branch is also projected from Wortham, Tex., northeast to Tyler, 90 miles. This branch has been surveyed and surveys are now being made on the main line. W. J. Hogue, President, Dallas, and J. A. Eutis, Secretary and Treasurer, Edgewood. (Feb. 14, p. 234.)

VANCOUVER, VICTORIA & EASTERN.—See Great Northern.

VANCOUVER, WESTMINSTER & YUKON.—See Great Northern.

VERA CRUZ TERMINAL.—This company, organized in London with a capital of $6,000,000, expects shortly to let contracts for new terminal buildings and improvements at the Port of Vera Cruz, Mex. According to the plans, the proposed improvements will cost about $6,000,000. The company is composed of the several railroads entering Vera Cruz. The general office is at the City of Mexico. (Nov. 1, p. 542.)

VIRGINIA & SOUTHWESTERN.—An officer writes that this company has taken over the properties of the Black Mountain Railway, with a main line 30 miles long, and branches lately completed and now in operation, and the Holston River Railway with about 38 miles partly finished. Construction work has been suspended on the latter for the past two months; plans for the completion of this line have not yet been perfected. (Mar. 13, p. 395.)

VICTORIA TERMINAL RAILWAY & FERRY CO.—See Great Northern.

WICHITA VALLEY.—See Colorado & Southern.

RAILROAD CORPORATION NEWS.

BUFFALO, ROCHESTER & PITTSBURGH.—Wm. A. Read & Co., of New York, offer $200,000 Buffalo, Rochester & Pittsburgh 4½ per cent. consolidating mortgage bonds of 1907-1957. The total authorized issue is $35,000,000, of which there is outstanding $1,737,000.

CHICAGO, JOLIET & KANSAS CITY.—It is announced that a special meeting of the stockholders is to be held in Chicago, July 6, to authorize an increase in the capital stock. This is a projected road from Chicago, via Joliet, Ill., to Kansas City, Mo., 350 miles.

CHICAGO RAILWAYS CO.—It has been announced that this company has sold $1,200,000 collateral 6 per cent. notes secured by $1,666,000 Chicago Railways consolidated mortgage 4 and 5 per cent. bonds.

DENVER & RIO GRANDE.—See Western Pacific.

ERIE.—See Pittsburgh & Lake Erie.

GREENWICH & JOHNSONVILLE.—The Public Service Commission of New York, second district, has approved of a consolidated mortgage to secure $1,000,000 30-year 5 per cent. bonds of the Greenwich & Johnsonville. The company is to issue $100,000 of these bonds to pay indebtedness incurred in the construction of its Salem branch from Greenwich to the connection with the Delaware & Hudson. The remaining $600,000 bonds are to be held by the company.

ILLINOIS CENTRAL.—It is officially stated that the Illinois Central will begin regular operation of trains into Birmingham, Ala., by the end of April. The Mobile & Ohio will come into Birmingham over the same tracks.

INTERNATIONAL & GREAT NORTHERN.—The receiver, Thomas J. Freeman, has been authorized to issue 6 per cent. receiver's certificates to pay the $338,730 interest due May 1 on the first mortgage bonds. The certificates are to be secured by a first lien on the net revenues of the company and are to be sold at not less than par.

KANSAS CITY, FORT SCOTT & MEMPHIS.—The first mortgage 7 per cent. bonds maturing June 1, 1908, of which there are now outstanding $2,055,300, are to be extended until June 1, 1911, at 5 per cent. interest.

METROPOLITAN STREET RAILWAY.—Holders of the general mortgage and collateral trust 5 per cent. bonds of 1897-1997 of the Metropolitan Street Railway, of New York, are asked to deposit these bonds with the Guaranty Trust Company, of New York. The interest due on Feb. 1 was not paid, and the trust deed provides that after 90 days the default becomes absolute.

METROPOLITAN WEST SIDE ELEVATED RAILWAY (CHICAGO).—The Farwell Trust Co., and N. W. Halsey & Co., of Chicago, have bought the remaining $1,250,000 of an authorized $5,000,000 extension and terminal first mortgage 4 per cent. bonds. The sale of these bonds provides for the retirement of equipment notes and loans falling due June 1.

MIDLAND VALLEY.—All of the $5,600,000 old notes of the Cherokee Construction Co. have been deposited and holders will receive in exchange Midland Valley first mortgage 5 per cent. bonds and new Cherokee Construction Co. five-year 6 per cent. notes. These notes are dated December 2, 1907, and are due December 1, 1912. Of the authorized issue of $2,500,000 only $1,650,000 is outstanding.

NEW YORK, NEW HAVEN & HARTFORD.—The Supreme Court of Massachusetts has decided that the control of street railway companies in Massachusetts by the New York, New Haven & Hartford is illegal. Charles F. Choate, Jr., counsel for the road, gave out the following: "The company will promptly obey the decree of the court. We believe the principle enunciated by the court applies as well to the holding of Boston & Maine stock by the New Haven Company, and that it will be necessary for the company also to dispose of this stock unless the legislature decides that it is consistent with the interests of the commonwealth that it should be retained."

PITTSBURGH & LAKE ERIE.—Trackage rights on the Newcastle & Sharon 20-mile branch of the Erie have been obtained by the Pittsburgh & Lake Erie.

PUBLIC SERVICE CORPORATION OF NEW JERSEY.—Of the authorized issue of $50,000,000 first mortgage 5 per cent. bonds of 1908, only $3,725,000 are to be issued at present, and this amount has already been sold by the company.

ST. LOUIS & SAN FRANCISCO.—The proceeds of the sale to J. & W. Seligman and Redmond & Co., of New York, of all the refunding mortgage bonds free in the company's treasury, together with $1,353,000 of the same bonds pledged among other collateral to secure $1,750,000 notes with the Mercantile Trust Company, are to be used to pay at once the $1,750,000 notes due June 26, and to pay other pressing obligations. The amount of refunding mortgage bonds authorized was $85,000,000 of which $62,500,000 were to be reserved for refunding purposes, and the balance to be used for betterments, equipment, construction, etc. The company has been doing the work for which these bonds might be issued, but until now the bonds could only have been sold at a sacrifice.

SOUTHERN RAILWAY.—It is stated that the Southern Railway is to sell in the near future enough short-term notes to retire floating indebtedness and meet future expenses. It is said that a syndicate headed by J. P. Morgan & Co. will take these notes.

TOLEDO & OHIO CENTRAL.—The Little Kanawha syndicate turned over the Marietta, Columbus & Cleveland to the Toledo & Ohio Central for operation on Feb. 1. The Toledo & Ohio Central officials, it is said, claim that the physical condition of the property is such that its retention is undesirable and refuse to operate the road.

WESTERN MARYLAND.—The Mercantile Trust Company has been given an order permitting it to sell the entire capital stock of the George's Creek & Cumberland, which has been pledged with it by the Western Maryland to secure a loan of $1,101,875. The stock may be sold at public auction any time within 30 days.

WESTERN PACIFIC.—The Denver & Rio Grande, on behalf of the Western Pacific, has sold to Blair & Co., William Salomon & Co., and William A. Read & Co., of New York, $15,000,000 2-year 6 per cent. convertible notes. It is said that the money from this sale will finish the Western Pacific and provide it with equipment.

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

OFFICERS.—In accordance with the law of the state of New York the following announcement is made of the office of publication, at 83 Fulton St., New York, N. Y., and the names of the officers and editors of the Railroad Gazette.

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CONTENTS

VOL. XLIV., No. 21. FRIDAY, MAY 22, 1908.

We print this week a letter from Mr. Griffin which is worth careful attention. The point made is one which the *Railroad Gazette* has often brought out: that cast-iron wheels as now made and at present costs are a source of danger under 50-ton cars, and that a general understanding and agreement about car wheels ought to exist between all roads exchanging cars, since the damage from a broken wheel occurs wherever the car may happen to be running, regardless of where it was built. The author offers no solution, but merely states his case. The *Railroad Gazette* will welcome full and free correspondence on the subject.

In 1899 some fast passenger locomotives having cylinders of 19 in. diameter with a piston stroke of 26 in. were built for the Lancashire & Yorkshire Railway. These cylinders were steam jacketed and the steam was controlled from the cab. The construction was an experimental one and a recent inquiry about the results obtained shows that these results tally with those so frequently encountered in stationary practice. There is a certain theoretical advantage in the use of the steam jacket that does not appear in practical operation, and for that reason it has never been extensively used. In the case of the Lancashire & Yorkshire locomotives, it was not found, after continuous experiments, that it was worth while to steam jacket any more cylinders. The steam jackets apparently had the effect of preventing the accumulation of water in the cylinders, and it was thought that a certain amount of economy was secured by their use, so long as they were carefully watched. That is to say, a good man got good results out of them, while an inferior man got no better results than with the ordinary engines. But they gave trouble from a mechanical point of view, and it was decided that it was not worth while to continue them. Experiments were also undertaken on the same road with a small superheater by which very dry steam was delivered to the cylinders, but owing to the small size that was used a sufficient degree of superheat was not obtained. The experiments were valuable, however, in pointing the advantages to be obtained from a system of this kind, and when the Schmidt superheater was developed in Germany and the results that were being obtained with it became known, a number of engines were equipped with it, and have shown a saving in many instances of 20 per cent. Besides this direct saving, it has been possible to use a lower steam pressure and thus increase the life of the boilers while at the same time there is a better steam pressure and a higher temperature in the cylinders.

Australia has so far recovered from its three-years drought that the people are discussing projects for new railroads, especially a transcontinental line. By far the larger part of the population and cultivable land are within 200 or 300 miles of the east and south coasts; there are important mining interests not far inland from the southwest coast; and very little population on the northwest: while the vast interior is mostly barren, with some grazing ground. But it is exactly on the northwest that Australia comes nearest to the world's great trade route from Europe and India to China and Japan. English steamers to Sydney take about 18 days from Colombo, Ceylon, eight of them along the stormy south coast of Australia. To Darwin bay, on the northwest coast the time is 10 days less, and the railroad journey across the island, about 1,800 miles, would at most require but five days. There is already a railroad from Port Darwin for 146 miles southeastward and from Sydney several hundred miles toward the northwest. But such a line is objected to by Melbourne, which is on the south coast near the southeast corner of Australia. It would have one of its own lines extended to cross the continent to the northwest; and Adelaide, which is still further west on the south coast, would have the railroad extend more nearly from south to north along the transcontinental telegraph line. And if this cannot be done, it would prefer an extension of its railroads westward not far from the south coast to Fremantle, the port of West Australia (near the southwest corner), which is 1,500 miles southwest of Port Darwin. This would enable passengers to substitute a rail journey for the sea passage along the south coast to Adelaide, Melbourne and Sydney, but would probably not serve as a freight route. Local interests prevent any union on one route. Sydney and Melbourne, the present great trade centers for exports and imports, both near the southeast corner of Australia, fear the establishment of a great port at Port Darwin, which is so much nearer the great international trade routes, though it has very little productive country within a thousand miles. Only the general government of the now united colonies would be likely to be able to carry through such an enterprise, the larger part of which would be in national territory, formerly the north territory of the colony of South Australia, a country, mostly barren, extending about 1,000 miles from south to north, and more than 500 from east to west. It is not expected that such a line, that is, the part yet to be built, would have any appreciable local traffic for some years to come; and it has been estimated that one through train a week would be sufficient for the business.

To learn how much of convenience and cost-saving can be secured to the maintenance of way department from a portable blacksmith shop, M. L. Byers, Chief Engineer Maintenance of Way of the Missouri Pacific, last fall had an outfit arranged for this purpose. It consisted of two box cars, one housing the blacksmith and his helper, and the other the shop. The latter included a forge, and the necessary tools, duplicate parts and supplies needed for repairing hand cars, frogs, switches, tools, etc. The outfit is moved by local freight trains. About one day is needed to do up the work of an ordinary section, and a longer time where the work of two sections is done at one point, or where there is a large yard. For repairing frogs where there is considerable traffic duplicates of the frogs to be fixed are put in the track while the work is being done; but when the traffic is light, or there is not much work to be done, the frogs are taken from the track, repaired and replaced under the protection of flagmen. The proper adjustment of guard rails is looked after at the same time, and section tools are sharpened and repaired. It has been found that the life of frogs can be extended considerably by repairs given on the ground in this way. The cost for labor and material in repairing about 225 main track spring frogs has averaged about $3.75 each. The fact that these frogs have not needed to be shipped justifies the opinion that the plan of field repairs is an economical one; particularly when the economies effected in repairing switches, tools, hand cars, etc., by saving the trouble and delay of sending them away for repairs, are taken into account.

The up-state New York Public Service Commission, on May 7, handed down a decision on the petition of the Lehigh & Hudson River Railway Company for leave to execute a supplementary mortgage and to issue bonds secured by the mortgage to the amount of $300,000. In asking the consent of the commission to issue these bonds, the first statement of the railroad company (afterward amended) was that the intended use of the funds was to reimburse the treasury of the company for part of the amounts paid by it on account of the construction and purchase of the Orange County Railroad, but the commission disallowed these reasons, holding that the Public Service Commission law permits capitalization in New York for four purposes only: (1) for the acquisition of property; (2) the construction, completion, extension or improvement of its facilities; (3) the improvement or maintenance of its service; (4) the discharge or lawful refunding of its obligations, provided the proper commission gives a certificate of reasonable necessary and authorizes the issue; and that, since part of the funds asked for were to be used in restoring funds already expended from the treasury, the terms of the statute were not complied with. It is easy to see the commission's line of argument, and we need go no further back into railroad history than the Chicago & Alton affair for an instance of genuine harm done a railroad property by capitalizing betterment work done for a series of years out of income, on so high a basis that the company's future borrowing power was seriously impaired thereby and the value of its securities was diminished. But it looks as if strict application of the principle laid down in the Lehigh & Hudson River case was going to do a great deal more harm than good. Like the Interstate Commerce Commission's depreciation system, it puts a premium on capitalizing all new work. It has been one of the best traditions of American railroad development that as much work as possible is done out of income—sometimes temporarily, sometimes permanently. At times when money costs a great deal, a road with an abundant cash surplus will pay its construction bills out of this surplus; at times when money is cheap it will issue long-term securities to restore its surplus—if one chooses to describe it in that way. It would be equally fair to say that the long-term securities were issued to pay for the construction work temporarily financed by means of the surplus; a process which saves money for the shareholders and saves time for all concerned. Moreover, if the company is prosperous, it will frequently omit to finance these improvements paid for out of surplus, but will let them stand to the permanent benefit of the values underlying the outstanding securities. The system gives flexibility of the highest value, and has very seldom been abused, but by the construction which the New York Public Service Commission places upon the law, it is henceforth impossible in New York. In doubtful cases it will be to the interest of the railroad company to issue securities at the start, whereas under the present system it will frequently happen that new construction on a small scale will be done without issuing any capital at all. There are a great many kinds of occasional ills for which a universal preventive can only be applied at very great disadvantage. We get along very well under compulsory vaccination, but if the Pasteur treatment was required of everyone, there would be riots; yet it is very clear that the Lehigh & Hudson River ruling of the New York Public Service Commission, like the Interstate commission's depreciation and the obstacles which Massachusetts places to raising new securities, is a heroic kind of Pasteur treatment which may at long intervals save a life, but is sure to cause a great deal of unnecessary sickness in the meantime.

A well-informed observer remarked recently that the three most serious causes of errors by trainmen are: (1) mental inefficiency due to drinking (not drunkenness); (2) mental dulness due to not taking adequate rest when off duty; (3) taking chances, contrary to the dictates of good judgment. It seems to us that this is a very plausible theory, and we have no doubt that it is based on a careful diagnosis. It is significant that all three faults are of a moral nature. In other words, the first element needed in their correction is a desire or purpose to improve, on the part of the faulty person himself. This shows most forcibly how futile must be all changes in method and all mechanical aids, unless the persons to be dealt with are men of some strength of character—men with consciences, who do some intelligent thinking for themselves. The man who drinks "moderately" yet constantly is a more difficult problem for the superintendent than the one who gets intoxicated; and he often needs as much backbone as does the drunkard, if he is going to try to make himself thoroughly efficient. Neglect to take the full amount of sleep needed is also a habit which is the result of, or at least is perpetuated by, a mental infirmity that needs a good moral backbone for its cure. This is perhaps the one danger most difficult for the superintendent to reach. The night worker who neglects to sleep in the day time as he ought to can delude himself into the notion that he does not need so much sleep as the normal worker, and in case of failure in his duty he will claim that sickness in his family or some other excusable irregularity forced him into this neglect of his health. That this defense often is utterly false does not help the superintendent much in his endeavors to demolish the claim and maintain efficient service. Surely nothing more useful for the promotion of the safety of trains could be done, if only the genius could be found to do it, than to educate young men's consciences in this matter. The reader will recall the confession of a well-known railroad manager, printed not long ago, of how he used to go to ball games in the day time, at the risk of impairing his efficiency as a telegraph operator the following night. Drinking too much, and keeping awake too much are, however, mild delinquencies compared with "taking chances." But while the cure of this vice is essentially a moral issue, it may be easier to accomplish than in the cases of the other two, for it is easier to show the folly of it. The engineman who runs the risk of reaching a meeting point when he knows that he lacks two minutes of the necessary time, does so largely because he has not coolly measured the risk; and this he can be trained to do, if the superintendent is determined. One cause of this kind of recklessness is the indifference of conductors; but the enforcement of regular, intelligent and prompt co-operation between enginemen and conductors is a thing wherein superintendents can greatly improve if they set out to do so. After all of the improvement in the instruction of trainmen that has been accomplished in the last ten years, and the increased dissemination of knowledge of train rules, we should be loath to believe that enginemen of experience would take chances, with their eyes open, were it not that instances are reported now and then in the government accident bulletins. A road sending in an accident report containing such a phrase as "took chances" would seem to offer a good field for the government accident investigators—who have not yet been appointed.

STRICT CONSTRUCTION OF SAFETY APPLIANCE LAW.

The strict construction put upon the anti-trust law a dozen years ago by Justice Peckham, of the Supreme Court of the United States, in the trans-Missouri Freight Association case, when he held that a combination of competitors, however innocent and beneficial, was illegal, has now a striking counterpart in a decision rendered last Monday by Justice Moody, of the same court, holding that the law requiring that the drawbars of empty freight cars shall be 34½ in. high (from the level of the tops of the rails) must be exactly complied with. To run a car having drawbars 34¾ in. high, when empty, or 34¼ in. high, is illegal. This opinion appears in the suit of Taylor against the St. Louis, Iron Mountain & Southern, arising in a court of Arkansas and appealed by the railroad company from the Supreme Court of that state to the Supreme Court of the United States. By parity of reasoning the law requiring all cars to have automatic couplers in good condition must be construed with the utmost rigidity. To run a car with a broken drawbar, even so little as five miles to a terminal, for repairs, will make the railroad liable to the full penalty of the law.

To the present decision there is no dissenting opinion, though Justice Brewer concurred only in the result, not in the entire language of the opinion. The decision incidentally sustains the right of Congress to delegate to the American Railway Association and the Interstate Commerce Commission the duty of fixing a standard height of drawbars for freight cars. As to the question of adhering to the standard height, it was contended by the railroad company that it had employed men whose business it was to see that the drawbars were of the standard height; that it had furnished them material and appliances to keep the drawbars at the standard height; that its employees were capable; in short, that reasonable care had been used to keep these appliances at the standard height. But the court holds that the statute is absolute, and that if the road fails to have the cars at all times in such condition as to comply with the statute, it is liable to an employee injured while using such unlawful couplers. This overrules a number of contrary decisions which have been made by district and circuit courts.

As to the claim that this strict construction would work hardship on the railroad company, Justice Moody said:

"Where an injury happens through the absence of a safe drawbar there must be hardship. Such an injury must be an irreparable misfortune to someone. If it must be borne entirely by him who suffers it, that is a hardship to him. If its burden is transferred, as far as it is capable of transfer, to the employer, it is a hardship to him. It is quite conceivable that Congress, contemplating the inevitable hardship of such injuries, and hoping to diminish the economic loss to the community resulting from them, should deem it wise to impose their burdens upon those who could measurably control their causes, instead of upon those who are in the main helpless in that regard."

SECONDARY STREET RAILWAY FINANCING.

Amid greater and more sensational events a new phase of street railway operation in Massachusetts bearing directly on street railway finance has almost escaped attention outside of that state. It is the extensive movement there toward the increase of railway fares. It cannot, as yet, be described as general. It does not affect much the fares in the cities of the state. But on country and cross-country lines the increase has already in many cases been adopted. It ranges all the way from the substitution of six cents for the familiar and convenient "nickel" up to the added nickel for runs not always long; and it is based, nominally, on the increased cost of labor, materials and the expense of operation generally. Actually it strikes back to conditions of street railway financing peculiar to Massachusetts and which suggest a secondary stage of such financing there and elsewhere.

It is a very familiar fact that during the last two decades of electric street railway expansion in this country while floods of water have been poured into both stock and bonds of street railway corporations and the unscrupulous "promoter" has been high in the saddle Massachusetts has insisted sternly on honest capitalization based mainly on actual replacement value. It is not too strong a statement to say that her enforced capitalization in stock and debt of about $50,000 a mile has fixed an American standard of just capitalization, contrasting strikingly with more than double that amount in Connecticut, and with the dropsy in such states as Rhode Island and Pennsylvania, saying nothing of the acuteness of that disease in the New York City lines. But honest financing in the Massachusetts trolleys has been attended with one unlooked for result. Theoretically it would argue high prosperity for her trolleys and few receiverships. In fact, returns on her trolley investments have not been high and receiverships have been many, while just over the line in Connecticut, under "high" trolley finance only one out of some 30 original street railway corporations has suffered reorganization—though it must be said that the contrast with other states would by no means be so impressive. The seeming paradox, however, is easily enough explained. In Massachusetts, with her 34 cities and dense population, excessive trolley building ensued *spite* of restrictive law and ensued under unusually strong competitive conditions. Low fares and good services—at pretty high cost in many cases—have been the rule as compared with other states; and, finally, to a much less degree than in other commonwealths have there been in Massachusetts the big trolley combinations in which the strong lines of high earning power have carried the weaker ones.

There comes now, in that state, a readjustment of the situation expressed in higher fares. This is interesting in itself. It is doubly interesting when correlated with the recent dictum of the Massachusetts special commission in favor of allowing street railway companies as well as other corporations, to issue new stock, no matter what its market value, at par instead of the market price and thus reverse the Massachusetts statutory rule in operation for 15 years. This is to be interpreted as the proffer of a higher reward than hitherto on street railway enterprise. In other states the proposition goes much further. Promoters are proclaiming loudly that, with profitable trolley territory to a great extent exhausted, a watery "bonus" of some sort must be an element in every new trolley project. Succinctly stated it has been "no bonus no trolley," though the claim has not been for a bonus of the size in the earlier days of trolley promotion. In the last Connecticut legislature this claim was made openly and, strangely enough, prevailed over a dozen or more vetoes of the Governor. "Give us the trolley no matter what its financing" was the dominating cry in the same commonwealth where the watering of street railway securities has been not only scandalous in amount but the object of the sharpest popular criticism.

In this secondary stage of street railway development in this country where the trolley project is necessarily breaking away from the cities and from dense populations into rural communities and into long distance lines it will be edifying and instructive to observe how the rival forces outlined are to work out. On the one hand there is the general outcry against watered stock, the assertion not unfounded in fact, that it implies poorer service and higher fares, and the demand that the lines be desiccated by new valuations based on actual cost. On the other hand, particularly when one panic period is past and capital becomes more free and fluent, we are certain to find fresh appeals to legislatures to validate the bonus in stock or bonds as the price of new electric lines. The material and localized temptation will be set against the same policy of a state and the same men who uphold that policy will be found yielding to temptation and sacrificing consistency when it comes to their own interests or that of their immediate constituency. We may also see the incongruity of one fiscal policy applied to lines in operation; another and entirely reversed policy to projected lines. As there is no middle way between honest and inflated capitalization some of the future results promise, to say the least, to be satirical

Train Accidents in April.

April, which may always be expected to show the lightest accident record of the year, well maintains its reputation, with the difference, this year, that it follows two other light months. The three together, February, March and April, make a showing more favorable than any three months since a time when the railroad system of the country was very much smaller than it is now.

None of the train accidents in the present list is of sufficient magnitude to be put into our "prominent" class, but we append notes of two of them, and also give, following the list, some notes on a number of accidents which do not come within the term "railroad train accident" though they are of a kind which should be mentioned here.

The collision of passenger trains at Cleveland, Ohio, on the 30th, is said to have wrecked the engines and the baggage cars of both trains, but fortunately only four persons were seriously injured. The accident was due to the misplacement of a switch just in season to send a southbound passenger train on to the side track, where it struck a northbound train. The switch was thrown, just before the train came along, by a man who is believed to be insane or demented. Having been arrested and questioned, he claimed to have obeyed a signal from a brakeman of the standing train; but the brakeman was attempting to make the man straighten the switch, having observed that it was wrong.

The collision near Rock Glen, Pa., on the 20th, which resulted in the death of a fireman, was between southbound passenger train No. 15 and a locomotive running in the opposite direction, which appears to have encroached on the time of the passenger train. The passenger was running about 35 miles an hour when it struck the empty engine, and both of the engines were wrecked and thrown into the ditch. The baggage car of the passenger train was crushed, but only one passenger was badly injured.

PRINCIPAL TRAIN ACCIDENTS IN THE UNITED STATES IN APRIL, 1908.[1]

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd.
*†2.	Chic., Burl. & Q.	Spanish Lake	rc.	P. & Ft.	1	1
15.	P., C., C. & St. Louis.	Collier, W.Va.	xc.	Ft. & Ft.	2	0
20.	Buf., Roch. & Pitts.	Rock Glen.	bc.	P. & Ft.	1	20
30.	Erie	Cleveland.	xc.	P. & P.	0	5

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	No. persons reported Inj'd.
3.	Wabash.	Catlin, Ill.	Pass.	b. rail.	0	5
10.	A., T. & Santa Fe.	La Plata, Mo.	Pass.	d. track.	0	4
14.	Northern Pacific	Glendive, Mont	Pass.	acc. obst.	2	1
17.	A., T. & Santa Fe.	Toluca, Ill.	Pass.	malice.	1	0
*20.	Great Northern	Summit, Mont.	Pass.	slide.	0	0
23.	Chic., P., & St. Louis.	Alton, Ill.	Ft.	washout.	1	0
24.	Erie.	Canisteo, N. Y.	Pass.	b. tire.	0	3
25.	Seaboard Air Line.	Tucker, Ga.	Ft.	d. bridge.	2	1
27.	St. Louis & San Fran.	Stanley, Okla.	Pass.	unx	0	20
28.	Pennsylvania	So. Elizabeth.	Pass.	acc. obst.	1	3
30.	Pennsylvania	Pittsburgh.	Pass.	unx.	0	4

Other Accidents.

Date.	Road.	Place.	Kind of train.	Cause.	Kil'd.	Inj'd.
7.	New York Central.	Floodwood.	Ft.	boiler.	0	7
9.	N. Y., N. H. & H.	Derby.	Ft.	boiler.	0	3

Of the dozen electric car accidents reported in the newspapers in April one resulted in the death of nine persons and three others were notable. The fatal one was a butting collision on the 28th between cars of the Detroit, Jackson & Chicago near Ypsilanti, Mich. Both the eastbound and the westbound cars were heavy and were running at high speed, the collision happening on a curve where the view was short. The responsibility is laid at the door of the motorman of the eastbound car, who was killed. The running time of this car had been changed, beginning on the day of the collision, but no evidence is published to show that this was the cause of the motorman's error. Whatever may have been his assumption as regards his right to the road, he ran at full speed past the side track where he should have waited. According to a press despatch the state railroad commissioner of Michigan attributes the collision to faults in the despatching system, and will take steps to secure the adoption of "a standard system of despatching"; he will call a meeting of railroad officers for this purpose. What is meant by "a standard system" we do not know; but the commissioner should know that the best standard in existence is unsatisfactory without the use of the block system along with it. The improvement of the American despatching system has been discussed for 25 years, but it still remains unsatisfactory. Those roads which have made the most intelligent and persistent attempts at the improvement of the despatching system are now adopting (or extending) the block system, the use of which removes the necessity for the impossible refinements of the despatching system. This action of these roads would seem to indicate that efforts to accomplish a satisfactory degree of safety by the use of the despatching system are likely to be fruitless.

At Chicago, on the 7th, the leading car of an elevated railroad train jumped the track near Indiana avenue and one end of it fell to the ground, lodging in the back yard of a residence. The rear end of the car, however, remained leaning against the elevated structure. Of the 50 persons in the car, eight were seriously injured. On the Washington, Baltimore & Annapolis electric road, near Crownsville, Md., on the 12th there was a butting collision of cars in which eight persons were slightly injured. In this case it is said that a special car standing on a side track was mistaken by the motorman of the eastbound car for the regular which he should meet.

Near Williamsport, Pa., on the 22d, nine lumbermen were killed and 15 others seriously injured in the wreck of a runaway train of logs; but this is not to be classed as a "railroad accident" as it occurred on a logging company's track.

A collision in Australia, on the 19th, killing 41 persons, and one in Mexico, on the 24th, killing 28, have already been reported in the *Railroad Gazette*.

[1] Abbreviations and marks used in Accident List:

rc........Rear collision.
bc........Butting collision.
xc........Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.........Broken.
d.........Defective.
dr........Defect of roadway.
eq........Defect in car or engine.
n.........Negligence.
unf.......Unforeseen obstruction.
unx.......Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman).
ms........Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.......Cars burned while running.
Pass......Passenger train.
Ft.......Freight train (includes empty engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

New York Central & Hudson River.

The annual report of this company for the calendar year in 1907 is of quite unusual interest, for several reasons. It will be recollected that the first train operated by electricity on this company's line ran into Grand Central on September 30, 1906, and that on December 11, 1906, regular service with motor cars for the Yonkers local trains was begun between the Lexington avenue temporary terminal and the present terminus of electric operation on the Hudson division at Highbridge, the trains being hauled thence by steam locomotive to Yonkers. Therefore, as far as electrification is concerned, 1907 represents the first complete year of operation.

The difficulties have been very great. Yard and station changes have been continuous. The New Haven road has not even yet got to the point where it hauls all trains out of its part of the station by electricity, and the New York Central has consequently been impeded by the long-drawn-out continuation of the construction stage of the work. Both the New York Central locomotives and the New Haven locomotives fall short of satisfactory performance, one company experiencing its principal difficulty in obtaining full tractive power; the other in the effect of the electric locomotives upon the track. To add to these difficulties, the New York Central has not yet been able to extend the zone of electric operation beyond the boundary at Highbridge on the Hudson division, and delays at these points are none the less irritating because they are inevitable. The multiple-unit trains have proved to be a heavy drag on the steam locomotives used to draw them over the portions of their run which have not yet been put under electric operation, and this has occasioned further delays.

To add to the embarrassment of its local service, the west side extension of the Interborough Rapid Transit subway has taken a great deal of the short haul traffic and made many of the commutation trains entirely unprofitable. While following out a natural desire to economize in a period of depression by reducing unprofitable train service, the company has encountered severe local opposition and has had to comply with the train service requirements of the Public Service Commission. But it can be freely said that the suburban difficulties have been gradually clearing away, and may be expected to make themselves less and less felt, with each succeeding month. The great advantages of operating this kind of traffic by electricity are bound to make themselves felt as soon as the unsatisfactory mixture of steam and electric service in the same territory is done away with. Nevertheless, these suburban difficulties make perhaps the most characteristic feature of the company's year.

Another very interesting development, brought out during the past year, has been the practical demonstration of the value of the company's "equities." The market price of New York Central has always been higher than would have been justified by its available surplus earnings, and the reason for this, apart from the geographical location of the lines, has lain in the fact that some of the subsidiary properties, notably the Lake Shore & Michigan Southern and the Michigan Central, were earning free and clear a good deal more than they were paying out in dividends and were putting the money back into permanent improvements which increased earning power. The actual value of these "equities" was clearly shown this year. Net earnings of the New York Central in 1907 after all expenses were $3,262,087 smaller than they were in 1906, but by the simple device of increasing the dividends of subsidiary companies, the company increased its "other income" $3,768,313, so that the gross income available for charges and dividends was half a million dollars greater in 1907 than in 1906, and net income after charges, including the interest on the three-year 5 per cent. gold notes of 1907, was $116,182 greater than in 1906.

Gross earnings were $98,369,060, as against $92,089,769 in 1906, the increase being occasioned in considerable part by the large additional tonnage both of bituminous and anthracite coal as compared with the unusually light tonnage during the first six months of 1906, at the time of the strike in the bituminous coal fields. The average freight haul for the year shows a slight increase, but the relative increase in coal tonnage as compared with that of higher class freight produces the decrease in the average haul per ton per mile. Passenger earnings were $29,847,859—just about half the freight earnings—an increase of $1,269,081, due entirely to the volume of business interchanged with foreign lines, since commutation business continued to decrease, doubtless for the reasons already outlined in this review. The company has an important equity, if it may so be called, in the undeveloped state of its commutation business at the present time in densely populated territory, and when it gets its electric operation in really first class shape, it can add very materially to its passenger profits from this source. The profit of an ordinary commutation service, with steam trains, is a moot point; at best, it is doubtful, but an electric service permitting of very frequent trains in relatively small units without unduly high costs is probably going to change this, as soon as it gets a fair chance to do so. The results will be watched with great interest.

At the close of 1907, the Lake Shore dividend was increased from 8 to 12 per cent.; the Michigan Central dividend, from 4 per cent. to 6 per cent. (annual basis), and the New York Central rate from 5 per cent. to 6 per cent. In connection with the increased stock, of which $149,300 was issued during the year, this increase in the dividend rate cost the company $2,885,036; the entire dividend payments in 1907 amounting to $10,717,920. A quarterly dividend of 1½ per cent. was paid in January, 1908, in spite of the great falling off in earnings, but at the March meeting the road was put back on a 5 per cent. annual basis, and the April dividend was 1¼ per cent. Prior to the panic, the company was well able to pay the higher rate, in spite of its very large legitimate capital requirements, and it may be surmised that it will be able to do so again before many years.

An agreement was entered into during 1907 between the New York Central and the Pullman Company, providing for Pullman car service for 25 years from January 1, 1905, and with the Western Union Telegraph Company, for telegraph service for 30 years from January 1, 1906. These contracts supersede all prior agreements with these companies and are more favorable in their terms to the railroad company. The company's holding of 5,748 shares of Boston & Maine stock, acquired during the previous year, was exchanged for an equal amount of the capital stock of the New Haven road during 1907. The New York Central's funded debt was not changed during 1907, but to obtain equipment for immediate requirements the New York Central, Lake Shore, Michigan Central, Big Four, and the Chicago, Indiana & Southern have become parties to an equipment trust dated Nov. 1, 1907, providing for an issue of $30,000,000 of equipment trust certificates, being 90 per cent. of the total cost of the equipment to be furnished under the terms of the agreement. J. P. Morgan & Co., and Drexel & Co. offered these equipment trust certificates in January, 1908, on the basis of about a 5¾ per cent. yield to the purchaser.

Since the publication of the report, perhaps the most important item of news about the company is the fact that the option on the controlling interest in the New York, Ontario & Western, given during 1907 to the New Haven road, and expiring early in January, 1908, has been extended indefinitely, probably until the New Haven-Boston & Maine tangle is straightened out.

Maintenance of way per mile of road operated in 1907 was $3,295, against $3,052 in 1906. Repairs and renewals of equipment cost $2,242 per locomotive, against $2,038 in 1906; $836 per passenger car, against $723 in 1906, and $76 per freight car, against $60 in 1906. The company spent for additions to property and charged to capital account $6,400,000. About $1,000,000 was spent in double-tracking the West Shore railroad between Churchill, N. Y., and Syracuse junction; third and fourth tracks between Lake Crossing, Mass., and South Framingham, on the Boston & Albany, cost $184,000, and third track at various other places on the Boston & Albany cost an additional $379,000. Maintenance expenses used up about the same percentage of gross earnings last year as in 1906, but conducting transportation increased from 40.17 per cent of gross earnings to 46.76 per cent.

Traffic statistics show slightly increased efficiency of operation. The average trainload of revenue freight was 419 tons carried per train-mile, an increase of 16 tons over the previous year. While the empty freight car mileage increased from 219,000 to 278,000, the average number of empty freight cars per train-mile remained precisely the same, that is 12, in 1907 as in the previous year.

The principal statistics of operation were as follows:

	1907.	1906.
Mileage worked	3,782	3,784
Freight earnings	$59,406,147	$54,824,283
Passenger earnings	29,837,859	28,568,778
Gross earnings	98,369,060	92,089,769
Maint. of way and struct.	12,162,047	10,718,599
Maint. of equipment	14,823,631	14,569,057
Conducting transportation	45,995,903	37,267,589
Operating expenses	75,803,334	64,953,695
Net earnings	22,565,726	27,136,073
Other income	11,476,051	7,707,738
Gross income	34,041,777	34,843,811
Net income	11,083,829	12,275,907
Dividends	10,717,920	7,832,885
Appropriated for betterments	......	4,108,261
Year's surplus	66,539	19,134

NEW PUBLICATIONS.

Practical Hydraulic Tables and Diagrams. By C. B. Heasden, Superintending Engineer P. W. D. India. London and New York: Longmans, Green & Co. 105 pages. 7 in. x 4¾ in.

The object of this collection of tables and diagrams is to afford a means of quickly ascertaining the sizes and cost of the pipes required for a complicated system of water supply. Incidentally, they also apply to surface drains and underground sewers. They were originally designed for personal use and they bear the marks of this purpose even in their final form in that the compiler has overlooked the fact that the engineer who will use them is not as familiar with all of the methods and the abbreviations that are used as the compiler himself. Until this familiarity has been obtained, it is necessary to refer back constantly so as to see what the signs and symbols that are used refer to. This holds not only for the formulas but also for the tables and diagrams as they are presented in their completed shape for use. The value of frequent repetitions of the meaning of symbols cannot be too strongly emphasized where a book is to be used for reference and there is to be a search for one item of information only, regardless of what has preceded or what is to follow.

In a book like this where the final results only are to be used and the steps in the process are not fully explained, it must be borne in mind that the user is presupposed to have a large amount of information on the subject, so that there is no review of the general principles of hydraulics. For this subject, only the methods of preparing the tables are given, and it will be necessary for the engineer to make himself perfectly familiar with these methods and back this familiarity with a further knowledge of hydraulics before the tables can be successfully used. This can only be accomplished by a careful study of the development of the formulas and their results from the start, and when this has been done the tables and diagrams will be found to be in such form that the determinations of size and capacity of the piping to be used will be rapidly made.

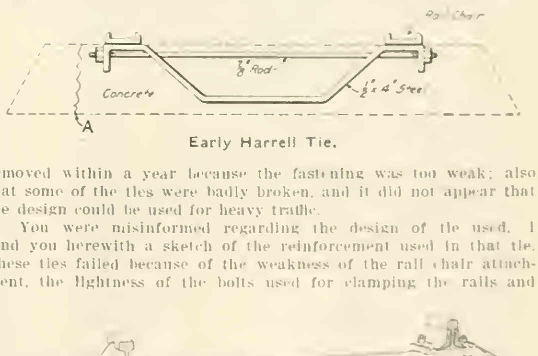
CONTRIBUTIONS

The Harrell Reinforced Concrete Tie.

Chicago, May 7th, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

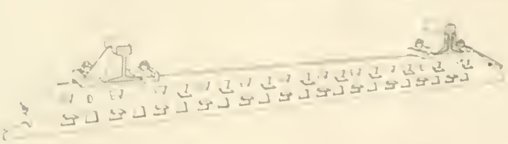
In the editorial on Metal and Reinforced Concrete Ties in your issue of May 1 you say there were 30 Harrell perforated vertical center-plate composite ties put in the Pennsylvania main line track near Harrison street, Chicago, in 1899. You state that they were all



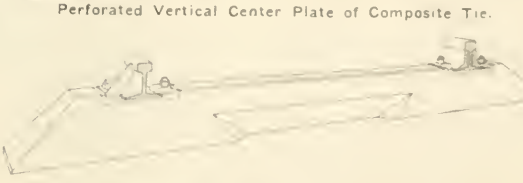
Early Harrell Tie.

removed within a year because the fastening was too weak; also that some of the ties were badly broken, and it did not appear that the design could be used for heavy traffic.

You were misinformed regarding the design of tie used. I send you herewith a sketch of the reinforcement used in that tie. These ties failed because of the weakness of the rail chair attachment, the lightness of the bolts used for clamping the rails and



Perforated Vertical Center Plate of Composite Tie.



Harrell Composite Tie.

Length, 8 ft.; depth [illegible]; width at bottom [illegible] 10 [illegible]; width at bottom in center, 11½ in.; [illegible] at top [illegible]; weight, approximately, 375 lbs. Reinforcing steel plate, 7 in. wide and [illegible] in. thick with 40 perforations 2 in. square. Bolts ¾ in. x 4 in. Rails clamped to and bear directly on steel center. End plates and bolts can be removed without disturbing the concrete.

the absence of reinforcement outside of the rail. The concrete in some of them broke at the point marked A in the sketch.

I also send you a drawing of the perforated vertical center-plate tie. The first ties from this design were made by McCord & Co. in 1901, 1,000 being made on contract at Hegewisch, Ill. These were tested in the tracks of the Illinois Car & Equipment Co.'s plant at Hegewisch and proved fully satisfactory. J. J. HARRELL.

Snow Fences.

Chicago, May 15, 1908.

To the Editor of the Railroad Gazette:

In your issue of May 8, page 636, I notice a statement in "Picked Up on the Road" which I know to be erroneous. Gulf says that snow fences were not common in this country until subsequent to 1893. I entered the service of the Chicago, Burlington & Quincy in October, 1882. In January, 1883, I made a trip over the entire line from Burlington, Iowa, to Denver, Colo., on a special. We also traveled some distance on the Humeston & Shenandoah (afterwards the Keokuk & Western and now part of the Burlington system), the Missouri Pacific and the Union Pacific. On all these roads as well as on the C., B. & Q. there were snow fences set up virtually along the same lines as we have them to-day.

I remember it distinctly because they were the first I had ever seen. From 1883 until 1893 I was employed on work that required my supervision of the taking down and storing snow fences for the summer and repairing same and setting them up in the fall.

As my duties along that line ceased in 1893 I know that it was prior to that time that snow fences were in general use throughout Illinois, Iowa, Nebraska, Kansas, Missouri and Colorado. I cannot say whether or not they were used further north at that time. If the Frenchmen did not adopt snow fences until 1890 they were certainly behind us. JAMES B. LATIMER,

Signal Engineer, Chicago, Burlington & Quincy.

For Better Car Wheels.

New York, May 18, 1908.

To the Editor of the Railroad Gazette:

In response to your invitation to present the car wheel subject again I will undertake to do so even at the risk of repeating some things that have been said before, and some things that are so well known that to mention them seems unnecessary.

No matter how old the car wheel story may be, no one can deny that it is a matter of increasing concern from year to year. Railroads may be constructed and operated according to one standard of merit or another. If the standard is good the results will correspond; if the standard is bad then the particular railroad in question will suffer. But there is one thing over which no railroad has control in respect to its particular standard of practice, and that is the car wheel. One of the leading American railroads has in the matter of its car wheel supply followed for years the plan of selecting its own materials conducting its own wheel manufacturing operation, and yet probably suffers as much as any other railroad of like magnitude with respect to the results obtained from wheels under cars running over its lines. The reason being that so large a proportion of its traffic consists of hauling cars built and owned by other companies, or even of its own cars equipped with wheels replaced on the lines of other companies. The same result obtains in great or lesser degree in the case of every railroad company endeavoring to live up to the standard of good practice in the purchase and use of wheels. If a car breaks down it is repaired and the cost charged where it belongs. If a rail breaks the penalty is paid by the railroad that purchased the rail, but the car wheel is purchased by any one railroad, to fail, perhaps, on some other, and allowing for the few dollars that may be recovered in the few instances that owners can be held responsible—the penalty is paid by the railroad on which the failure occurred. This one fact places the car wheel in the front rank of items for which any one railroad may have to pay the bill for the order of practice carried on by any other.

The failure of one wheel running under a car on tracks adjoining other tracks on which passenger trains with every part of equipment maintained at the highest standpoint of quality and efficiency may precipitate an accident as fatal to life and property as the failure of tho most carefully constructed part of the passenger train. In these days of continuous operation of passenger and freight trains over tracks but a few feet apart there is little time or opportunity to avoid the results of such accidents and the whole operation becomes one in which all parts affect other parts—the failure of one involves disaster to another. Such observations are part of the old story—to repeat them as stated seems unnecessary, but the point is, are they true, and is the effort to guard against such dangers being exercised as energetically as should be. There is no doubt that the great majority of the makers and users of wheels give their best efforts under their control to safeguard such operations, and that there is a greater appreciation than ever before of the necessity of bringing the order of practice as near as possible to the best standard on the part of all concerned.

The difficulty seems to be to agree upon the way in which progress toward the desired end can be made. Taking it for granted that it is the desire of all concerned to bring the car wheel up to the necessary standard of safety and durability, the first necessity is to determine the conditions which have to be met and provided for in the present order of operations, compared with those that existed a few years ago, when the makers and users of wheels were better able to meet the situation. There is a vital necessity of prompt action in this respect because there appears to be differences of opinion on matters which after all are simple mechanical questions.

The increased load and speed have produced two effects on the wheel.

First.—It has become more liable to failure through inability to support the load.

Second.—It has been called upon to sustain greater physical and molecular changes in the parts immediately affected by breaking friction and the shocks and strains of service. As the result of investigation and study of present service conditions and as proved by statistics concerning them it may be conceded that the strength of the wheel *as a whole* is sufficient. The percentage of failure in this regard is not increasing; in fact, considering the great increase in hardship of service, it may be said that progress in this direction is most satisfactory. During the past few years the subject has received such attention and study from the wheel makers and railroad officials through the action of their representative associations that uniform standards of section and weight for different classes of service have been adopted and have been put into general use with a promptness seldom known in past experience.

The results of the second effect referred to are more difficult to provide for. There has been a marked increase in the percentage of wheels removed for certain causes, and whether this increase can be or should be prevented by the maker or user of wheels is a question that so far is responsible for a great deal of delay in finding the remedy.

Naturally the user looks to the maker to provide the remedy if possible. The average railroad mechanical officer is a busy man; he has many problems to solve that call for immediate action, and until general problems become acute he does not usually spend much time upon them. In this part of the car wheel problem a practical if not technical knowledge is needed, and it is not to be expected that such knowledge is possessed by all concerned. To make careful investigation, to seek information from those having it and to be governed accordingly, is after all the most that can be expected from the average railroad official of the kind.

On the part of the manufacturer, to study conditions of manufacture and service, and to make provision so far as the limits of possible cost and price obtained, will admit whereby wheels suitable for the increased service conditions may be supplied is about all that can be expected.

The natural tendency of both maker and user is to feel that the responsibility rests principally on the other man. That may be so, but when both are confronted with a condition which involves the safety of life and property, and that condition is becoming daily more critical, then it becomes the duty of each to find the remedy as quickly as possible.

To provide the remedy in this case must first depend on finding the cause. The defects referred to in which the increase is serious are confined to the wearing surface of tread and flange. Fine cracks in the surface coming in contact with brake-shoe and rail develop until groups of such cracks make the wheel defective.

Some railroad officials and some car wheel makers say that it may be possible to make certain changes in the quality of metal used or in the process of manufacture that will overcome this defect—in other words prevent its occurrence.

This statement disregards the fact that the repeated heating and cooling of the surface of any metal will inevitably produce similar effects, for the reason that rapid heating of the surface causes expansion which does not occur with the metal under such surface and unless the heating is gradual enough to permit the proper expansion of the metal as a whole, then the heated part must expand regardless of the fact that expansion does not take place in adjoining parts.

When the surface of the tread and flange of the wheel is quickly heated and expands, the fine surface cracks must occur. Considering the great number of times that such surface heating is caused by the friction of brake-shoes, there can be no question that the reason for the defects in question arises from the condition described. No metal used in car wheels can be free from such defects under such conditions. It may be that certain changes in material used will apparently produce better immediate results, but this will be due to the fact that trials of that description occupy a certain period of time, during which the defects are developing in the trial lot of wheels.

The condition that produces such defects is repeated many times before its worst results accumulate and become plainly evident.

In any case railroads that have manufactured their own wheels, using the best of material, suffer as much from the defects referred to as those that have given much less time and trouble to the matter.

The conclusion that seems apparent is that relief will be obtained only by decreasing the severity of the conditions causing the defect or by providing some means of changing such conditions.

To find qualities of metal that will stand constant and excessive heating and rapid cooling and that will produce the conditions of safety and durability under such treatment, may be a future but certainly is not a present possibility. It therefore appears necessary to develop some other means of preventing the trouble. The need for some effective action is very great. Wheel manufacturers and railroad officials appreciate that fact. Not only does the great reduction in life of wheels cause a heavy increase in cost of operations but the menace of accidents that must result from the large number of wheels that are constantly having to be removed for the defects described is very great.

It is natural to conclude that if a large and increasing proportion of all wheels removed show flange defects, there is danger of accidents from wheels in service with similar defects. It is natural also that considerable time should be required to investigate and work out such matters, but after all the subject is about the most important practical one before the railroad public.

It appears from statistics that over 50 per cent. of all wheels are removed from service on account of flange wear and flange defects, and that the proportion is increasing. Some way must be found of meeting such a situation. There are about 20 million car wheels in use in America, of which over 95 per cent. are chilled wheels, the balance steel tired or solid steel wheels. A great deal has been said and written of the comparative merits and the demerits of each kind of wheel. That is probably a question that will be determined by service results.

The chilled wheels possess the advantage of low first cost, high relative scrap value and long life under proper conditions of service with very little expense of maintenance. The hardness of the wearing surface of tread and flange exceeds that of steel by about the relative difference in the proportion of combined carbon present in the metals.

Steel wheels have not been used under freight cars to a sufficient extent or for a sufficient time to afford very much knowledge of what they will accomplish and to what extent maintenance cost will be increased. Probably both classes of wheels have their advantages in point of wear and economy for certain classes of service, but these advantages will be determined by service results only.

If the situation is to be relieved by the use of steel wheels then railroads must certainly face a very heavy increase in first cost and maintenance charges. If it is to be by some modification of the chilled wheel then it is time for modifications to be tried. Railroads must have wheels that will do the work safely regardless of cost—to disregard this fact would be impossible. To allow the present condition to grow from bad to worse is not sensible.

Chilled wheel manufacturers have not changed their conditions of practice as much as might have been done to keep pace with the increasing demands of service, but this is largely if not wholly due to the fact that railroads in general have been unwilling to pay prices for car wheels that would admit of any such changes and improvements.

It appears now that railroads may take a different view in such matters, and it behooves the chilled wheel makers to take up the subject actively; otherwise the inference will become established that in the opinion of the majority of wheel makers improvements are not possible.

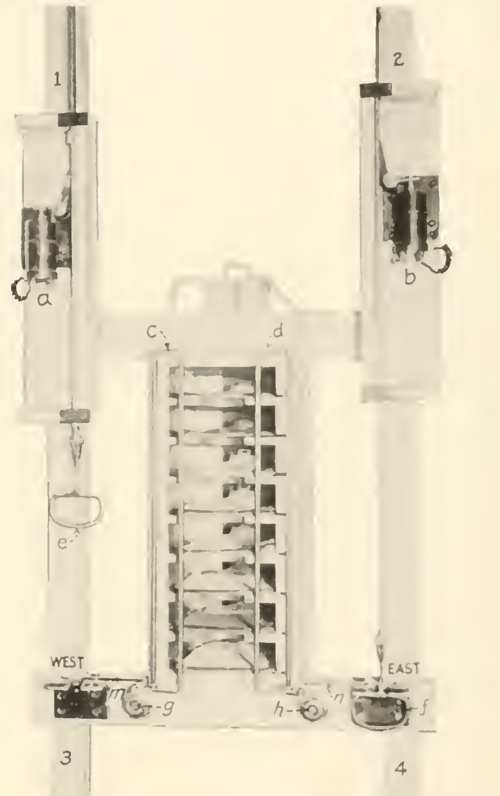
Of course such an inference would be absurd but only active work on the wheel makers' part will avoid its establishment. There is also the disinclination on the part of some wheel makers to concern themselves about such matters. In some particular sections of the country the use of heavy capacity cars has not yet attained considerable proportions, and wheel makers in such localities no doubt feel that they are not particularly concerned. The broad fact is, however, that the use of heavy equipment is rapidly increasing and that some way must be found of bringing the car wheel up to the point of greater safety and durability without much further delay.

F. H. GRIFFIN.

A Locked Cabinet for Train Orders.

The photographic illustration given herewith shows a safety device for handling train orders, invented and patented by W. R. Scott, Assistant General Manager of the Southern Pacific, at San Francisco, and E. M. Cutting, Supervisor of Signals of the Western division, of which Mr. Scott was formerly superintendent. The purpose of the invention is to keep operators from forgetting to deliver orders to trains, and this purpose is carried out by locking up the orders and blanks so that the operator cannot get a blank to use for making an order until his signals are displayed in the stop position. The different parts of the illustration are indicated as follows: 1, 2, 3, 4, frame; *a*, *b*, solenoid locks on signal levers; *c*, *d*, frames, in the nature of doors, by which the train order clips are locked in the cabinet; *e*, *f*, handles by which the signals are cleared; *g*, *h*, push buttons for closing electric circuits; *m*, rod connected to the door for preventing the locking of the handle of the signal lever in the clear position when clip boards are out.

The cabinet has as many shelves as may be required to furnish one for each train-order clip-board in use. These boards have at their back ends brass strips by means of which, when put in place on the shelf, they close each an electrical connection forming part of the circuits to the locks *a b* on the signal levers. With all the clips in place, the electric circuit is completed, so that by pressure on button, *g* or *h*, current from the battery is supplied to the solenoid *a* or *b* withdrawing the dog from beneath the boss on the signal rod and allowing the signal to be pulled clear. Either or both locks may be energized by pressing the appropriate button or buttons. Both signals must be displayed at stop before the operator can withdraw a clip-board, as both doors must be opened before a board



Southern Pacific Train Order Cabinet.

can be taken out. When the doors are open they prevent fastening the signals at clear by pushing rods *m* and *n* over the hooks by which the signal handles are held down. With any board out, it is impossible to close the circuit to either lock, and, therefore, the operator is unable to clear either signal until the boards are all restored to their places.

Having taken an order, the operator leaves it on the clip-board until the conductor comes in to affix his signature, and, with the board (and order) out of the cabinet, the operator may go about his other duties being assured that his signal is displayed at stop. Having delivered an order he restores the clip-board to the cabinet and closes the doors *c d*. Having closed these he has withdrawn rods *m n* so that either of the signal handles *e* or *f* may be hooked down, and therefore he can clear either signal.

The division between Russia and Japan on that part of the Chinese Eastern Railroad which extends from Charbin southward to Port Arthur is at the station Kuanchentsy, 148 miles south of Harbin, and 428 miles north of Port Arthur. The Japanese narrowed the gage on their part of the line, so that through trains are now impossible. Provision is made for tracks of both gages for 20 miles south of Kuanchentsy to Changchun, where transfers from southbound trains will be made. Kuanchentsy is the transfer station for northbound traffic.

Accident Bulletin No. 26.

The Interstate Commerce Commission has issued Accident Bulletin No. 26, giving a summary in the usual form of the railroad accidents in the United States during the three months ending December 31, 1907. The number of persons killed in train accidents was 220 and of injured 1,187. Accidents of other kinds, including those sustained by employees while at work and by passengers in getting on or off cars, etc., bring the total number of casualties up to 20,458 (1,092 killed and 19,366 injured). These reports deal only with (*a*) passengers and (*b*) employees on duty.

TABLE No. 1.—*Casualties to Persons.**

	Passengers Kil'd.	Passengers Inj'd.	Employees Kil'd.	Employees Inj'd.	Tot'l persons reported Kil'd.	Tot'l persons reported Inj'd.
Collisions	11	1,477	105	1,188	119	2,665
Derailments	7	629	71	519	78	1,148
Misc. accidents and boiler explosions	..	19	23	355	23	374
Total train accidents	21	2,125	199	2,062	220	4,187
Coupling or uncoupling	..	.....	77	945	77	945
Other work about trains or switches	..	.....	64	4,771	64	4,771
In contact, bridges, structures, etc.	..	5	26	422	26	427
Falling from or getting on cars or engs.	36	568	181	3,395	217	3,963
Other causes	24	626	464	4,447	488	5,073
Total, other than train accidents	60	1,199	812	13,980	872	15,179
Total all classes	81	3,324	1,011	16,042	1,092	19,366

*In Table No. 1 "passengers" includes passengers traveling on freight trains, postal clerks and express messengers, employees on Pullman cars, newsboys, live-stock tenders, men in charge of freight, etc.

This bulletin shows marked decreases in nearly every item of Table No. 1, reflecting the marked falling off in traffic which began last autumn on practically every railroad in the country. The largest proportional decrease, that in the number of passengers killed in train accidents, is in an item which is not so directly proportionate to the volume of traffic; this for reasons which have been noticed in previous bulletins; while the fatal accidents to passengers from other causes—largely from their own negligence or want of caution—have not decreased (60 now, 54 a year before). This probably indicates that the decrease in the total number of passengers traveling was not large; while, on the other hand, the diminution in the number or the severity of accidents affecting only trainmen undoubtedly is due, not alone to a falling off in traffic, but also to the diminished pressure under which the trainmen do their work. With the reduction in the volume of traffic there has been less of overwork and excessive hours, and also probably a weeding out of the less competent men.

The list of train accidents notable by their magnitude, heretofore of considerable length in each quarter, is now happily much reduced, the chief items in Table 2*a* being collisions 1, 9 and 11. Derailment No. 1, though comparatively of small magnitude, is noticeable as being one of a new class. It was a derailment of an electric car, running alone. Electric railroads doing interstate business have been so few that hitherto their reports have not been prominent in the accident records. Cars running alone are subject to accidents from defective brake apparatus which in trains of cars would not cause serious trouble.

In the amount of damage done to cars and engines there is no important decrease, as compared with the corresponding quarter in the preceding year.

TABLE 1*a*. *Comparisons with Last Bulletin and with Same Quarter One Year Back.*

	Bulletins No. 26.	No. 25.	No. 22.
Passengers killed in train accidents	21	110	180
Passengers killed, all causes	81	195	234
Employees killed in train accidents	199	236	294
Employees killed in coupling	77	87	84
Employees killed, all causes	1,011	1,144	1,196
Total passengers and employees killed, all causes	1,092	1,339	1,430

The total number of collisions and derailments was 3,964 as below:

TABLE No. 2. *Collisions and Derailments.*

	No.	Loss.	Killed.	Injured.
Collisions, rear	508	$472,847	39	705
" butting	264	474,144	46	1,051
" train separating	166	58,869	2	88
" miscellaneous	1,156	530,863	32	821
Total collisions	2,094	$1,536,723	119	2,665
Derailments due to:				
Defects of roadway, etc.	404	$243,272	10	299
Defects of equipment	819	650,528	9	224
Negligence of trainmen, signalmen, etc.	129	86,874	9	85
Unforeseen obstruction of track, etc.	84	92,720	17	169
Malicious obstruction of track, etc.	23	27,521	7	38
Miscellaneous causes	411	324,822	26	333
Total derailments	1,870	$1,425,747	78	1,148
Total collisions and derailments	3,964	$2,962,470	197	3,813

TABLE 2*a*.—*Causes of Forty-One Prominent Train Accidents (Class A).*

[NOTE.—R. stands for rear collision; B, butting collision; M, miscellaneous collisions; D, derailment; P, passenger train; F, freight and miscellaneous trains.]

COLLISIONS

No.	Class	Kind of train	Killed.	Injured.	Damage to engines, cars & roadway	Reference to record	Cause
1	B.	P. & F.	5	0	$2,125	76	Passenger train ran over misplaced switch and into head of freight train standing on side track; dense fog; man in charge of switch in service only five days but had been employed by this company two years before.
2	B.	P. & F.	0	18	2,215	46	Eastbound passenger collided with westbound standing freight; passenger ordered to run on westbound track; operator wrongfully reported freight had cleared that track. It was standing near his cabin, but he thought, or assumed, that it had passed.
3	R.	F. & F.	1	2	2,500	71	Engineman (killed) disregarded flag; had been on duty 28 hrs.
4	B.	F. & F.	2	1	2,500	81	Misplaced switch; misplaced by brakeman of seven months' experience; on duty 18 hrs. 30 mins.
5	R.	F. & F.	0	3	2,520	82	Failure to protect standing freight train by flag; conductor asleep in cab; flagman also in caboose; these men on duty 13 hrs. 57 mins.; following train had been warned by two torpedoes.
6	R.	F. & F.	3	0	3,275	41	Freight standing at water station not protected by flag; 3 men in caboose killed.
7	R.	P. & P.	1	4	5,075	5	See note in text below.
8	B.	P. & F.	0	11	5,725	20	Conductor held order giving him until 6:15 to reach a certain station; took it for 6:50 and so told engineman; engineman did not read order; order not shown to fireman or brakeman.
9	R.	P. & P.	3	36	5,920	67	Three passengers killed; passenger train ran past automatic block signal indicating stop and struck passenger train standing at station. Engineman on duty 11 hrs. 20 mins.
10	B.	P. & F.	1	165	6,042	12	Conductor and engineman of empty engine overlooked schedule of regular passenger train; engineman's experience, 6 months. Engineman depended on conductor; conductor forgot.
11	R.	P. & P.	3	22	6,500	68	Three passengers killed; train in yard not protected by flag; other train approached at uncontrollable speed in dense fog.
12	B.	P. & P.	0	15	6,660	13	Misplaced switch; southbound train ran through cross-over in dark tunnel and engineman did not discover that he was on wrong track; switch not in working condition; had been spiked, but was loosened and turned by employee of contractor without authority.
13	M.	P. & F.	1	1	6,980	9	See note in text below.
14	B.	P. & F.	0	10	7,100	75	Order misread by engineman; conductor did not deliver order to engineman in person as required by rule.
15	B.	P. & F.	1	3	7,927	79	Freight had 1 hr. 10 min. on time of passenger train; conductor and engineman unaccountably calculated 2 hrs. 10 min., though they had read the order aloud.
16	M.	F. & F.	0	1	9,252	55	Cars ran out of siding at night; derailing switch 290 ft. from fouling point; cars had been left outside of derailing switch.
17	B.	P. & F.	2	11	9,900	45	Conductor and engineman of freight overlooked schedule of passenger train.
18	B.	F. & F.	3	2	10,150	7	Cars ran out of side track. Contrary to orders, cars had been left on unsuitable temporary track. Believed brakes had been maliciously loosened.
19	B.	F. & F.	1	1	10,170	13	Northbound train approached station at uncontrollable speed; engineman, experienced, did not manage air brakes properly.
20	B.	F. & F.	1	4	10,500	8	Southbound met one northbound train, but men forgot that order specified two trains. Conductor (10 years' experience as brakeman) was on his first trip as conductor.
21	B.	F. & F.	2	1	10,800	51	Operator neglected to deliver one of four orders. Conductor accepted other orders knowing his signature had been prematurely and wrongfully sent to despatcher. Operator in service at this place 12 days.
22	B.	P. & F.	3	53	12,400	16	Misplaced switch at meeting point; brakeman, 8 months' experience, on duty 20 hrs. 40 mins.; should have closed switch, and claims that he had done so.
23	B.	F. & F.	1	2	12,800	1	Disregard of distant and home signals approaching station (2 a.m.); engineman believed to have been asleep; brakeman in cab also probably asleep; fireman not well acquainted with road.
24	B.	P. & P.	1	10	13,650	42	Collision opposite station, both enginemen disobeying rule to approach under control. (See note in text below.)
25	R.	F. & F.	0	3	15,789	72	Standing freight not protected by flag; flagman's experience 1½ years; damage largely due to fire started from broken stove in caboose and from overturned engine.
26	B.	F. & F.	1	5	17,000	19	See note in text below.

No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars & roadway.	Reference to record.	Cause.
27	M.	F. & F.	0	2	20,700	84	Westbound freight backed through cross-over into eastbound freight; brakeman, in service two months, set cross-over switch instead of side-track switch, as ordered.
28	B.	P. & F.	3	39	15,700	44	Conductor and engineman northbound freight encroached on time of regular southbound passenger train: men on duty 19 hrs. 52 mins. They knew that they were on the time of the passenger, detached engine and tried to reach station, evidently depending on possibility of passenger being a little behind time.
Total..			38	457	$271,875		
							DERAILMENTS.
1	D.	P.	1	35	$350	63	Excessive speed on curve due to broken brakebeam (electric car running alone).
2	D.	F.	0	3	2,700	29	Runaway on 2.2 per cent. descending grade; bad management of air; train pipe leaky; hand-brakes not promptly used. Engineman, on duty 28 hrs., did not seasonably signal to apply hand brakes.
3	D.	P.	1	13	3,100	32	Accidental obstruction; wreck caused by derailment No. 10.
4	D.	F.	1	0	5,865	35	Excessive speed on curve and steep descending grade; engineman making his first trip on this branch; conductor applied air brakes in caboose, but applied them too suddenly and broke coupling between engine and tender.
5	D.	P.	1	10	7,894	93	Two cars of passenger train blown off track by high wind.
6	D.	P.	0	3	10,287	97	Unknown.
7	D.	F.	0	2	10,400	95	Runaway on descending grade. (See note in text below.)
8	D.	F.	0	2	10,977	65	Mast of steam shovel struck overhead bridge, and bridge was weakened and fell. Height of shovel 19 ft. 6¾ in., clearance at bridge had formerly been 19 ft. 7 in., but new and thicker ties had been put in, raising the rails.
9	D.	P.	1	12	11,100	57	Accidental obstruction; wreck of freight train on adjacent track derailed by shock due to automatic application of air brakes. Triple valve on one car too sensitive.
10	D.	F.	0	0	13,210	31	Broken flange.
11	D.	F.	1	3	16,545	25	Unknown.
12	D.	F.	1	4	17,250	30	Runaway on descending grade; engineman in service on this steep grade two weeks; 7 years' experience elsewhere; had run four trips over this section as learner.
13	D.	F.	0	0	19,950	89	Broken flange.
Total......			7	87	$129,628		
Grand total			45	544	$401,503		

Collision No. 7 was caused by an error of a signalman. The signalman at A allowed a passenger train to leave A for B before a preceding passenger train had reached B. This signalman is 25 years old, and has been employed in that capacity for five years. His explanation is that he was busy setting the switches and signals for switching movements which were going on at his station at the time when he was called upon to give the signal for the passenger train.

Collision No. 13 was at a crossing, a freight train of road A running into the side of a passenger train of road B. One sleeping car conductor was killed and four passengers were injured. The collision occurred at 5.45 a.m. The freight train approached the crossing at uncontrollable speed, either on account of the air pressure in the air-brake system having been excessively reduced, or by reason of defective judgment on the part of the engineman. This freight train had begun its trip without proper inspection, the air-brakes not having been tested; and besides this, the rule requiring 75 per cent. of the train to be air-braked had been disobeyed, only 22 cars out of 34 having their air-brakes connected to the engine. Road A asserts that the passenger train did not comply with the law requiring a full stop before passing over this crossing, and that if this stop had been made the collision would not have happened. The men in charge of the other train declare that they had made the stop. The conductor of the freight train had been on duty 21 hours and the engineman 13 hours, the experience of the conductor, as such, was five months, and of the engineman two years and four months.

Collision No. 24 was between a regular westbound and a regular eastbound passenger train, and it occurred exactly opposite a block-signal station. According to the rule, both trains should have approached the block-signal station with speed under such control that a stop could be made before reaching the signal in case it was not clear. It is stated in the report that the block signal was obscured by fog and also by smoke from an engine standing nearby on a side track.

Collision No. 26, a butting collision between freight trains at 9.36 p.m., and causing the death of a fireman, was due to the error of a telegraph operator, 19 years of age, who had been in the service of the road two months, though, according to the report, he had had four years' experience as an operator. An order having been sent to this operator for train No. 6 and it having become desirable to change this order, the despatcher asked the operator if the train had passed, and was told in reply that it had not, whereupon he sent an order restricting the right of train No. 6. It appears that when the despatcher asked his question the operator looked out of his window and saw the headlight of a locomotive and took it for train No. 6, but afterwards found that No. 6 had already passed and that the light was that of a switching engine. Train No. 6 had passed this station some minutes ahead of time, this having been authorized by the despatcher.

Derailment No. 7 was due to the mismanagement of the air-brakes, a heavy freight train becoming uncontrollable on a steep descending grade. The train had two engines. The leading engineman is held responsible, having neglected to use "straight air" to apply the brakes when he found the train was eluding control; and the engineman of the helping engine is held at fault for not having been watchful so as to take an opportunity to recharge the "train line" (air pipes and cylinders) and apply the brakes. The leading engineman had been in the service on this division only three months, but is reported as having had one year's experience elsewhere. He had been on duty 21 hours, with five hours' intermission. The other engineman had been on duty 17 hours, with five hours' intermission.

The bulletin contains the usual tables showing in detail the causes of injuries to employees in coupling and from falling off cars, etc.

The Exchange Settlement for Cars.*

BY J. R. CAVANAGH,
Superintendent of Freight Transportation, Cincinnati Northern.

We hear a lot of talk about returning cars to owners, etc. We might as well talk about insisting on the individual national bank notes being returned to each bank within a given time as to ever hope of having a practicable economical rule of returning to owning lines, the individual cars, except at an enormous expense of empty mileage and loss of traffic. As common carriers, we must furnish through cars to carry the traffic contracted for on through bills-of-ladings and under through published tariff rates.

Let us distinctly understand that every restriction on a car retards the accomplishing of the very purpose for which the car was built, namely, to take care of traffic offering from originating point to destination.

After long and careful investigation, I have concluded that the solution is a system of car hire and equalization on junction or exchange balances. There is no system that can be evolved that will not be met with some objections, but I believe that the junction exchange plan will reduce such objections to a minimum. I have considered several plans in place of per diem, such as percentage of all revenue obtained from freight charges, switching, demurrage and reclaims to be paid the car owners in place of per diem, thus making them to a certain extent participators in the revenue derived from use of the car, but such an arrangement would be almost as burdensome in accounting as the present per diem plan. Under the exchange plan we deal only with our immediate connections instead of three or four hundred car owners. We do away with a lot of three cornered fights on account of discrepancies at remote points, thousands of miles away from the car owner. By the 20th of each month all car service accounts for the previous month should be settled. No voluminous reports to several hundred car owners for per diem on cars used. No large force of clerks to check up the stack of per diem reports received from several hundred roads, endless correspondence in regard to discrepancies, thousands of dollars outstanding unsettled account of the individual items too small to arbitrate, expense of errors in figuring and checking per diem, or elaborate expenses of postage and stationery.

The present interchange reports as adopted by the American Railway Association with slight modification and providing additional space as submitted herewith will cover the requirements.

Dr or Cr	Balance from last report	
	Delivered this date	
	Received this date ..	
Dr or Cr.	Balance this date	

Both agents have their copy and certify. The delivering line must pay the car balance rate until it has cleared the car. In cases of omissions, should recommend the use of a consecutively numbered credit slip to be taken into account in the current day's report. Under the proposed exchange settlement plan we can report and settle on a car basis, a ton capacity or both. We can, if deemed practicable, make a different rate for each class of car without materially increasing the accounting. The rates may be changed from time to time to meet the existing or temporary conditions, without disturbing the method of accounting as it would be simply changing the rate that the balance is multiplied by. Under this plan we exchange our cars under rules that may be agreed upon. This scheme also prevents any industrial or other road building

*From an address before the Central & Western Association of Car Service Officers.

a large equipment and forcing it with their own loading on connections, as they must take an equal number of cars in exchange if offered.

I do not suppose that this plan will insure absolute equalization, but I do think it will come nearer doing it than any other plan yet devised. Under the exchange plan, if a connection persists in not equalizing or in reducing the balance there are several remedies that can be applied, such as the stopping of loading *via* such a line, or, if deemed practicable, the application of a penalty in the nature of an advance rate after a given time, which would not affect any other road or territory.

The Minneapolis Freight Station of the Wisconsin Central.

The Wisconsin Central recently completed in Minneapolis, Minn., a fireproof freight station and storage warehouse to replace the one which was destroyed by fire in April, 1907. The building is at Hennepin avenue and Bridge square, in the heart of the wholesale district. It is 417 ft. long, 79 ft. 7 in. wide on Hennepin avenue, 66 ft. 1 in. wide at the rear, and is four stories high. Two photographic views of the station are shown herewith. From the rear view and the cross-section it will be observed that the tracks are below the street grade, which leaves 18 ft. clear headroom under the second-story floor beams. The freight is worked in this sub-story on a platform 24 ft. wide and 415 ft. long, and is hoisted to the storage floors by five electric elevators. Four of these are of 5 tons and one of 10 tons' capacity. Scales are located in front of every door on this floor. On the other side of this platform or sub-floor is a sub-street for incoming freight. Above this is a 34-ft. roadway from Hennepin avenue to First avenue north, which is intended primarily for transfer and storage vehicles. The front part of the second story, which is only a little above the street level, contains the offices and vaults, and the remainder of this floor and the two floors above are for storage, there being about 100,000 sq. ft. for this purpose.

The building is fireproof throughout. The floor system and supports are reinforced concrete on the Turner system, the walls are hard brick, the roof solid concrete slabs, and the windows have metal sash and wire glass. The elevator shafts and the stairways are incased in tile, with fireproof doors. All openings for loading have rolling steel doors.

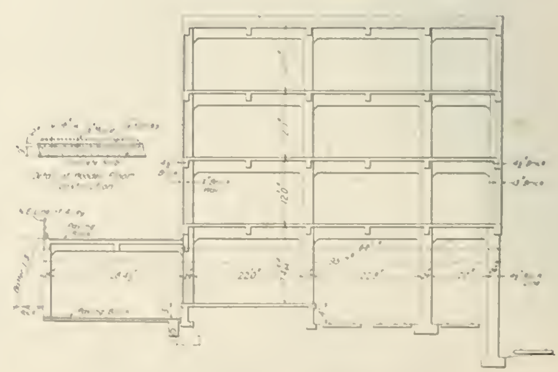
The footings of the building are on solid limestone ledge. The columns in the sub-story are 26 in. square, reinforced with eight vertical rods, banded together with bar hoops, at intervals. In the three upper stories the columns are round, 24 in. in diameter. The beam connection to these round columns was made without great difficulty. A beam ceiling was used, except under the 34-ft. driveway from Hennepin avenue. The maximum clear span is 26 ft. The reinforcement in the beams was well lapped at the continuous end to provide for maximum moment at that point, and bent suitably to provide for shear. Wire net wrapping was used in the beams. The maximum panel is 18 ft. x 26 ft.

The first, second and third floors were designed to carry a working load of 350 lbs. The floor slab was reinforced two ways, the

Minneapolis Freight Station and Warehouse; Wisconsin Central.

Plan of First Floor of Wisconsin Central Freight Station.

End View of Wisconsin Central Freight Station.



Section at North End of Freight Station.

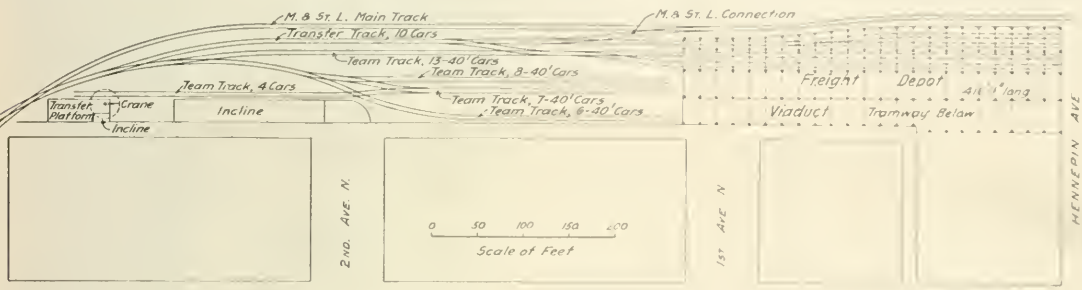
panel being subdivided by a secondary beam running from girder to girder. Nailing strips were laid on the slab with a filling between, 2-in. rough pine over this, and on the top a 1¾-in. maple floor.

The concrete was mixed in the sub-story at the level of the tracks by a "Cube" mixer, was raised to the floors by a Ransome hoist and placed by dump cars running on a narrow-gage railway. The concrete was a fairly rich gravel mixture, mixed wet.

The slab for the driveway is the Turner "mushroom" system. There are no beams, and the flat ceiling thus secured allows a good distribution of light, and accomplishes a very necessary object—the saving of headroom in the sub-story. This slab is 11½ in. thick and spans 30 ft. It is reinforced in four directions, directly and diagonally from column to column. A great many advantages are claimed for this system in the matter of speed of construction and cost. The centering for the slabs in this, as well as the beam construction, was corrugated iron. It was quickly placed and struck without material damage to the iron.

The need of erecting the building as quickly as possible afforded a comparison of some of the advantages of reinforced concrete over steel construction. Sketches were made and the steel order placed in a day's time. The building was erected complete in practically three months, or in the time ordinarily necessary to get structural steel on the ground. Shop details for such a structure of steel would take considerable time to get out, owing to the curved side of the building, where no two beams are of the same length. The reinforced concrete skeleton was pushed ahead in advance of the walls, which saved time and provided a floor for the masons, facilitating the laying of the curtain walls.

The design and erection of the building were under the supervision of C. N. Kalk, Chief Engineer of the Wisconsin Central. The reinforced concrete was designed by C. A. P. Turner, Consulting Engineer, Minneapolis. Butler Bros., St. Paul, were the contractors.



Proposed Reconstruction of Hennepin Avenue Yard; Wisconsin Central.

Rebates and the Steel Industry.*

On completion of the Erie, New York Central, Baltimore & Ohio, and the Pennsylvania systems between the Atlantic seaboard and the great West, a strong competition for through traffic at once began. At first it was a scramble, and each road got what it could, at the best rate it could, regardless of everything. The position was peculiar, and is so still, and must long remain so.

Matters went along tolerably well until railroad rates were thoroughly demoralized by war between the trunk lines. Our Carnegie Steel Company, upon this occasion, had had what it thought the certainty of a contract of great value for material with the Newport News Shipbuilding Company, freight from Pittsburgh to Newport News being much less than from Chicago. The contract went to Chicago, and upon investigation we found that the rate given to our Chicago competitor to Newport News was less than the Pennsylvania Railroad rate from Pittsburgh, the distance not one-half so great. President Ingalls of the Chesapeake & Ohio, then beginning his brilliant career, had made the low rate for his new line not yet embraced in the "gentlemen's agreement." We investigated, and found several rates of a similar nature prevailing to other points, and having a list of these made, the writer carried it to President Roberts of the Pennsylvania Railroad, with a request that he place us upon his own line on an equality with manufacturers on other lines. When the paper was presented to him, showing the overcharges we labored under, he pushed it aside, saying: "I have enough business of my own to attend to; don't wish to have anything to do with yours, Andy." I said: "All right, Mr. Roberts; when you wish to see me again, you will ask an interview. Good morning."

The situation had become intolerable, and we looked about for the best means of protecting ourselves. A railroad line of our own from Pittsburgh to the Lakes would be an invaluable acquisition. I purchased the harbor at Conneaut and a few miles of railroad connected with it, and began extending the line to Pittsburgh. I took good care that the authorities in Philadelphia were advised of the policy I had determined to pursue if there was the slightest interruption to our business. It was not long before I received a note from Vice-President Thomson, saying that President Roberts and himself would like an interview. I agreed to call as I passed through Philadelphia, and did so. My partners did not see their way to fight the great Pennsylvania Railroad; but my Scotch blood was up, and I was in to fight to the death. What I needed for the interview with my former railroad associates were the secret rebate rates prevailing elsewhere. Our freight agent, Mr. McCague, a clever young man, obtained these and placed them in my hands in a few days.

Entering President Roberts' room, I found him and my dear friend, Frank Thomson, vice-president, sitting together. My reception was cordial. "How are you, Andy?" "How are you, Mr. Roberts? How are you, Frank? Gentlemen, you asked me for an interview, and here is the culprit before you. Put me in the dock and question me as you wish." Frank said: "This is just what we want to do. May I be examiner?" "Yes," I said, "you are just the man." "What are you fighting the Pennsylvania Railroad for?" he asked. "You were brought up in its service. We were boys together." "Well, Frank, I knew you would ask me that question, and here is the answer." I handed him the packet of secret rates, and, begging to be excused for a few minutes, left the room, desirous of giving them an opportunity of looking it over together. Upon my return they were still sitting with the packet lying before them. Frank raised his head and exclaimed: "Andy, I feel like Rip Van Winkle." "Frank, the Pennsylvania Railroad officials have slept just about as long." "Well, tell us what you want." "I don't want anything. I did not ask to see you. You asked to see me." "Don't talk that way. What do you want? We wish to make an arrangement satisfactory to you. We did not know these things were going on. We can hardly believe it; but we shall now find out. Tell us what you think we ought to do."

I said: "Gentlemen, all that we have ever asked was that the rates charged us shall be at all times as low as those which competitors on other lines are paying on the same articles for similar distances. We ask for nothing else. Other lines are carrying freight for our competitors cheaper than you are carrying it for us, and you take part of this freight at the cut rates. We cannot stand that. We have never asked for lower rates than our competitors, but we shall never rest satisfied with less." "If you will stop building that line from the Lakes to your works, we will do what you ask," was his response. "Gentlemen, that cannot be. I have agreed to build that line, and certain parties have taken action in consequence of my promise. It has to be built." The result of the meeting was that I got all I asked for, and greatly obliged the Pennsylvania Railroad by allowing them to retain transportation of our own coke traffic from the coke fields to Pittsburgh. Everything was satisfactorily arranged, and we were all "boys together" again. I was the ally of the Pennsylvania Railroad, much to my delight. It was estimated that the agreement saved us about one and a half millions of dollars per year.

Some time after that, when war again broke out between the rival systems, the late William H. Vanderbilt asked me what I thought of the project of his son-in-law, Mr. Twombly, to extend the Reading system to Pittsburgh, through Pennsylvania. I said: "If you will undertake it, I and my friends will go with you to the extent of $5,000,000," a prodigious sum then—at least to us. "If you will, then I will put in $5,000,000 also," he replied. Thus the South Pennsylvania was organized, and its construction begun. Here was a chance for the New York Central to grip and hold its antagonist by the throat, but the Pennsylvania interests, seeing

*From a paper by Andrew Carnegie in the *Century Magazine*.

what the movement involved approached Mr. Vanderbilt while I was in Europe and induced him to surrender. Exactly what advantage the New York Central system received I do not know, but it should have been great indeed; for this was probably the greatest mistake in its history. The key to masterdom for the Vanderbilt interests was foolishly thrown away.

My personal effort to build the Bessemer Railroad to the Lakes came after these vain efforts of united Pittsburgh to emancipate herself. When Mr. Cassatt ended the agreement entered into between his predecessor and myself, I was quite prepared to take up the challenge. We were once more free. I called upon George Gould and said to him: "Years ago your father approached me and said he would buy the control of the Pennsylvania Railroad, and divide profits equally with me, if I would promise to devote myself to its management. My heart was in steel development, and I declined. This morning I come to you and offer an opportunity to create and control a through line from the Atlantic to the Pacific. Extend your line to Pittsburgh, and we will give you a contract for one-third of all our business, provided you agree to give us the rates prevailing elsewhere and enjoyed by our competitors." I offered to build west to meet him, and also to join him in building east. Fortunately he agreed, and the result is that the Gould system to-day is in Pittsburgh, enjoying that contract. We were just on the eve of arranging to extend the line eastward, taking in our coke works en route, which would have been a hard blow to the Pennsylvania Railroad, since we controlled our own coke traffic, when Mr. Morgan asked Mr. Schwab if I wished to retire from business; if so, he thought he could let me out. I replied in the affirmative. Of course we stopped all negotiations looking to eastern extension after this, and the result was my retirement from business.

Rail Section Tracing Machine.

At a recent meeting of the Institution of Civil Engineers (England), H. E. D. Walker gave a description of a rail section tracing machine that he had designed for obtaining a drawing of worn or new rail sections that would be accurate and reliable.

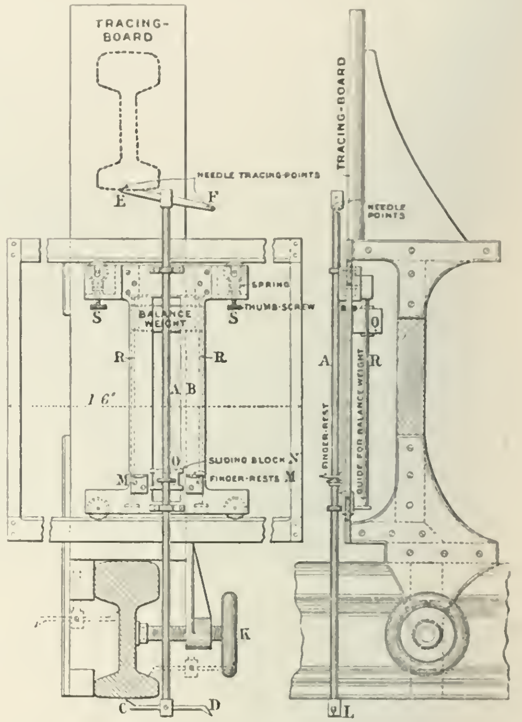
The machine consists of a rod A, having a free vertical and axial motion, and held by a carrier B, having a free horizontal motion. The bottom of the rod is fitted with a sharp pointed bent steel cross arm, C D; one of the sharp points (C) is bent upwards, and the other (D) downwards, so as to be able to follow the lower and the upper curves of the rail-section respectively. The top of the rod has a cross arm E F, fitted with two hardened needle-points at each end, which, when in contact with the paper affixed to the tracing-board, are adjusted to correspond with the position of their respective tracing-points below. This adjustment requires the lengths of the upper and lower tracing-arms to be different, as shown in the engraving, and the correct position is indicated by the line *hg*, being at right angles to the tracing-board and to the rail section to be taken. The sliding-block N, in which the boss O of the tracing-rod can freely turn, is attached by a string, passing over a pulley to the metal box Q, placed between the guide-rods R R. The box Q is filled with lead to balance the weight of the tracing-rod and of the arms, thus relieving the operator, in his necessarily cramped position, from the small but inconvenient weight of the tracing-rod. The horizontal motion of the carrier is steadied by fitting the upper wheels to a sliding axle-box backed by springs, the pressure of which may be regulated by the milled head-screws S S.

The first step is to oil thoroughly around the rail where the section is to be obtained, so that the steel point may pass easily along the roughened surface of the worn metal. The machine is then clamped firmly to the rail by the wheel-screw K. The paper having been fixed on to the tracing-board by drawing pins, the operator, sitting across the rail and facing the front of the machine, takes hold of the boss L at the bottom of the tracing-rod with the right finger and thumb and guides the pointer (C) across the under surfaces of the rail, at the same time placing two fingers of the left hand on the finger rests M to assist and steady the horizontal motion of the carriage. With this pointer he follows both the lower curved surfaces and the web on one side of the rail. Then, by running the carrier to the end of its path, he can turn the rod round on its axis, as it is then clear of the tracing-board, so that the downward bent pointer (D) can be made to follow all the upper curves on that side of the rail, and join up to the line already made for the vertical side of the web as indicated by lighter and darker dotted lines of the rail tracing in the front elevation. By allowing the rod to rise to its highest position the carriage can be passed across to the other side of the rail, which can then be traced, thus completing a perfect diagram of the rail section. The whole operation can be performed in from three to four minutes.

The paper is then taken off the board, and the section traced in the office, and by being placed within the lines of the original section or previously obtained diagram, the position and quantity of the worn portion is immediately seen; the area can be obtained by a planimeter. The rate of wear can be valued from the time elapsed since the preceding operation, and the modulus of section can also be calculated.

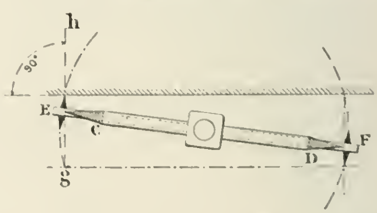
The author suggests, in order to obtain satisfactory data for determining the time for the renewal of any portion of a line, that the above operation should be repeated at two-year intervals, at exactly the same position, on a typical rail fairly representing the conditions of situation, curve and gradient of each length relaid.

As it is essential that the needle-points of the tracer E F should



Rail Section Tracing Machine.

not become worn, the author experimented with various surfaces on which to make the tracing, and finally adopted a strong smooth drawing paper which he covered with a very thin layer of melted white wax mixed with lamp-black. A black surface was obtained which the needle-point easily and smoothly cut through, and the section of the rail thus appeared as a thin white line on a black ground. This proved quite satisfactory, as it prevented any scratch-



Detail of Tracer.

ing or tearing of the paper surface, and the section was afterwards easily traced.

Such an apparatus as this offers the only really satisfactory method that there is of obtaining a correct cross section of a rail, and if this information is obtained at regular intervals it will not only provide the desired data as to the strength of the rail from time to time, but will also afford a reliable guide as to the position and the rate of the wasting in progress, by means of which the exact time may be determined when its renewal will be necessary, provided the conditions of service remain comparatively constant. As the rate of deterioration may vary considerably on even a short length of railroad, it is worth while logging the information obtained in the form of a continuous record.

The Thames Tunnel.

The old "traffic tunnel" under the Thames, in London, was designed by Brunel in 1823, and took upwards of 17 years to build, including a lapse of seven years when no progress was made. Through the courtesy of the Pennsylvania Railroad we are enabled to reproduce a pamphlet published in 1840, describing this work, together with the original illustrations. It will be observed that the fundamentals of the modern tunnel shield are all there except the tail tube, which only came into use when tunnels were given a perfectly circular form. The pamphlet, slightly excerpted, follows:

The constant inquiry for information relating to the construction of the tunnel under the Thames has induced the directors to publish the following account of the origin and progress of the work.

An acquaintance with the immense and various mercantile concerns carried on in the vicinity of London Bridge, and immediately in the neighborhood of the tunnel, will show the obvious utility, and the consequent importance, of a convenient communication by land from shore to shore at that part of the river Thames; and it appears from the number and magnitude of the shipping constantly passing, that the only plan which could be resorted to with a necessary regard to economy, and which should be free from objections on the ground of injury or inconvenience in the navigation of the river, is that of a tunnel under the bed of the river, of sufficient capacity to accommodate the local traffic.

The project of a tunnel at Gravesend was put forward in 1799, but the scheme was soon abandoned; this was followed by an attempt to form a tunnel from Rotherhithe to Limehouse in 1804, under the authority of an Act of Parliament. A shaft of 11 ft. in diameter was sunk to the depth of 42 ft., with a view to the commencement of the horizontal excavation, when from difficulties which were encountered it was for a time suspended. It was afterwards continued at a reduced diameter of 8 ft. to the depth of 76 ft., at which depth a small driftway was carried therefrom under the river to the extent of 923 ft., and to within 150 ft. of the opposite shore, when new difficulties having arisen, the engineer reported that any further progress was impracticable, and the work was abandoned.

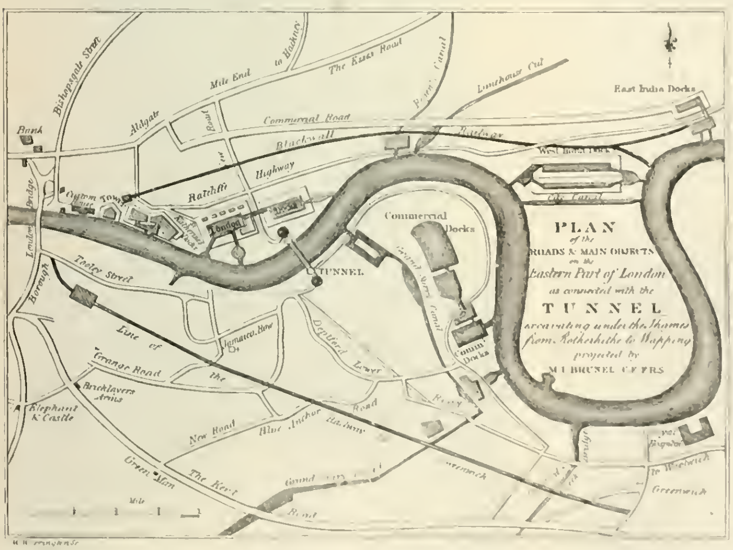
Various plans were, from time to time, proposed for the construction of a tunnel, none of which came to maturity; and they are now only adverted to, to show the interest and importance attached to such an undertaking.

Mr. Brunel, in 1823, proposed and exhibited his plan for constructing at once, and on a useful scale, a double and capacious roadway under the Thames, which was not only well received, but liberally supported by many gentlemen of rank and science, who were not discouraged by the extraordinary risks which an enterprise of such magnitude must encounter, and no one has given it more prominent and consistent support, under all its vicissitudes, than the Duke of Wellington. His Grace described it as "a work important in a commercial as well as in a military and political point of view."

The spot between Rotherhithe and Wapping, selected for the intended communication, is perhaps the only one situated between London Bridge and Greenwich, where such a roadway could be attempted without interfering essentially with some of the great mercantile establishments on both sides of the river. It is about two miles below London Bridge, in a very populous and highly commercial neighborhood, and where a facility of land communication between the two shores is very desirable, and will prove to be of very great advantage, not only to the immediate neighborhood, but also to the neighboring counties.

Cross Section of River and River Bed.

While the necessary steps were taking to obtain an Act of Parliament, and to raise money to carry the plan into effect, the committee of subscribers employed competent persons, unconnected with the engineer, to make borings across the river in the direction of the future work, in three parallel lines. On the 4th of April, 1824, they reported most favorably on the projected enterprise, upon which Mr. Brunel was induced to enlarge the dimensions of his original plan, and consequently the apparatus by which he intended to secure the excavation, while the brick work was in execution.



General Location Plan of Thames Tunnel.

An act of Parliament having been obtained on the 24th day of June, 1824 and Mr. Brunel appointed the engineer to the undertaking he began his operation by making preparation for a shaft of 50 ft. in diameter, which he commenced at 150 ft. from the river on the Rotherhithe side. This is effected by erecting a substantial cylinder of brick-work of that diameter 42 ft. in height, and 3 ft. in thickness, which was sunk *en masse* into the ground.

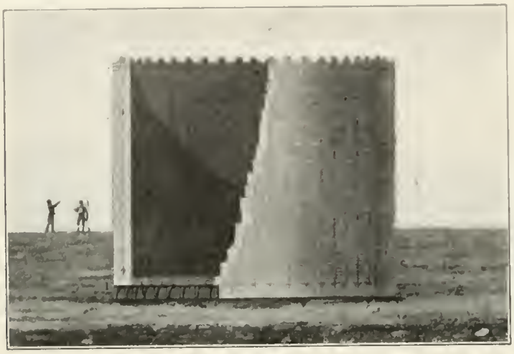
Upon the top of the cylinder was placed a steam engine for the pumping out of the water and for the purpose of raising the excavated earth. By this means Mr. Brunel succeeded in forcing the cylinder through a bed of gravel and sand 26 ft. deep, full of land-water, constituting, in fact, a quicksand in which the drift makers formerly had been compelled, as well to suspend their work, as to reduce the dimensions of their shaft from 11 to 8 ft.

While this operation was in progress, Mr. Brunel received an intimation from eminent geologists apprising him of the existence of a bed of sand lying at a greater depth, and advising him to go as little as possible below the bed of the river. This information corresponded with the account given before by the drift makers respecting the existence of a quicksand, and its depths beneath the level of high water.

The shaft having been sunk to the depth of 65 ft., another smaller shaft 25 ft. in diameter, destined to be a well or reservoir for the drainage of water, was also sunk from this lower level, but, at a depth of about 80 ft. the ground suddenly gave way, and sunk several feet at once, sand and water blowing up at the same time. Thus was the previous intelligence confirmed of the existence and the nature of the bed of sand in question, and which governed the engineer in the level he had proposed originally to take for his horizontal structure.

The shaft and reservoir having been completed, the excavation for the body of the tunnel was commenced at the depth of 63 ft.; and in order to have sufficient thickness of ground to pass safely under the deep part of the river, the excavation was carried on at a declivity of 2 ft. 3 in. per hundred feet.

The excavation which has been made for the Thames tunnel is 38 ft. wide, and 22 ft. 6 in. high, presenting a sectional area of



The Shaft.

850 ft., and exceeding 60 times the area of the drift which was attempted before.

The base of this excavation, in the deepest part of the river, is 76 ft. below high water mark.

It is by means of a powerful apparatus of iron, which has been designated a shield, that this extensive excavation has been effected, and that the double roadway and foot-paths, which now extend to within a few yards of the wharf at Wapping, have at the same time been constructed. This shield consists of 12 great frames lying close to each other, like so many volumes on the shelf of a bookcase; these frames are 22 ft. high and about 3 ft. wide. They are each divided into three stages or stories, thus presenting 36 chambers, or cells, for the workmen—namely, the miners, by whom the ground is cut down and secured in front, and the brick-layers, by whom the structure is simultaneously formed, and which serves also as a scaffolding for them.

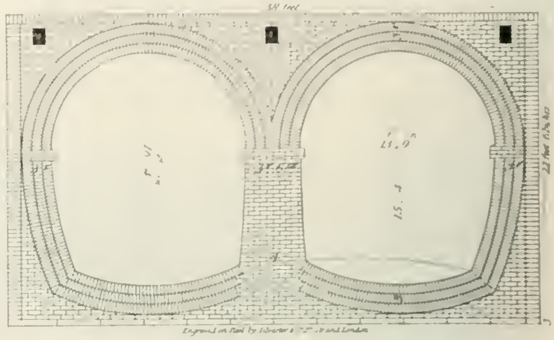
Powerful and efficient as this apparatus has proved to be in accomplishing the work, the greater part of which is now happily completed, the influence of the tide upon some portion of the strata beneath the bed of the river, greatly contributed to increase the labor, and to multiply the difficulties, and materially to add to the danger attending the excavation. That influence upon some of the strata, or upon some portions of the strata, was not noticed by the drift makers previously; owing, most probably, to the circum-

Working Inside the Shield.

stance that more than nine-tenths of their excavation had been carried on under a bed of rock, and the comparatively small dimensions of the work in question.

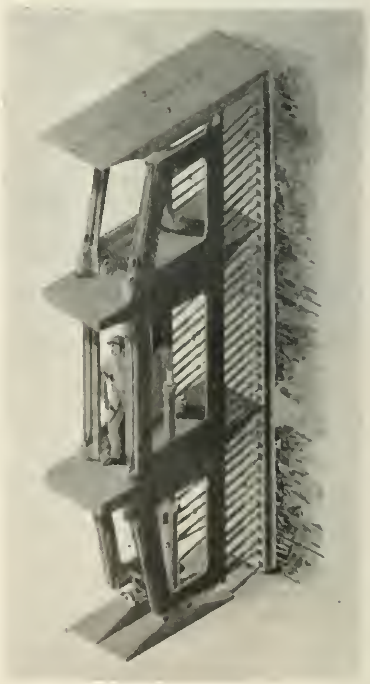
The shield was placed in its first position at the bottom of the shaft by the first of January, 1826, and the structure of the double archway of the tunnel was commenced under a bed of clay; but on the 25th of the same month the stratum of clay was discovered to break off abruptly, leaving the shield for upwards of six weeks open to a considerable influx of land water, which flowed copiously from a bed of sand and gravel, which was saturated anew at each rise of the tide. The progress of the work was in consequence much impeded.

On the 11th of March this fault or break in the clay being passed, and the shield again under a bed of clay, the work proceeded, and on the 13th of June, 1826, was advanced under the



Cross Section of Tunnels.

bed of the river, increasing daily in its progress. By the 13th of April, 1827, the tunnel had extended 400 ft. under the river; these 400 ft. of the tunnel were excavated, and the double archways substantially completed with brick-work in ten months and a half. On the 18th of May, 1827, and again in the month of January, 1828, the river broke in, and filled the tunnel; thereby occasioning the apprehension that this unprecedented undertaking, which had excited so much interest, not only in England, but throughout Europe, might be abandoned. After, however, filling



Frame of Shield.

the chasms in the bed of the river with bags of clay, and clearing the tunnel of water, upon re-entering it, the structure was found in a perfectly sound and satisfactory state; and the strongest proof is afforded of the efficiency of Mr. Brunel's system of constantly protecting as much as possible every part of the soil during the excavation; and finishing the structure in the most solid manner as the work proceeded, by the instrumentality wholly of the shield.

Subsequent to these eruptions of the river, such was the desire to see the work completed that several hundred plans were communicated to the directors and engineer for filling up the cavity, as well as for the prevention of future accidents. All the plans were duly examined, and attentively considered; and the board of directors expressed, under date of the 16th of December, 1828, their obligations to the many scientific men who had so spontaneously communicated their several ingenious suggestions for securing and completing the undertaking.

View of Wapping, With Cross Section of Tunnels.

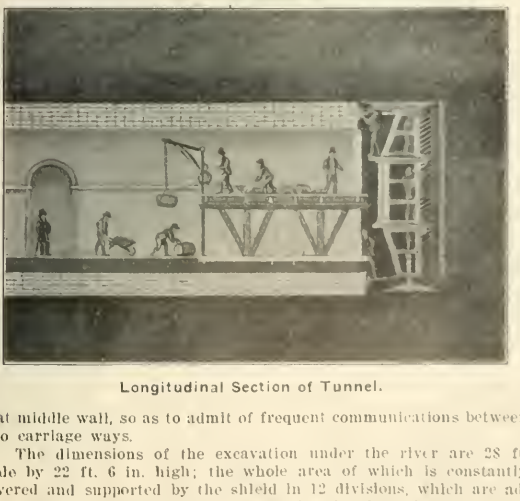
The works from that time remained suspended during a period of seven years, when they were re-commenced, and have been steadily and successfully continued to the present time.

To facilitate the access to the tunnel for the large population in its immediate neighborhood, it is intended to make the carriage way descents circular, and they will not exceed in any part the slope of Ludgate Hill, or Waterloo place, Pall Mall. The shaft, from whence the tunnel works are now carried on, was built at Rotherhithe in the form of a tower, 50 ft. in diameter, 42 ft. high and 3 ft. thick, at about 150 ft. from the edge of the wharf, and it was sunk into its position by excavating the earth within. In the annexed sketch the brick-work is supposed to be broken open, to show its construction, and the numbers below refer to the different parts of that "tower," which now forms the foot passenger's shaft, and is intended finally to be occupied by an easy double flight of steps, for the use of passengers going through the tunnel.

1, 1.—The wooden rings, or flat curbs.
2.—The iron curb.
3. Hoops, or laths, binding together the uprights.
4, 4.—Iron rods enclosed in wood } Screwed tight to the top and the bottom curb.
5, 5.—Wooden road . . . . }

A transverse section of the tunnel is here given, showing the dimensions of the mass of brickwork, which is all firmly set in Roman cement.

It must be observed that the middle wall is, for greater security while in progress, built quite solid; but for convenience, light and general effect, a succession of arches are subsequently opened in



Longitudinal Section of Tunnel.

that middle wall, so as to admit of frequent communications between two carriage ways.

The dimensions of the excavation under the river are 28 ft. wide by 22 ft. 6 in. high; the whole area of which is constantly covered and supported by the shield in 12 divisions, which are advanced alternately and independently of each other; they have each three floors, or stages, forming a succession of scaffolding and cells for the bricklayers and mines during their operations.

A longitudinal section of about 10 ft. of the tunnel, with a side view of the shield, and the miners as well as the bricklayers at work. This sketch represents also the moving stage, with two floors, used by the miners to throw thereon, for removal, the earth they excavate; and where the bricks, cement and other materials are placed in readiness for the bricklayers. Towards the head and foot of the shield is also shown the position the horizontal screws, a pair of which being attached to each of the divisions, and turned so as to press against the brick work, are used to propel each division forward.

The divisions of the shield are advanced separately and independently of each other, by the means pointed out in the foregoing sketch, each division, as is attempted to be shown in the annexed design, has boards in front (known by the technical name of poling boards) supported and kept in position by means of jack screws, which are lodged against the front of the iron frame; these boards are in succession taken down while the earth in front of each is excavated, the board being always replaced before a second is removed; thus forming a constant firm buttress. The several parts will be better understood by reference to the following numbers.

1. Poling boards.
2. Jack screws.
3. The "top staves" covering the upper part of the excavation, till the shield is succeeded by brickwork.
4. Screws to raise or depress the top staves.
5. "The legs" being jack screws fixed by ball joints to the shoes.
6. "The shoes" upon which the whole division stands.
7 and 8. The sockets where the top and bottom horizontal screws are fixed to force the division forward.

The opposite transverse section of the river Thames, with a longitudinal section of the tunnel beneath it, shows the progress of the work, which is now completed (1840) to the extent of 1,135 ft

Western Archway of Tunnel, Lighted by Gas.

from the foot passengers' shaft at Rotherhithe towards Wapping, with the openings provided to afford free communications from one archway to the other.—*Thames Tunnel Office, Walbrook Buildings, Walbrook, 1st September, 1840.*

The Municipality and Public Utilities.

City Operation.

Methods embarrassed by law.

Methods antiquated.

Methods non-direct; to increase the importance of officials.

Appointments of head men made as rewards for political service.

Appointments and dismissals of subordinates hampered by the civil service laws and by the exigencies of politics.

Many unnecessary or inefficient men carried on the pay roll, for political reasons.

Appropriations granted or withheld, largely for political reasons.

In many cases, 50 per cent. of a day's work accepted for a day's pay.

Honesty, sobriety, loyalty, willingness, energy, courtesy, and tact command no better rating than the opposite qualities; the civil service certification of competency levels all.

Corporation Operation.

Methods chosen by the head men of the corporation.

Methods kept up to date.

Methods direct; to make the minimum amount of work.

Appointments of head men made for fitness.

Appointments and dismissals of subordinates at the will of their immediate superiors, who are responsible for results.

A few unnecessary or inefficient men carried on the pay-roll for political reasons.

Appropriations granted or withheld in accordance with sound business reasons.

Generally 100 per cent. of a day's work demanded for a day's pay.

Honesty, sobriety, loyalty, willingness, energy, courtesy and tact command corresponding rewards in the shape of increase of salary, or promotion; or in the shape of a reputation which will attract the attention of other and more liberal employers.—*H. S. Wynkoop.*

Reinforced Concrete Overgrade Highway Crossings.

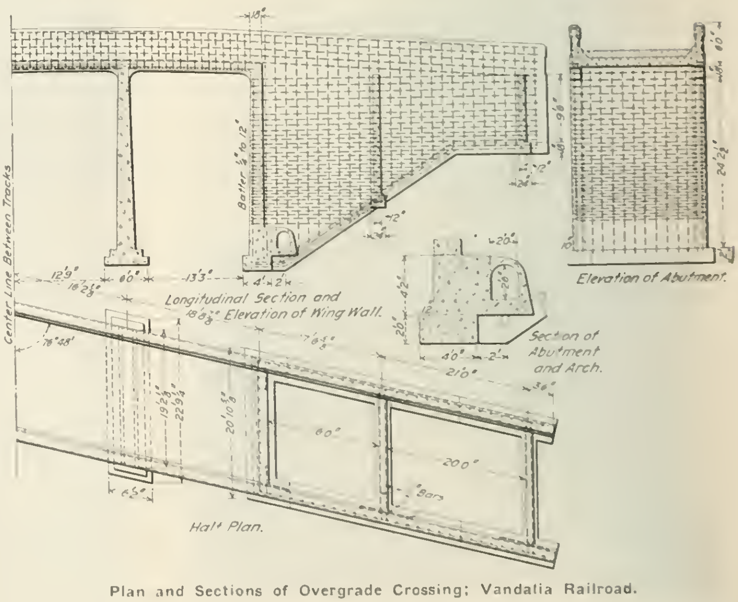
The photograph and drawings show a crossing built by the Vandalia in connection with line improvement work between Terre Haute, Ind., and Brazil. This bridge is near Seelyville. It is designed for four tracks, the central opening being 30 ft. between piers, and the side openings 17 ft. The latter are for proposed running tracks. The clearance is 22 ft., and the width, over all, 18 ft. 8 in. The floor of the bridge is on a vertical curve of 572-ft. radius, giving a 6 per cent. grade. Cross-sections show the floor construction and corrugated bar reinforcement. The filling for the roadway is 12 in. of gravel.

Overgrade Crossing near Seelyville, Ind.; Vandalia Railroad.

Another of these bridges was built near Turner, on the same work, the amount of material used in each of the two being exactly the same. Following is the cost of the Turner bridge:

Foundation excavation, 627 yds. at $0.40 ..			$250.80
Cost of placing:			
80 cu. yds. plain concrete at $3.45		$276.00	
466 " reinforced concrete at $3.65........		1,700.90	
			1,976.90
Material:			
457 cu. yds. gravel.... at $0.25	114.25		
220 " stone ... " .70	154.00		
786 bbls. cement ..... " 1.60	1,257.60		
28,807 lbs. bars...... " .02	576.15		
			2,102.00
			$4,329.70

This does not include the cost of grading the approaches. The specifications called for gravel concrete, but the gravel used was too fine and some 2½-in. stone was added. The material was furnished by the company and the work done by contract. We are indebted to Maurice Coburn, Engineer Maintenance of Way, for data.



Plan and Sections of Overgrade Crossing; Vandalia Railroad.

Drawings and a photograph of a reinforced concrete arch overgrade highway crossing designed by S. B. Fisher, Chief Engineer of the Missouri, Kansas & Texas, are shown herewith. Crossings of this kind are being put in as a part of the extensive grade revision and line improvement work being done by this road in the southwest, and are for country roads as well as city streets. Mr. Fisher objects to the form of overgrade crossing having rectangular openings, especially where permanent structures must be put in. To use his own words: "There always seemed to me something unsatisfactory in the appearance of the rectangular openings under these overgrade crossings as usually constructed. When made of wood they are not disagreeable to the eye, but when the form of a wooden structure is imitated in reinforced concrete it seems at odds with the fitness of things."

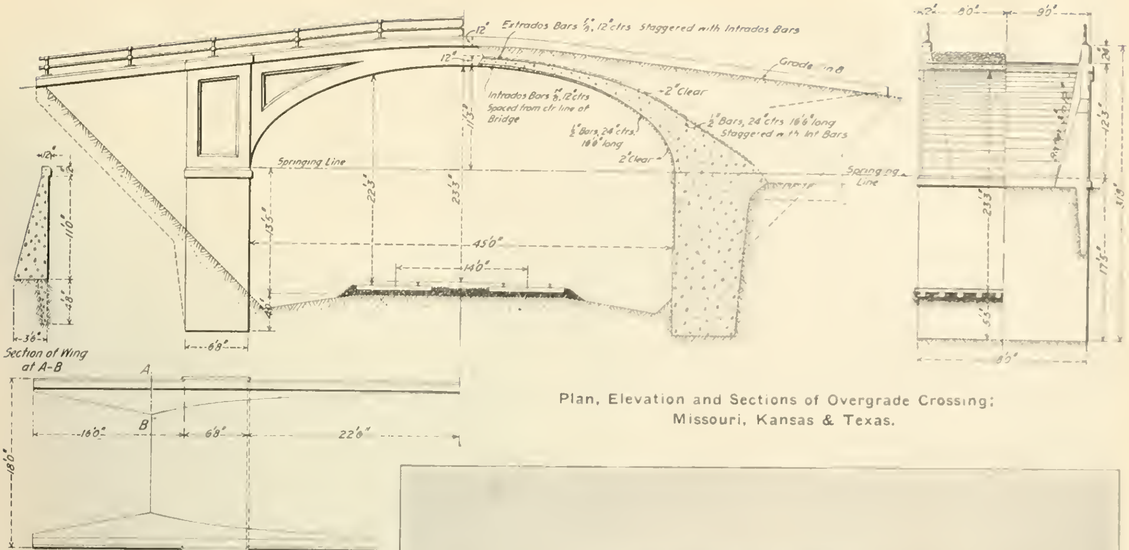
The bridge shown herewith is for a street or highway where the railroad cut is 10 ft. or more deep and the foundation is firm, preferably rock. The intrados of the arch is a true ellipse whose rise is one-fourth the span. The spandrel walls are carried back in cantilever form, as shown by the drawings. They have shallow panels moulded in them. The hand railing is made of old boiler tubes filled with grout to stiffen them and make them more durable. The horizontal tubes are connected with couplings and are continuous, passing through the crosses which are bored out for the purpose.

Details of the falsework are shown in the accompanying drawings. The same amount of thought was given to its design as to the arch, as it is made to be put up, used and taken down over traffic without any disturbance thereto.

Thus far, two of these arches have been built. One in the village of Caddo, Okla., with roadway 18 ft. wide, cost as follows:

Material for moulds, etc	$369.75
Excavating foundation	183.56
Shoring, setting up machinery all miscellaneous work	1,029.92
Concrete, about 319 cu. yds.	2,210.77
Hand railing	50.97
Total	$3,844.97

The other is near a section-corner in Oklahoma to take a north-



Plan, Elevation and Sections of Overgrade Crossing; Missouri, Kansas & Texas.

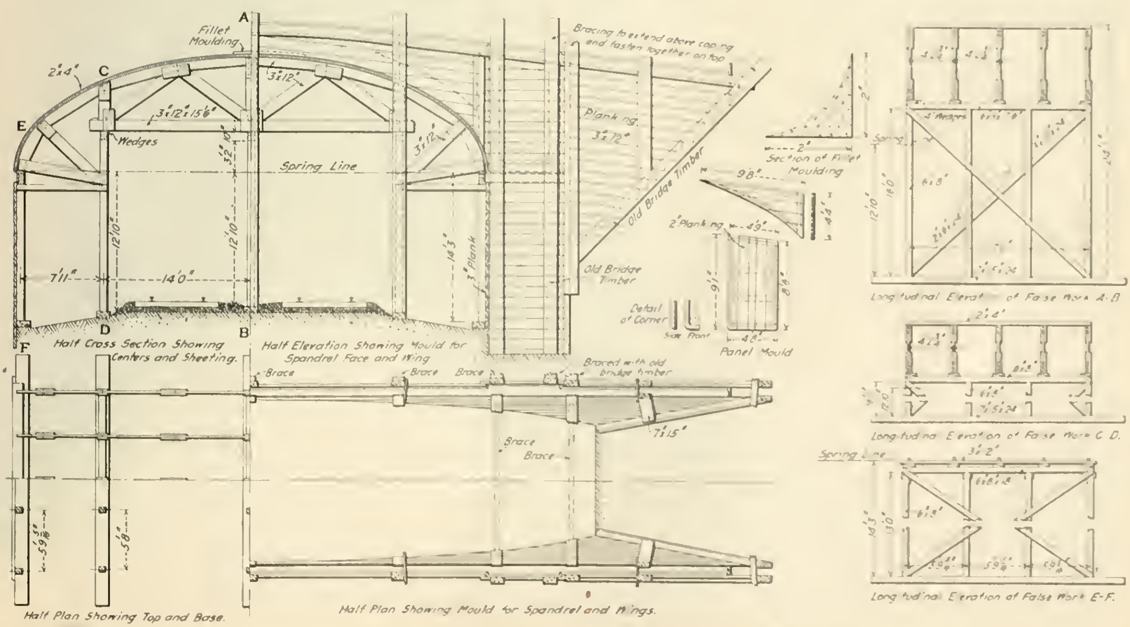
and-south and east-and-west public road. It has a 16-ft. roadway and was built with the same falsework as the first. The cost was:

Additional material for moulds..........	$51.35
Excavating foundation..................	167.40
Shoring, setting up machinery, all miscellaneous work	640.90
Concrete, about 390 cu. yds............	2,332.39
Hand railing	106.22
Total	$3,298.26

To the above should be added 50 cents per yard of concrete for freight charges on material. Plans are being prepared for another bridge for a street crossing in Fort Worth, Tex., with two 18-ft. roadways separated by a rib in the middle quite similar to the spandrel wall. This rib is intended to stiffen the arch and counteract any tendency of heavy and irregular traffic loads to distort it.

The span of 45 ft., shown in the draw-

Overgrade Highway Crossing; Missouri, Kansas & Texas.



Form for Erecting Highway Bridge; Missouri, Kansas & Texas.

ings, was selected as most suitable for a double-track road, giving sufficient room on each side for ditches. The clearance of 22½ ft. above the rail will probably be increased 6 in. or a foot in future structures; for while the present clearance is ample for some years to come, the unavoidable tendency of the track is to rise higher and higher as fresh ballast is put in.

Freight Car Efficiency.*

The railroads of the United State probably handled, during the year ending June 30, 1907, in the neighborhood of 1,800 million tons of freight. The freight handled by the whole of the railroads of teeming Europe can hardly have much exceeded 1,500 million tons. Physical conditions, and political prejudices and fears have co-operated in keeping at a low level the average haul in Europe, and consequently the more favorable environment here has placed the ton-mileage—the true measure of the freight service of a country—out of all comparison with that of the older continent. During the year named, the ton mileage of the United States probably amounted to 230 or 235 billions, against which Europe, so far as can be estimated, could not present more than about 100 billions. It goes without saying that enormous difficulties have to be met and overcome in order to administer successfully so huge a mass of business, diffused over a territory of more than 3,000,000 sq. mi. But the real extent of these difficulties is not realized until it is comprehended that during less than a generation—specifically, since 1880—the ton mileage of this country has not merely doubled or trebled, but actually septupled itself, an increase of more than 600 per cent. Under these circumstances, it would not be surprising to find the railroads experiencing difficulty in meeting the ever-increasing demands being made upon them, nor would it necessarily be discreditable to them that, in shaping their organization to the changing conditions, there resulted considerable friction of adjustment. Accordingly, the existence of shippers' complaints with reference to car supply, founded though they may be on facts, should not be regarded in itself as conclusive evidence of culpable negligence on the part of the managers of railroad transportation. Even without any special general development from year to year, every business has difficulties during the busiest season of each year in properly meeting the demands made upon the resources of its organization. In arguing thus, there is no desire on the part of the writer of the paper to justify the railroads in carelessness of management, whenever such exists, but his object is to deprecate the measurement of railroad performance by an impracticable standard, which the critics themselves would not consent to apply to their own business undertakings.

In the nineteenth annual report of the Interstate Commerce Commission on the statistics of railroads in the United States, figures are given covering the results of railroad operation during the year ending June 30, 1906, and a comparison of them with the corresponding figures for 1900 may serve as a text with which to introduce what I have to say. The ton mileage of the railroads operating in 1900 was 141,596 millions; in 1906, 215,877 millions—an increase of 52½ per cent., of which 40 per cent. occurred during the latter year. Though the mileage increased by no less than 31,017 miles during the six years, freight business was received and taken care of so well that the density of freight traffic, measured in tons carried one mile per mile of line, increased from 735,352 to 982,401 or about 35 per cent. The mere fact that the railroads were able to take care of this remarkable increase is an indication of the entire inappropriateness and injustice of those general charges of inefficiency which superficial observers, including some writers for the press, have felt themselves free to make. So great an achievement has been possible of accomplishment only by reason of the fact that past freedom of development (subjected though it has been to certain restrictions) has stimulated the growth of the most enterprising railroad policy in the world, admirably suited in many ways to its economic environment; it is not denied that this freedom has permitted some evils to thrive, though less during the last few years than previously.

The freight car equipment during the period was enlarged from 1,365,531 cars to 1,837,914 or 34½ per cent. At first glance this compares unfavorably with the 52½ per cent. increase of business. That this is not really so is obvious when the capacity of the car is taken into account. So far as I can judge from the equipment statistics, the increase of average capacity from 1900 to 1906 must have been close upon 20 per cent. Assuming that this increase of capacity were made full use of, the increase of car accommodation would be 61½ per cent. The enlargement of the freight car was not accompanied, however, by a raising of minimum weights, so that, in some cases, shippers made no practical use of the extra space facility. Hence, we cannot regard the whole of the 61½ per cent. as an actual increase of facility to the shipping public; it requires modification in proportion as the average carloads shipped by the various industrial and commercial concerns were not easily susceptible of increase. It must be borne in mind that, primarily, the transition to higher capacity cars is in the interests of the railroad operator. Subject to a certain amount of qualification, it may be said that, under normal conditions, the shipper prefers smaller cars and more of them to larger cars and fewer of them. But, in either case, the practical meaning of the car to him is measured by the position of carload minimum, marking as it does a very considerable difference in transportation charges. Of course, in the long run, under a competitive régime, the shipper is deeply interested in the high capacity car proposition because its utilization, in preference to smaller cars, means greater economy of operation, part of the benefit of which is likely to go, sooner or later, to the shipper.

The idea suggests itself here that, while working towards the higher capacity car, the railroads would be unwise to attempt to impose it upon the shipping public unless the conditions of freight movement were favorable, otherwise considerable inconvenience might result to those whose business organization and relations could not readily be adapted to larger units of distribution. Thus, if increase of car capacity were the sole consideration, an increase of car equipment (but not of car numbers) corresponding with the growth of tonnage to be transported, though theoretically a desirable achievement, might be no small impediment to the manufacturer and dealer in their efforts to attain maximum business expansion. It is to the credit of the far-sightedness of the leaders of railroad policy that, while fostering, for several years, the growth of the larger and more economically operated car, they refrained from even the appearance of coercion in connection with their economical utilization. Thus from the beginning of the present century, the increase of car size steadily proceeded, generally speaking without any notable sacrifice of number, but the carload minimum remained stationary.

The last general movement in the direction of increase of minimum carload weights was, I believe, in 1899, when under the official classification, general weights were raised in all the classes from 20,000 to 30,000 lbs., after having stood at 20,000 lbs. for third class and higher, and 30,000 lbs. for fourth class and lower, during a number of years. At the same time, the Western classification minimum for lower than third class was raised from 24,000 to 30,000 lbs.; four years previously the minimum for lower than third class had been increased from 20,000. The Southern classification minimum of 24,000 lbs. for all classes has remained undisturbed, for all practical purposes, during the last 20 years. Recently, however, a movement has set in toward an advance of existing minimum weights, to accord with the very pronounced advance of the last few years in average car capacity, and this has already found partial, though not very startling, realization in the official classification.

The policy of the railroads, it is plain, has been marked in this regard by great conservatism, and they have amply showed their desire to allow reasonable time for the assimilation of shipping methods to the improved car facilities. They are hardly open to charges of arbitrariness or inconsiderateness in now attempting to take an active step toward the realization of aims long announced, looking to the more effective use of the car accommodation they have provided. If there be any room for criticism at all, it should be directed towards the actual increase of minimum weights in individual cases with regard to the effect of the same upon existing methods of distribution in the industries concerned. But no general opposition to the increase of minimum weights simply because it is an increase is logically well grounded under the conditions.

The possible effect of the actual organization of the distribution of products in hindering full use being made of increased car capacity, secured through the substitution of a smaller increment of higher capacity cars for a larger increment of smaller capacity cars, has now been considered. It may be further observed that changes in the general character of production, while not preventing full use of car space provided, may similarly hinder an increase in car capacity, equaling in percentage the increase of business to be handled in ton miles, from establishing an equality of adjustment of freight equipment to traffic. The character of the tonnage may have altered so that equality of car adjustment can be secured only by a relative increase of car capacity. For instance, to take a hypothetical case of as simple a character as possible, if the tonnage at the beginning of the period of comparison were three-fourths coal and pig iron and one-fourth merchandise and hay, whereas, at the end of the period, the proportions were half and half, each cubic foot of car space would be less efficient on account of the greater space demand of each average ton of freight carried. To some extent, a movement of this kind has been in operation, but by reason of the continued marked preponderance of heavy freight in railroad tonnage, probably not sufficiently to reduce very materially the effectiveness of increase of car accommodation calculated on nominal capacity, yet it is worth bearing in mind that the real working capacity of a car is not its stenciled maximum, or, rather, that plus the additional 10 per cent. allowed, but the average ton-

*From a paper presented at the April meeting of the Western Railway Club, by E. R. Dewsnup, Professor of Railway Administration, University of Illinois.

nage it can accommodate of the class or classes of freight it is commonly required to convey.

So far as the practical results of American freight operation of recent years are concerned, it is not at all difficult to demonstrate that, coinciding with the movement toward a high tonnage car, there has been a material increase in average load, indicating that, to a certain extent at least, such a car has proved adaptable to modern methods of industrial distribution. To quote a few roads indiscriminately, the average carload per loaded car during the period 1900 to 1907, increased with the New York, New Haven & Hartford from 10.2 to 13.4 tons, with the Norfolk & Western from 19.9 to 25.5, with the Wabash from 14.9 to 18.1, with the Louisville & Nashville from 15.3 to 18.7, with the Illinois Central from 13.7 to 17.8, with the Southern from 12.7 to 14.8, with the Chicago & North-Western from 13.8 to 15.3, with the St. Louis & San Francisco from 13.6 to 15.9, with the A., T. & S. F. from 12.7 to 15.5, with the Northern Pacific from 13.4 to 17.8, and with the Great Northern from 16 to 20.4 tons. According to the 1906 statistical report of the Interstate Commerce Commission, the loaded freight car miles for that year amounted to 11,410,599,327 and, as before stated, the ton-mileage to 215,877,551,241. From these figures it appears that the average load per loaded car of all systems was 18.9 tons. It is impossible to say exactly what the average load was for 1900 on account of the failure of the Commission to collect and publish loaded car mileage before 1901, and, by the way, its Public Service tables still neglect the average load per loaded car. However, the average load for 1901 was 16.5 tons, and after an examination of the reports of a considerable number of railroads I am inclined to think that for 1900 the corresponding figure must have been approximately 16⅕ tons. Thus the increase of average loss per loaded car was about 17 per cent. The proportion of this increase due to higher capacity equipment and to improved loading methods respectively are not capable of being determined. After having observed loading methods fairly closely during the period, it does not strike the writer that there has occurred any particularly marked advance in this direction. The exceptions to this general statement are but sufficient to prove the rule. Accordingly I prefer to credit the higher capacity equipment with the greater part of the improvement. From 1900 to 1906, then, a 20 per cent. increase in average capacity has been met by a 17 per cent. increase, or thereabouts, in average load, indicating, as already remarked, the suitability of the high capacity car, within certain limits, to present industrial conditions. From this it follows that the deduction to be made from the 61½ per cent. increase of total car capacity during the period of our comparison, on account of shippers being unable to use to advantage the extra space of each car, is but small and assuredly not sufficient to reduce the per cent. increase of effective accommodation below the 52½ per cent. increase of business.

In the matter of adequacy of car accommodation, therefore, I fail to see how there can be any reasonable dissent from the conclusion that, under the unprecedented boom of business, the railroads as a whole have done astonishingly well in keeping their equipment level, and probably more than level, with the rapid increase of agricultural and manufacturing output.

I say this of the railroads as a whole, thus qualifying my statement because there are individual roads of which it could not be made, just as there are other roads of which more than this could be said. Quite a few railroads have not only managed to keep level with present needs, but have even anticipated future requirements, evidently determined, whatever the cost may be, to provide an adequate amount of car accommodation for their patrons. On the other hand, there would appear to be roads who are not indisposed to piece out their own inadequate car resources with forced loans from their more plentifully supplied neighbors, a larceny which the current of traffic hinders these good neighbors from effectively stopping. The saying attributed to a certain wit: "God help you if you get into the hands of your friends," is entirely apropos of the freight car situation in some respects. Curiously enough, some of the roads which, according to the bulletins of the committee of car efficiency, have been maintaining on their lines a marked excess of cars (amounting, in one case to 50 per cent., and at times to 100 per cent. over the number owned),[1] have really not done badly in the increase of their cars during recent years as compared with the increase of their business. For instance, in the case to which I have made reference the company increased its freight cars during the seven years ending in 1907, 51 per cent., as against an increase of ton mileage of 44 per cent., the difference being still greater in favor of the equipment when capacity is taken into account. Its record of ton miles per freight car in 1907 does not appear excessive on the face of it, when compared with that of numerous other companies. Of course, the explanation of its persistent retention of foreign cars lies in the nature of its tonnage which is comparatively light and bulky, thus necessitating a large proportional number of cars than is necessary for roads with heavier freight: its own equipment was evidently inadequate in space accommodation in 1900 (possibly lethargic car movement played some part) and the improvement accomplished subsequent to that date was obviously insufficient to reduce to really moderate proportions its demands upon foreign equipment. The light and bulky nature of the freight carried, occupying much car space per ton, explains also the moderate car ton-mileage record.[2] The unfortunate feature of a policy of foreign car detention is that it necessarily deprives other roads of equipment, usually at the time when it is particularly needed, so that the whole car situation of the country is disturbed. The railroads of the middle West with their extensive forwarding business are conspicuous sufferers, and the roads in New England, on the Pacific slope and in the Southwest conspicuous gainers by the interline shuffling of cars. In the old days, when freight was transferred at every junction point, it was necessary for each participating carrier to own sufficient cars to haul the freight over its own lines. It would seem proper that the introduction of interline organization should not change this requirement. Of course, the proportion of home and of foreign cars on the lines of a railroad will be determined to a great extent by the direction of the stream of traffic. Lack of promptness in handling foreign cars will soon swell up the number of such upon a road with the stream of traffic traveling toward it. Given a fairly dense and growing local traffic, substantial moral fiber is required to resist the obvious temptation—sometimes the moral element fails to make good. On the other hand, roads doing a large outward, but comparatively small inward, business must make allowance for this extra drain in the extent of their equipment. They must expect to be regularly deprived of the use of a certain proportion of equipment, and it is up to them to do the best that they can to keep track of its movements and to secure the enforcement of mutually agreed upon regulations directed toward securing prompt return.

One of the difficulties connected with per diem as a means of stimulating the prompt handling of foreign equipment is that at the times when cars are in most demand it is least effective. Whether the cost of car hire be 20, 25 or 50 cents a day, or even $1, it is obviously to the interest of a road short of cars to retain foreign equipment if, during the rush of business, the cars are capable of earning more than sufficient to cover operating and per diem expenses.[3] Conversely, when business is dull and cars less urgently needed by the home roads, low car earnings stimulate the effectiveness of per diem to the cost of, it may be, unnecessary empty mileage. There seems much to be urged in favor of a variable per diem charge, especially if handled, along with the whole matter of car interchange arrangements, by some permanently organized central bureau of the railroads. This is a tempting subject to dilate upon, but one impossible to discuss adequately in this paper.

Reference to the problem of car interchange brings our discussion very close to the matter of car shortages, the recent acute attack of which was so dramatically terminated at the close of last November by the financial crisis, whose industrial effects are still lingering with us. The more one studies the car situation in general, the more one realizes that the intensity of such car famines, as they recur from time to time, could be materially relieved if more skilful attention were applied to the supervision and improvement of the distribution and of the mileage performance of cars both in local and in interline business, the crowning difficulties of railroad operation. In speaking thus, it is not intended to have inferred that, under any reasonable economical system of car equipment, the

[1] The statement refers, of course, to the period prior to the present abnormal depression.

[2] Heavy freight would have revealed a striking ton mileage per car. The car ton mileage, at any one time, is the quotient of the total ton mileage divided by the number of revenue cars owned. In general, this represents sufficiently accurately the performance of the average car on the normal railroad, but not in the case of roads, with large standing excesses of cars (or the reverse); the real work secured by such railroads out of the cars operated by them can only be obtained by substituting, as the divisor, average number of cars on line for average number of cars owned. Allowance needs to be made, of course, for private cars.

[3] Suppose that, during the very active season of the business year, a car is capable of earning $2.50 a day after the costs of hauling the car and handling the freight (but not the maintenance charges against the car) are deducted. The railroad has more business than it can handle promptly with its own equipment, and therefore, must either build extra cars just for the traffic of this road, or it must borrow. If the period extends over, say, three months then, if it builds, it ought to debit all expenses of the cars to that short period. These expenses in the case of a modern car, a 40-ton steel underframe box car, for instance, probably average about 10 cents a day, the expenses of maintenance and renewals being distributed over the year, the car being assumed to be in more or less constant use. The estimate is based on $1,025 as the cost of such a car, with 20 to 25 years as average life, 5 per cent. interest on cost of car, $85 or thereabouts as cost of repairs and renewals, allowance also being made for maintenance of repair tracks and sheds, tools and the like including interest on capital invested in them. But in the case before us, these expenses have to be distributed over but three months, allowance being made for lighter repairs, longer life of car, etc., on account of its more limited use. It is not possible to do more than estimate very roughly the appropriate charge against each day of the earning period, but it probably would not be less than $1.25 a day. Thus to earn the assumed $2.50 a day, the railroad must spend (and could well afford to spend) $1.25 a day during the period of the employment of the car if it should provide its own car. But if it borrows other companies' equipment for the period, it will incur hardly any maintenance charges, probably not amounting to as much as 25 cents a day, at the most. So that, under the assumed conditions, there is no inducement for the road to provide its own extra equipment, even if a dollar per diem were levied upon it, and with a 50 cent or 75 cent per diem, it is considerably in pocket by borrowing equipment which it can send home as soon as it has no further use for it.

railroads could obviate such shortages. As a matter of fact the charges of gross inadequacy of equipment, so freely made by choleric shippers during periods of car shortages, are based entirely upon the reasoning that there is a shortage, that the railroads have no business to allow a shortage to take place, and that its existence is sufficient evidence of wilful neglect on the part of the railroads to provide a proper amount of equipment. No consideration is given to the relation of that equipment to business requirements during the periods when surpluses take the place of shortages nor to the possible loss which may result to a railroad maintaining an extra supply of cars whose service is necessary, perhaps, only three months out of the twelve. Unless the daily earnings of such cars during the limited period of their necessary service are sufficient to cover not only the costs of handling the freight, of moving the cars, of use of roadbed, terminals, motive power and so forth, but also interest on capital invested in the cars, maintenance charges, depreciation and insurance, and storage accruing during the whole year, it is patent that the provision of such cars would be a pure act of charity on the part of the railroads, and in no sense a commercial transaction. I am not going to assume gratuitously that it would be necessarily unprofitable for any specified railroad to provide this extra equipment, but note the possibility as something that needs to be investigated before charges of incompetent management are rested simply on shortages in car supply during busy seasons. And in connection with estimation of car shortage, it should be noticed that the extent of the same is not accurately measured by shippers' demands, since they frequently order more cars than they really need in the hope of securing a larger number than they would otherwise be likely to do. The actual shortage at any date is, undoubtedly, less by a considerable percentage than the total of the shippers' nominal requirements.

Moreover, while this shortage is a very real difficulty at the times of its recurrence, it is, in large measure, the result of a tendency on the part of shippers to keep their stocks down to the working minimum, frequently involving procrastination in the ordering of their supplies. An annual example of this is to be found in the coal trade in which the dealers regularly fail to make long enough preparation ahead for the fall trade, so that, with the advent of the cold season, orders for cars are rushed in with instructions that they are to be treated as urgent. They (and many others) are anxious to combine all the advantages of keeping as little capital as possible tied up in their stocks with an absence of all the disadvantages that naturally attach to the undue crowding of business. A little earlier preparation, even if at the expense of tying up more capital in the shape of stocks and storage facilities, would, in many cases, be entirely reasonable, and a legitimate expense of the business. At any rate, if this natural organization of their business arrangements is not attended to, such traders hardly ought to feel aggrieved if their aggregated demands make it impossible for the carriers to reply as promptly as they desire.

From what has been said, it must not be supposed that the railroads, on their side, are keeping down equipment to the level of the traffic of the least active seasons. As a matter of fact, they are providing cars in marked excess of this, and an appreciable portion of their equipment is lying idle or running light during the "off" season. The actual extent of their equipment is a compromise between the requirements of the periods of maximum and minimum trade. The railroads, of course, will continue to increase equipment so long as there is a reasonable profit arising from the receipts of the car during its active period after deducting the charges against it during both active and inactive periods. It is not easy to see how more than this can be expected from the railroads,[1] though it may happen, in consequence, that cars demanded during only three or four months of the year are not supplied. Shippers do not always realize that the surplusage of cars is quite as important a matter to the railroads as shortage is to them. The railroads are most keenly interested, naturally, in balancing supply with average demand, though even then they are liable to be hit pretty hard by business depressions, as witness the 300,000 car surplus during the past two months, the expense of whose enforced idleness (if cost of repairs, renewals, insurance, interest and storage be considered as distributed equally throughout the year) can hardly have been less than $4,500,000.

There are then, difficulties on both sides. But I have already indicated that shortage evils are accentuated among the roads themselves by the action of certain companies in persistently retaining and improperly using the equipment of other lines, thus reducing the pressure upon themselves, but, at the same time, causing it to be more widespread. Per diem arrangements so far tried, though an improvement upon the old mileage system, have failed to bring about an equitable distribution. A resort to car pooling methods really appears to be the only alternative, if economy of equipment is to be a consideration at all. Granted that capable administrators can be found to take charge of such pools—and no one familiar with the official personnel of the railroads would deny this—their influence upon the car situation in general would be very real. Possibly, there could be established district pools with jurisdictions covering, say, official classification territory, Southern classification territory, the Southwest, the St. Paul Chicago, St. Louis, Kansas City and Denver territory, and the territory between the latter and the Pacific coast, each of these district pools focusing in a central distributing office, which would receive full reports from the district pools and would arrange for transfer of equipment from district to district when necessary. In each district, the pooling principle could be made to apply separately to each of the major varieties of cars, and possibly, though the practicability of this is not quite clear, with a rough reference to their capacities. I have sufficient faith in the genius of the American railroad man to believe that the details of some such plan could be worked out satisfactorily. It is not unnatural that reluctance to enter into a car pool arrangement should arise from the dislike of some roads to hand over the management of a part of their equipment to an external authority, and from a fear that they will thereby get the worst of the transaction. Indeed, it is very likely that, during the formative period and early operation of such a scheme, equitable distribution would fail, at times, to be attained, but, in the long run, it would surely work out to the general advantage of all the roads concerned, except in the case of those who now habitually rely upon other people's supply to make good their own deficiences, and these we are not called upon to take into consideration.

Before concluding this paper, I should like to supplement the figures, with which the discussion of adequacy of car equipment was introduced, with one or two more relating to the cognate and equally important question as to how far such equipment is used efficiently. We have seen that the typical car of 1906-7 is considerably larger in capacity than the typical car of 1900; it is also performing a somewhat greater actual service. The real efficiency of a freight car is the resultant of two forces, if I may borrow the language of mechanics, one the average load, the other the mileage it covers, that is, its average rate of movement. Put into figures, the measure of this product in 1906 was 117,450 ton miles as against 103,700 ton miles in 1900, an increase of 13,750 ton miles per car, equivalent to 13¼ per cent. The average load for 1900 has been estimated at 16½ tons, and from this it follows that the loaded miles per car averaged 6,285; in 1906, the corresponding figure was 6,208. This indicates a backward movement so far as the matter of car movement is concerned. But there are reasons why this result should not be accepted at its face value. By reason of the absence of proper statistical data covering the whole of the railroad systems of the country during the years of comparison, I have been obliged to base the loaded mileage performance of each car upon the number of revenue cars owned at the end of the fiscal years. Obviously, the car mileage is made by the average number of cars owned throughout the year. If it were to be assumed that the net increase of cars, during 1900 and 1906, respectively, took place uniformly during these years, then the figures given above would be changed to 6,450 and 6,396, the decrease of miles per car being thereby reduced from 77 to 54. In dealing with the comparison of individual railroads, it would be necessary to take into account the fact that, at different periods and with different roads, the proportion of cars used in making the mileage to cars owned may vary, but, in dealing with all systems collectively, this is obviously unnecessary.

A further reason for neglecting the apparent decrease in car mileage lies in the omission of privately owned cars from the calculation, though the results of their movement are included in the record of total loaded car miles. If the proportion of private cars were the same in 1906 as in 1900, the net decrease as shown above would be slightly reduced, though the percentage of decrease would not be altered, of course. Private car statistics are not available, but I should take it as unlikely that such cars attained quite as large an increase (relative) as railroad owned cars, and, if this be true, a more appreciable reduction in both the absolute and the percentage decrease took place. For instance, private cars in 1900-1 were estimated to equal from 7 to 8 per cent. of railroad freight car equipment. If, during the following six years, they increased but 20 per cent. in number as against the 35 per cent. of railroad owned cars, the net decrease of loaded car miles per car would be reduced from 54 to 19.

A still additional reason for modifying the result first arrived at is to be found in the varying nature of railroad tonnage over the period. Coal and other mine traffic tends to limit the mileage performance of the cars engaged in it and, when such traffic increases more rapidly in volume than the rest, the effect upon general car mileage average is depressive. Undoubtedly, this has taken place, to a certain extent. The products of mines in 1906 accounted for more than 53 per cent. of total originating tonnage, whereas, in 1900, the proportion was slightly over 52½ per cent. Mineral ton mileage and car mileage figures are not accessible but, no doubt, this movement is reflected in them, and though the difference in percentage is hardly large enough to exert much influence upon the average in car, it would probably be sufficient to wipe out the decrease with which the present analysis of car mileage averages started.

[1] In the matter of car equipment, that is, as apart from the question of car movement.

It is satisfactory to find that, the railroad freight service being taken as a whole, there has been no absolute retrogression in the movement efficiency of the freight car, and yet unsatisfactory not to be able to say more than this. The efficiency of the freight car of 1906 over the car of 1900 is due entirely to improved load; there has apparently been no appreciable improvement in the average number of miles traveled per annum. Except in so far as the trader was able to secure lower rates, a supposition hardly justified by the facts, the benefits of the increased efficiency of the freight car during the period 1900-06 must be regarded as having been in favor of the railroad rather than the trader.

It is a somewhat remarkable fact that the power and ability displayed by railroad managers in so many directions has been unable to secure tangible improvement in a matter which is more vital than most things to the really economical and successful handling of a railroad. In scanning the results of freight operations during the half dozen years covered by the main figures of this paper, one may observe with pride the handling of an increase of business of 52½ per cent., with a train mileage increase of but 14 per cent. (492½ millions to 559½ million miles), and a consequent increase in train load of 42 per cent. (271 to 385 tons), accompanied by an increase of 17 per cent. or more (16⅛ to 18.9 tons) in car loading, but car mileage—the less said about it the better! Perhaps, it is incapable of improvement! But the query is inevitably provoked as to whether some of the improvements named have been purchased at too high a cost. The bulletins of the committee on car efficiency reveal great differences between the various roads in the mileage results obtained from their cars. Unquestionably, varying physical and economic conditions play an important part in these differences, yet one cannot help but believe that the personal equation, the organization of the railroad, is no trivial factor. To take but one illustration, the reports published impress one with the idea that a great deal of misapplied economy is frequently exercised with regard to shop repairs. No doubt, a road hauling heavy tonnage over adverse grades and around sharp curves must expect to be troubled more with the question of car repairs than a road working under the reverse conditions. Yet even in this case, the loss of car time may be seriously increased by lack of proper provision of shop facilities, usually a poor kind of economy, and, to the extent to which shop repairs accumulate, a lessening of the effective equipment of the road. In studying the returns covering July, 1906, to August, 1907, one is surprised, again and again, by the high percentages of cars in shops, and high not merely during the period of slack business. Some roads apparently maintain, during the major part of the year, 8, 9, 10 per cent. of their freight equipment, or even more, as shop ornaments. More attention needs to be given to shop policy, and, one might add, to the treatment cars receive in the yards; with the needed improvement, one hindrance to better freight car performance will be removed.

Yard working affords even more fruitful opportunities of improvement. Terminal yard delays is a vexed problem that is apparently eternal in nature. Poor yard design, or, to be more correct in many cases, lack of design, has been condemned again and again as too common a feature, but it is by no means an unknown thing to find the evils of bad design supplemented by those of poor organization and still poorer management. I think a mistake has been made frequently in locating terminal yards too near the centers of the cities, though sometimes the growth of a city has been so rapid as to reach out to fairly distant sites, crippling the possibilities of their expansion by the immense resulting increase in land values. Again the storage privileges of terminal yards have been notably abused. To judge by the space which railroad managements are often prepared to assign to storage tracks in response to the "needs" of the shippers, they do not always realize that, in the physiology of the yard system, the function of the storage yard is about that of the vermiform appendix. It is satisfactory to note, however, that demurrage regulations are being rounded into more uniform shape over the country at large and, with their steady enforcement, less trouble from shippers' delays can be expected.

Much more could be profitably said about the influence upon loaded car mileage of such trans-shipping arrangements as the Pennsylvania provides at Fort Wayne for the making up of "through" loaded cars at that point, thus reducing the pressure upon the Chicago yards, and much more upon the general extension of "consolidation" arrangements in relation to both increased average loading and mileage. A further interesting question is that of adequacy of motive power and the desirable ratio of such power to freight business and equipment. In this matter, as in so many others, there are marked differences in the practices of the various roads, the justification of which it would be desirable to have explained.

The lack of progress along the lines of car mileage is in such astonishing contrast with improvement in other branches of railroad operation, that everyone feels that something should be done to remedy the situation. There are many factors contributing toward a low daily car mileage which are unavoidable, but advance along the lines suggested, and, perhaps, more radical measures, will certainly do something toward raising the present standard.

The previous statistical analysis rests upon figures covering the operations of all systems, both large and small, during the years 1900 to 1906. It will be interesting to see how the general results are borne out and, indeed, emphasized, over a larger period, by the statistics of a group from which very small roads are excluded.

These are compared below, in the case of 31 railroad systems, some of the operating results of 1907 with the corresponding ones of 1897, a ten-year period. The roads whose statistics were available are the following (arranged in alphabetical order):

A. G. S.	Louisville & Nashville.
Atch., Top. & Santa Fe.	Michigan Central.
Baltimore & Ohio.	M. & O.
Boston & Maine.	Mo. Pac. and St. L., I. M. & S.
Central of Georgia.	N. Y. C. & St. Louis.
Chesapeake & Ohio.	Norfolk & Western.
Chic. & E. Ill.	Northern Pacific.
Chic. & North Western.	Pennsylvania Railroad.
C., C., C. & St. Louis and P. & E.	Rock Island.
Chic., Mil. & St. Paul.	St. Louis & San Francisco.
C., New Or. & T. P.	St. Louis Southwestern.
Erie.	Southern.
Great Northern.	Texas & Pacific.
Grand Trunk.	Union Pacific.
Illinois Central.	Wabash.
Kansas City Southern.	

In 1907 these railroads were handling considerably more than half the railroad traffic of the country, and hence, in spite of some prominent omissions, are well representative of the more important systems. They owned 538,830 revenue freight cars in 1897 and 1,065,548 in 1907, an increase of 97.8 per cent. In calculating the average capacity of these cars, I have been compelled to omit, in 1897, the L. & N., N. P., Rock Island, Mo. Pacific, B. & O., St. L. & S. F., Southern, C. of G., and K. C. S., representing a total of 140,074 cars, on account of average capacity for that year not being ascertainable, but I have added to the list previously given the C., B. & Q. with 36,469 cars. For 1897, accordingly, the average capacity has been based upon 23 roads with 435,225 revenue freight cars, having a total capacity of 9,780,211 tons, thus giving an average capacity of 22½ tons. For 1907 I have had to exclude four roads, the L. & N., C. of G., K. C. S. and Mo. Pacific, with 94,348 cars, but have again added the C. B. & Q. with 47,164 cars, making a net total of 1,018,364 cars, having a total capacity of 34,181,517 tons, or an average capacity of 33.9 tons. On account of the large number of cars included in the calculations, the omission of the roads named cannot materially affect these averages. An increase from 22.5 to 33.9 tons represents a percentage increase of 50.7, from which we can see, much more clearly than in the case of the general statistics covering the shorter period, the really great advance made by the larger and more progressive roads in the direction of the increase of car capacity. When this 50.7 per cent. increase of car capacity is combined with the 97.8 per cent. increase of car numbers, an increase of 198 per cent. of car accommodation is shown. How does this compare with the growth of business handled by these roads? The 31 systems handled, in 1897, 53,046,151,280 ton miles; in 1907, 136,037,276,970 ton miles, so that against the 198 per cent. of car accommodation there has to be set only 156½ per cent. increase of ton mileage. The average load per loaded car mile was 13.4 tons in 1897, and 19 tons in 1907, an increase of 41.8 per cent.* This substantiates the statement made in the body of the paper that there has been evidently a fairly economical utilization of the extra capacity of the enlarged car.

With respect to car movement figures, the 3,991,494,854 loaded car miles of 1897 represented 7,407 loaded car miles per revenue car owned. In 1907, the 7,143,781,875 loaded car miles average out to but 6,704 loaded miles per car owned, an apparent decrease of 9½ per cent. With some of the most important roads included in the averages, the decrease reaches as high as 15½ to 19 per cent. As noted already, these percentages would undoubtedly undergo reduction if adjustment were made for (1) average number of cars owned throughout each year; (2) railway cars owned but not on lines, or vice-versa; (3) average number of private cars operated throughout each year, and (4) proportion of coal and similar car delaying traffic to total traffic. It will be understood from previous remarks that the percentage results can be affected by adjustments under these four heads only when there is, in any of the cases, a percentage variation in the years compared. Should the proportions remain the same the percentage of decrease could not be influenced by such adjustments. It is not unlikely that some roads would find it extremely difficult to account statistically for the whole of the decrease.

Japan's acquisition of the railroads of the country for its state system seems to have been untimely to say the least. It was undertaken just after the great war which had brought the country much glory but no money, and had enormously increased the national debt. Then the railroads needed great expenditures for improvements. The Minister of Transportation asked for $180,000,000, to

*The average is based on the 31 roads named in the list with the exception that the Boston & Maine could not be included in the average for 1897 on account of the absence of loaded car mile figures for that year.

be expended within 12 years. But the Cabinet would only appropriate $15,000,000 at this time, and the authorities finally limited the amount to $12,000,000, whereupon the Railroad Minister resigned.

How Can the Railroads Best Serve the Public?

1. For the protection alike of those who have invested their money in railroads, and of the public served thereby, there should be a local ownership of shares, and that ownership as widely scattered as possible among the greatest number of people.

2. Directors should make full and frequent reports to their stockholders, and encourage the latter to question and discuss them at their meetings, as is done in England, in advance of declaring dividends.

3. Stockholders should realize they are partners in a common venture, and that it is their duty, alike on moral grounds and on grounds of self-interest, to hold their directors, as trustees, to frequent accounting and a strict accountability for all their acts.

4. The use of the misnomer, "interstate commerce," be discontinued, as the word "inter" means "between" rather than "among." The thing really is "domestic commerce."

5. The supervision of railroads should continue as at present under state and federal authority:

(*a.*) The state to exercise such measure of regulation as shall provide for the local trade therein prompt, frequent and safe service, adequate to the growing needs of the public and to retain all its police powers.

(*b.*) The larger matters, which really affect "commerce among the several states," being relegated to federal control, if need be, through an amendment to the constitution.

As to federal regulation:

6. Measures should be taken to expedite the investigation and determination of all questions affecting commerce among the several states, by putting the administrative work under the direct control of the executive, entrusting the judicial determination of all such questions to the judiciary, and leaving with congress itself all the legislative power.

7. The attempt under the present law to delegate to one body functions which our constitution has vested in the executive, legislative and judicial branches of government separately, be given over. A purely administrative body should be created as a part of one of the departments of the executive. Preferably this should have at its head one man as a "commissioner of domestic commerce," occupying, in respect to all companies engaged in transportation among the several states and territories, whether by land or water, much the same place as the comptroller of the currency does toward the national banks. He should be aided by such assistants in various parts of the country as may be necessary, and authorized to call upon the other departments of the executive, particularly the department of justice, and the secret service bureau, for assistance at all times and in all places. To this commissioner each company should make periodic reports, and it should be his duty to see that steps are promptly taken to enforce the law in every particular and in every case.

8. The judicial functions hitherto exercised by the interstate commerce commission should be relegated to the courts, where they properly belong. If needed, additional district and circuit judges should be appointed. I would not favor, as was, I believe, proposed some years ago by your distinguished fellow citizen, the Hon. Richard Olney, the creation of special courts in which to try cases relating to "commerce among the several states," because all citizens have an equal right to be heard in the same court.

9. The attempt by congress to delegate the legislative function of fixing in advance the rates be abandoned. At best, it is of doubtful constitutionality. All disputed cases before the interstate commerce commission must eventually be passed on by the courts; congress should, therefore, so legislate as to really expedite the final decision of such cases.

10. And lest it be said that I have left out the vital question of rates:

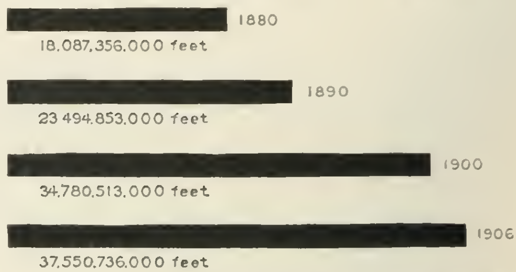
Let it be also provided that rates shall be fair in themselves; that is, above the cost of rendering the service, and below its value, which, while remunerating the owners, shall not restrict trade, but shall tend to stimulate its development. Such rates to be open and equal to all under like circumstances, and subject to legislative revision and regulation. Every trick and device in respect to them to be so promptly detected and punished, that those guilty of the offense shall be deterred by fines, and, if need be, prevented by imprisonment from repeating it.

It is obvious that this final recommendation contains nothing more than the Common Law has always provided as to carriers' charges. The time is coming, indeed it is at hand, when we will do well to revert to the practice of our fathers in basing our action on the Common Law, which, while called the "Sum of human wisdom," is but common sense and common honesty, as practised for centuries by intelligent free men. —*Stuyvesant Fish.*

The Drain on the Forests.

The Forest Service has issued a pamphlet by R. S. Kellogg, Chief of the Office of Wood Utilization, describing the annual consumption of wood in the United States and the timber supply available for the future. This is accompanied by several charts, most of which are reproduced herewith. These charts and the information given in the circular are based, with the exception of those for mine timbers, on statistics of forest products for 1906.

The total quantity of timber used annually for lumber, shingles, hewed cross ties, domestic pulpwood, cooperage stock, round mine timbers, lath, wood for distillation, veneer, and poles (these prod-

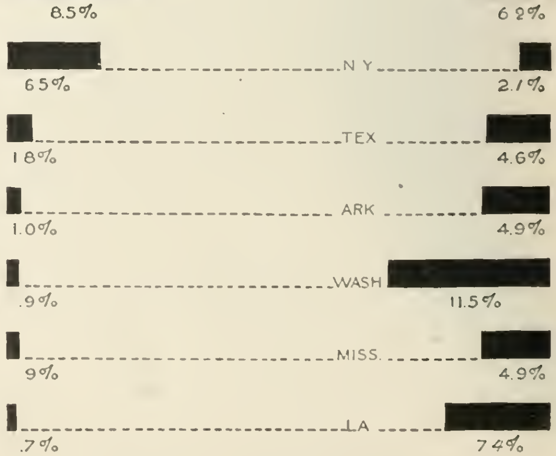


Lumber Production of the United States in 1880, 1890, 1900 and 1906.

ucts being mentioned in the order of their production during 1906) is equivalent to about 50 billion board feet. Of this amount lumber makes up about 37 billion board feet, which is about three times as much as for all the other items combined. Shingles and hewed cross ties each require about three billion board feet, and pulpwood about two billion.

The cut of lumber by kinds of woods in 1906 is shown by the accompanying diagram. Yellow pine furnished 31.1 per cent. of the total, Douglas fir 13.2 per cent., white pine 12.2 per cent., hemlock 9.4 per cent., oak 7.5 per cent., spruce 4.4 per cent., and western pine 3.7 per cent. These seven kinds of timber furnished over four-fifths of the total. The production of no other kind was as much as one billion feet.

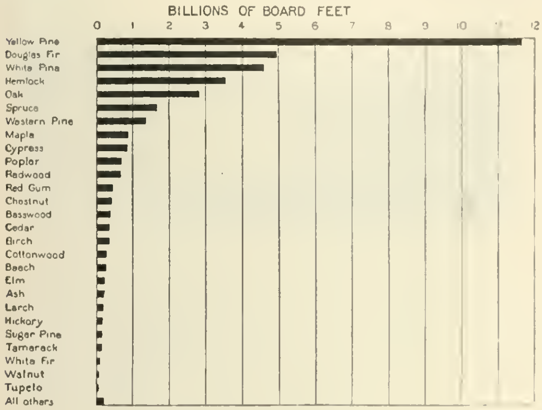
Another diagram shows the lumber cut by states in 1906. Washington produced 11.5 per cent. of the total, Louisiana 7.4 per cent., Wisconsin 6.2 per cent., and Michigan 5.6 per cent. The



Relative Lumber Production of Nine States in 1880 and 1906.

15 states which cut over one billion feet in 1906 supplied nearly three-fourths of the total production. Another diagram shows the proportion of the total lumber production from nine states in 1880 and in 1906. These nine states produced 52.8 of the total in 1880 and 51.5 in 1906. These proportions are about equal, but the changes in the output of individual states are very striking. Michigan, for instance, cut 23 per cent. of the total in 1880 and only 5.6 per cent. in 1906. Louisiana cut 0.7 per cent. of the total in 1880 and 7.4 per cent. in 1906. In 1880 Washington furnished only 0.9 per cent. of the lumber production of the country, but in 1906 it furnished 11.5 per cent. The cutting of the virgin timber in the North and East has been followed by greatly increased drains on the forest resources of the South and West.

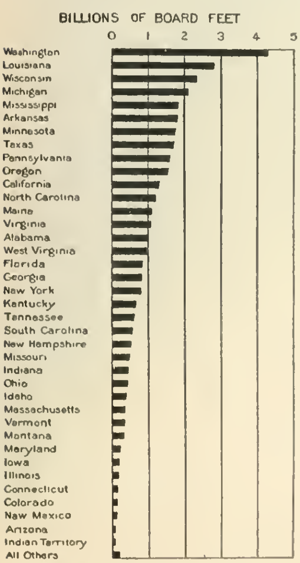
The hardwood and softwood lumber production in 1906 is shown in another figure. The amount of softwood cut was over four



Forest Products in 1906.

times the amount of hardwood. There has been a decided change in the ratio between the two kinds in recent years. In 1889 hardwoods furnished nearly 25 per cent. of the total, against 19½ per cent. in 1906. There has been a greatly increased cut of certain softwoods. In the last seven years the cut of yellow pine has increased 20.7 per cent., western pine 46.9 per cent., cypress 69.3 per cent., redwood 83.2 per cent., and Douglas fir 186.2 per cent. These increases far more than counterbalance the decrease during the same period of 40.8 per cent. in the cut of white pine. On the other hand, the cut of oak has decreased 36.4 per cent., and of poplar 38.7 per cent. These are the two most important hardwoods.

The total lumber production reported by the censuses of 1880,



Lumber Production by States in 1906.

Comparison of Hardwood and Softwood Production in 1906.

Excess of Annual Cut of Timber Over Annual Growth.

1890, 1900 and 1906 is shown in another figure. The cut of lumber has more than doubled since 1880. The annual per capita consumption during the same period has increased from 360 board feet to 440 board feet. The rate of increase in lumber production has been small during the last few years, which probably indicates that the maximum cut for the country as a whole has been nearly if not quite reached.

The United States uses each year 100,000,000 cross ties, three-fourths of which are hewed. Sawed ties are included in the item of lumber mentioned in the second paragraph. Of the hewed cross ties, the oaks, and chiefly the white oaks, furnish nearly one-half. The cut of the hewed ties from young oak trees constitutes, with the exception of lumber, the most serious drain on the oak forests. Two-fifths as much oak timber is required for ties as for lumber. The southern pines furnish nearly 18 per cent. of the hewed cross ties, cedar about 8 per cent., and chestnut about 7 per cent. Other woods which are used in large quantities for hewed cross ties are cypress, tamarack, western pine and redwood.

The annual consumption of lumber in firewood is estimated at 50 billion board feet. Much timber is also destroyed or damaged by fires and storms. For example, in 1891 it is estimated that 12,000,000 acres of forest land were burnt. Again, in the fall of 1906 a great deal of timber was thrown down by wind in the Gulf states. The present consumption of wood in all forms may therefore be conservatively estimated as at least 100 billion board feet a year, and possibly much more. One leading authority has estimated that the total annual use of wood in the United States is equivalent to 150 billion board feet.

Only approximate answers can be given as to how long our timber supply will last at the present rate of cutting. The accompanying diagram shows the excess of the annual cutting over the annual forest growth in the United States as nearly as can be estimated. The annual cut is about three times as great as the annual growth. The most detailed estimates of the standing timber in the United States range from 1,400 to 2,000 billion feet. On this basis the exhaustion of our timber supply is indicated in from 9 to 33 years, according to the method of estimating. Yellow pine, the most important single kind of timber at present, will probably be exhausted in from 10 to 25 years, and Douglas fir in from 25 to 70 years, though this estimate for these woods disregards annual growth.

At present only about 22 per cent. of our total forest area, assuming a forest area of 700,000,000 acres, is in State or National Forests, the remainder being on unreserved public lands or in private hands. The forest area of the United States is amply sufficient, if rightly managed, to produce eventually enough timber to supply all our needs. Yet private owners, as well as the state and national governments, must use their forest lands in a right way if we are to maintain our timber supply.

Foreign Railroad Notes.

Although there has been a decided check to the industrial activity of Germany, the railroad gross earnings are larger than last year; on the Prussian lines 7 per cent. larger in February.

By the electrification of the Giovi tunnel, a short distance north of Genoa, it is expected that 2,000 cars daily may be passed through, instead of 1,000, as at present. The improvement is to be completed early in June.

The degree of Doctor of Engineering was conferred by the Karlsruhe Technical School February 19 last, his 50th birthday, on Wilhelm Schmidt, in recognition of his merits in connection with the use of superheated steam in locomotives.

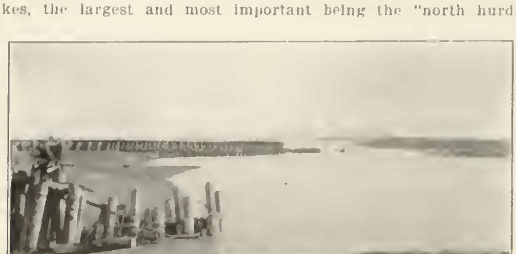
The production of cotton in the Russian dominions north of Afghanistan affords a considerable traffic to the Asiatic Midland (to the Caspian Sea) and the new Orenburg & Taskend line, and an appreciable contribution to the Russian cotton factories, though as yet not enough to make Georgia and Texas tremble. Up to the first of January last the shipments of last year's crop had amounted to 309,620 bales.

A railroad was recently built in Norway from Christiania westward over the mountains to Bergen, on the German ocean. This was snowed under so deep that the section over the mountains was closed in January, and not till April 6 was it attempted to dig it out, with a rotary snow plow. Several miles of snow sheds are to be built; but these will detract from the attractions of the journey.

In answer to a deputy who is an authority on German coal and iron traffic, and who had called attention to the advantages of cars of large capacity as used in America, the Prussian Minister of Public Works said that experience had shown that 20-ton (44,000 lbs.) cars were as large as could be used to advantage on their lines, and that self-unloading cars were economical only on short routes where they are discharged every day.

Repairing a Dike on the Southern Railway.

The "North Incline" of the Southern Railway leading to the freight car ferry on the Illinois side of the Mississippi river near Granite City—about half a mile north of the Merchants' bridge—handles as much if not more freight than any other incline in the vicinity of St. Louis. From the map shown herewith it will be seen that the incline trestle is double-track and is protected by three dikes, the largest and most important being the "north hurdle" dike. This was built in 1902-1903, a part of the work being done during the high water of the spring of the latter year when the stage of the river was about 25 ft. The current was so strong that it was impossible to sink matting to protect the piling against washing out. As a result, the floods of succeeding years cut the piling out until a gap of about 500 ft. had been made. This allowed the current to attack the incline, as shown by the river contours.

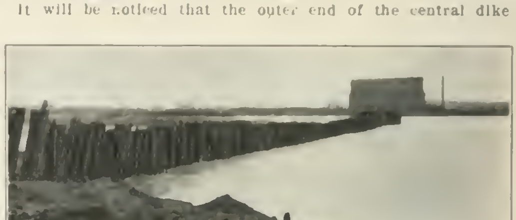


Dike Piles in Foreground Were Part of Original Structure.

It was decided, in repairing the dike, to build the new section at an angle that would deflect the direct current from Gaberet's slough, since during flood periods this current is very strong and difficult to break. The construction of the new work was favored by an extremely low stage of the river.

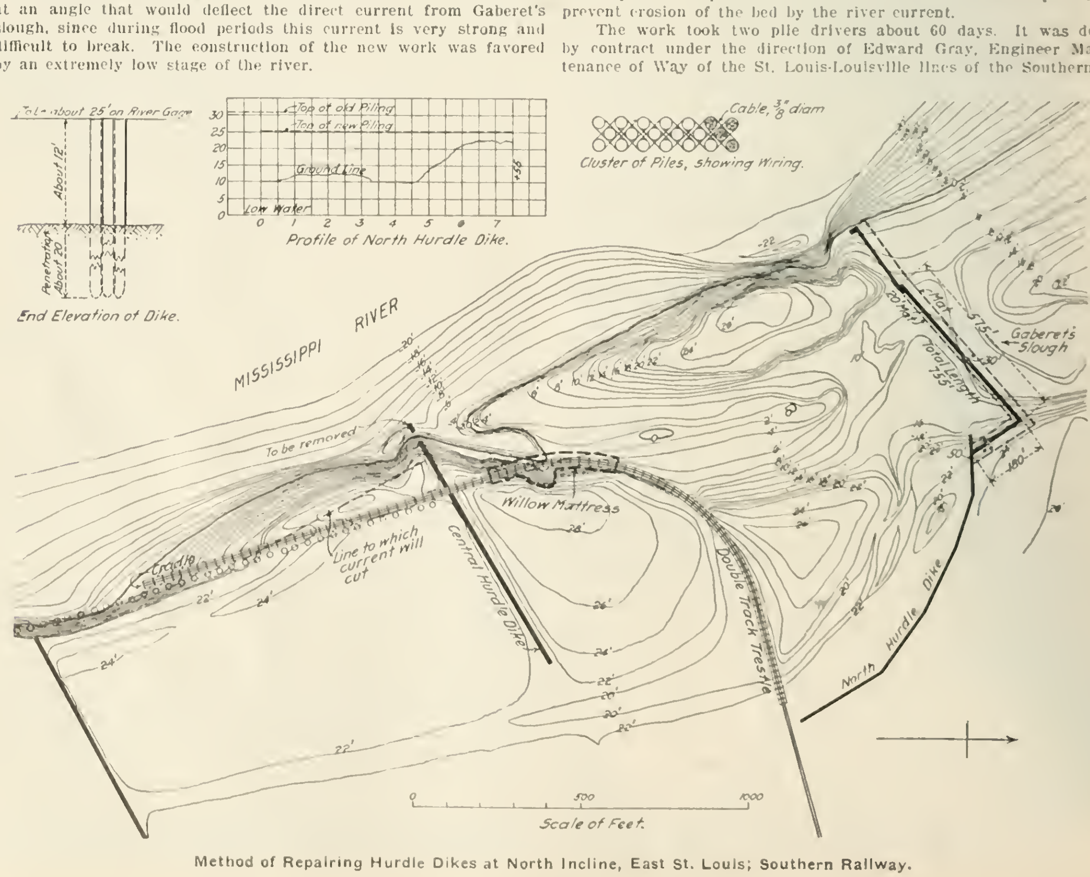
An excavation about 5 ft. deep and 50 ft. wide was made in the bed of the slough, which at this point is at an elevation of about 10 ft. Willow mattresses closely woven and wired were laid in this trench and covered with limestone riprap to the amount of about 1½ cu. yds. to each 100 sq. ft. of mattress. The up-stream side of the mattress was dipped about 2 ft. and heavily riprapped at the toe to prevent under-scour. The piling was then driven through the mattress about 20 ft. from the up-stream edge. The plan shows the spacing of the piling, which averages about two piles per lineal foot. These were carefully drawn into place and wired and stapled, and the tops of the piles cut off evenly. Theoretically, in one or two years' time all space between the dike and the trestle should be filled in with sand deposit to a contour of 18 to 20 ft., giving positive protection to the incline from floods.

It will be noticed that the outer end of the central dike is marked for removal. This dike now extends so far into the river as to keep the current too far away from the lower incline trestle, and sand banks form over the tracks during each high water, which have to be removed either by hand or hydraulic power. Cutting off about 50 ft. of the dike will allow the current to cut in close enough to the trestle to do away with this trouble. The presence of a mattress at the outer end of the trestle curve is indicated on the map. It was placed there at the time the dike was repaired to prevent erosion of the bed by the river current.



View of Dike Before Tops of Piles Were Cut Off.

The work took two pile drivers about 60 days. It was done by contract under the direction of Edward Gray, Engineer Maintenance of Way of the St. Louis-Louisville lines of the Southern.



Method of Repairing Hurdle Dikes at North Incline, East St. Louis; Southern Railway.

GENERAL NEWS SECTION

NOTES.

It is reported that the St. Louis & San Francisco will dispense with the services of train auditors.

The State Railroad Commission of Illinois has ordered sweeping reductions in switching charges at Chicago.

The New York Central has closed its telegraph school for the summer; this for the reason, it is stated, that the company now has a surplus of operators.

The Pittsburgh Traffic Club has passed resolutions complaining because the railroads are not so free as formerly in furnishing shippers with copies of all new freight tariffs.

At Columbus, Ohio, last week Judge Evans granted a temporary injunction against the enforcement on interstate shipments of the demurrage rules prescribed by the State Railroad Commission.

The Supreme Court of Texas has sustained the contracts, made before the passage of the present anti-pass law, under which the employees of express companies are carried free on railroads.

The newspapers say that there is to be a conference in Chicago, June 12, of members of the railroad commissions of six states—Illinois, Indiana, Wisconsin, Michigan, Ohio and New York, Second district.

Joseph Richardson, Chairman of the Southeastern Passenger Association, announces that after June 1 mileage books will not be accepted on trains but must be presented at the ticket offices for exchange.

The Wabash has issued freight tariffs at Chicago in which the rates, while no higher than before, include the charges for carrying freight in the tunnels from the shippers' stores to the Wabash freight houses.

The Massachusetts legislative committee on railroads and taxation, sitting jointly, has voted to report the bill based upon the petition of John P. Wainright, and advocated by President Tuttle of the Boston & Maine, to amend the Massachusetts anti-stock watering laws with regard to the issuing of new stock by steam railroads and street railways.

It is announced that beginning May 31, through passenger trains are to be run between Chicago and Savannah over the Illinois Central and the Central of Georgia. The route will be over the Illinois Central's main line to Jackson, Tenn.; from there to Birmingham, Ala., over the new line of the Illinois Central and from Birmingham to Savannah over the Central of Georgia.

Railroad Club of New York.

This is the name of a new social club which has just been opened in the "down town" section of New York City. It is in one of the two new Hudson Terminal buildings. At the dedication on Monday last about 1,000 members and guests were present. The rooms are in the twenty first and twenty-second stories of the building named, which is at the corner of Church and Cortlandt streets. The club's officers are E. H. Gary, of the United States Steel Corporation, President; F. D. Underwood, President of the Erie Railroad, Vice-President, and C. W. King, Secretary and Treasurer. The house committee is composed of W. G. McAdoo, W. G. Oakman, W. H. Marshal, F. B. Jennings and W. G. Besler.

Entering the foyer on the twenty first floor, one passes directly to the office, which is flanked by a broad staircase leading to the floor above. Off the foyer to the north are the smoking or lounging rooms and the grill, and in the southwest corner the main dining room for men. Along the east side of the building on this floor are 10 private dining rooms. It is possible here to open sliding doors throwing five of these rooms into one long banquet hall. The floor above has a ladies' dining room and a roof garden.

The Chicago Subway.

The lines of the underground electric freight railroad in Chicago now connect with the freight station of every railroad in the city except one, and with 34 large stores, warehouses, etc. The company has just completed a freight station at 169 West Jackson boulevard and one at Dearborn avenue and North Water street, for the accommodation of merchants whose buildings cannot profitably be connected directly, through their basements, with the railroad tunnels. From an article in the *Western Electrician* it appears that the tunnel roads now have 1,800 cars and [illegible] electric locomotives. The speed of trains is limited to 1[illegible] miles an hour. It has been found desirable to have signals of some kind at the numerous intersections of north and south with east and west lines, and an automatic arrangement is being put in, to be actuated through the trolley wire. With this a red light is shown at a crossing when a train is approaching. At the 13 places where the lines run beneath rivers, a similar connection to the trolley wire is to be made to provide an automatic block system for trains following one or another on the steep grades. These grades under the river are from [illegible] ft. to 160 ft. per mile. The officers of the Illinois Tunnel Co. are Samuel McRoberts, President; A. J. Earling, Chairman of the Executive Committee; W. J. C. Kenyon, General Manager, and J. W. Callahan, General Superintendent.

Scherzer Bridge in Egypt.

The contract for the bridge over the Nile at Cairo, costing over $1,500,000, has been given to the Compagnie de Fives-Lille, of France. The bridge will be about 900 ft. long between abutments, and will carry a road, two footpaths and a double-track electric railway. There will be one draw span, consisting of a Scherzer double-leaf, rolling lift bridge, 129 ft. 1 in., center to center of pins, and 63 ft. wide. The bridge will be built according to plans prepared by the late Sir Benjamin Baker, one of the designers of the Forth bridge in Scotland, and the Scherzer Rolling Lift Bridge Co., Chicago, which company will act as Consulting Engineers for the draw span and adjacent parts. It is expected that the bridge will be in service before the end of 1910.

Steel Fence Posts.

The standard steel post made by J. H. Downs, 299 Broadway, New York, is made of a single high carbon steel angle. It is driven into the ground, thus saving the expense of digging post holes. To hold it more firmly in place, a vitrified clay collar, fitting loosely on the post, is slid down it after the post is driven, leaving about 1 in. of the collar above ground. The posts are made in various lengths, and in sizes from $1\frac{1}{2}$ in. x $1\frac{1}{2}$ in. x $\frac{3}{16}$ in. to 2 in. x 2 in. x $\frac{3}{16}$ in. The fence wire is attached to the posts by special staples engaging the wire and then driven into holes punched through the post and clinched on the inside. Instead of staples, clips which grip the post may be used. This is a convenience when it is not known in advance what fencing will be used, so that the posts cannot be punched accordingly. A special non-climable fence post is furnished for use with barb wire, the top of the fence being bent inward at an angle of 45 deg.

Williamsburgh Bridge Terminal.

The new subway station under construction for the past two years at the Manhattan end of the Williamsburg bridge, New York City, has been opened for business. The station is used by the electric (surface) street cars which cross the bridge to and from Brooklyn. The new terminal station has eight loops with separate platforms, and entrances and exits for each loop, so that the streams of incoming and outgoing passengers will not get in each other's way.

In Brooklyn a connection is being made between the Broadway elevated road and the bridge, and it is expected that elevated cars will soon be run over the bridge.

The Amsterdam Corporation.

The Amsterdam Corporation, 165 Broadway, New York, has been organized for the purpose of acting as engineer on special railroad problems, such as electrification of steam lines; subaqueous tunnels; urban and interurban railways, passenger and freight terminals, and analyses of operating contracts. While the principal purpose is to give advice on these matters, the corporation is prepared, when desired, to act as agent for the principal in supervising and directing new construction to a conclusion. With this object in view, no alliance or connection has been nor will be made by the corporation, or its officers or employees, with any manufacturing company or others, that will interfere with unbiased and disinterested devotion to the interests of its clients.

The corporation is also prepared to initiate and perfect plans for new enterprises, accompanied by data that will demonstrate their merit to investors. The President, William J. Wilgus, was formerly vice-president of the New York Central. The Vice-President, Henry J. Pierce, is president of the International Railway, Buffalo, and president of the Netherlands Tramways Corporation.

Crop Conditions on May 1, 1908.

The crop reporting board of the Bureau of Statistics of the United States Department of Agriculture finds, from the reports of correspondents and agents of the bureau, that the area of winter wheat standing on May 1 to be harvested was about 29,751,000 acres, which is 4.2 per cent., or 1,318,000 acres, less than the area reported as sown last fall and 5.8 per cent., or 1,619,000 acres, more than the area of winter wheat harvested last year.

Winter wheat.—The average condition of the growing winter wheat on May 1 was 89.0 per cent. of a normal, as compared with 91.3 on April 1, 82.9 per cent. on May 1, 1907, and 85.8 per cent. the mean of the May 1 averages of the past 10 years.

Rye.—The average condition of the rye crop on May 1 was 90.3 per cent. of a normal, as compared with 89.1 on April 1, 88.0 on May 1, 1907, and 89.5 the mean of the May 1 averages of the past 10 years.

Meadows.—The average condition of meadow (hay) lands on May 1 was 93.5 per cent. of a normal, as compared with 83.6 on May 1, 1907, and 89.5 the mean of the averages on May 1 of the past 10 years.

Pastures.—The average condition of pastures on May 1 was 92.6 per cent. of a normal, as compared with 79.6 on May 1, 1907, and 87.8 the mean of the averages on May 1 of the past 10 years.

Spring plowing.—Of the total acreage of spring plowing contemplated, 66.6 per cent. is reported as actually done up to May 1, as compared with 71.5 per cent. at the corresponding date last year, and 65.9 the mean of the averages so reported in the past 10 years.

Spring planting.—Of spring planting 54.7 per cent. is reported as having been completed on May 1, as compared with 47.0 per cent. on May 1, 1907, and 52.6 per cent. on May 1, 1906.

Increase in Stockholders.

Since the panic of last year the number of stockholders of the principal railroads in the United States has increased greatly. A considerable part of this increase may be due to the registration of shares in the names of the individuals instead of in the names of brokerage firms, but it is also due to increased investment by people who were attracted by the relatively low price of railroad stock during and after the panic.

The following table compiled by the *Wall Street Journal* gives the approximate number of shareholders of certain corporations at present, compared with certain dates previous to the panic in October:

Company.	Shareholders Now.	Before panic.
U. S. Steel	95,000	68,000
New York Central	22,098	16,445
Big Four	1,650	1,277
Nickel Plate	807	630
Standard Oil	5,156	5,087
Rock Island preferred	3,020	2,295
Rock Island common	4,105	3,049
Chesapeake & Ohio	2,648	1,735
Norfolk & Western	4,530	3,679
Erie	10,050	9,258
Chicago Great Western	10,500	9,000
Chicago, Milwaukee & St. Paul	10,000	6,000
New York Air Brake	1,200	800
Atchison	25,000	19,700
Delaware & Hudson	5,861	3,700
Canadian Pacific	18,943	15,900

Sale of Passenger Coaches.

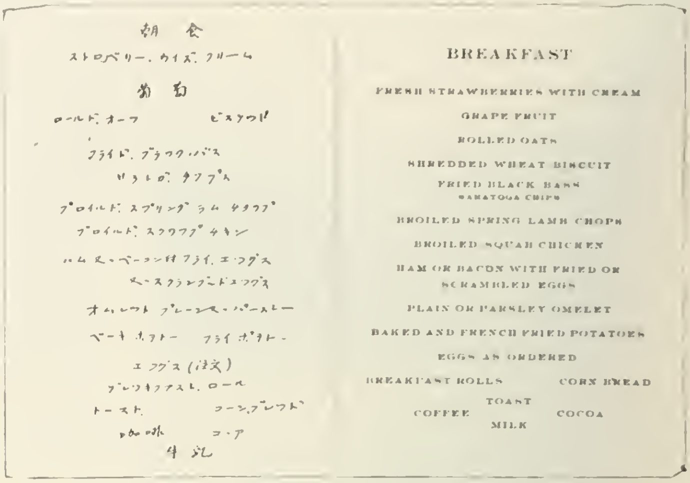
The Commissioner of Bridges will sell at public auction June 2, 1908, in Brooklyn, N. Y., 92 passenger coaches, 20 of which are motor cars weighing about 36 tons each, as noted on advertising page 22 of this issue.

Limit of New Security Issues in New York.

The Public Service Commission of Albany, in granting authority to the Lehigh & Hudson River Railway to issue only $270,000 bonds on its application for permission to issue $300,000, decides that bonds or stocks cannot be issued to repay money taken from the treasury, although this money may have been used for work properly chargeable to capital account. The Commission points out that the only thing that can be considered is the new use of the money acquired from the sale of bonds or stock. (See discussion on editorial page.)

A North Western Menu Card in Japanese.

A facsimile of a menu card prepared by the Chicago & North Western Ry. for a party of Japanese merchants, manufacturers, bankers and newspaper men which traveled over that road in April is shown herewith. The party was on a sight-seeing trip around the world. They traveled eastward from San Francisco on the Overland Limited. When nearing Chicago their sleeping cars and special dining car were detached and run as a special train to enable

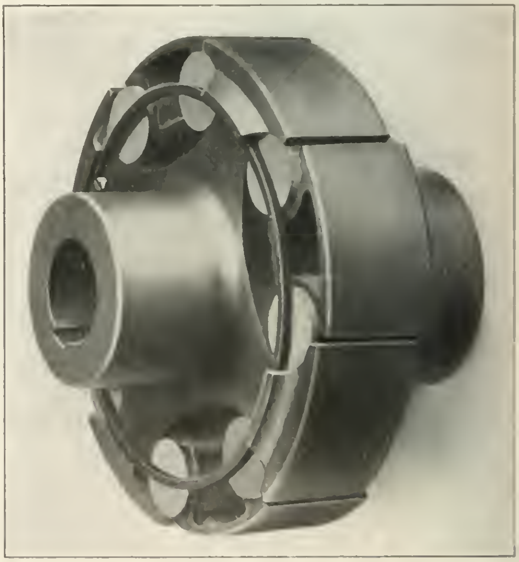


North Western Menu Card in Japanese.

the visitors to examine such industries on the North Western as interested them. The special menu card was bound in a cover bearing the crossed flags of Japan and the United States.

A New Flexible Insulated Coupling.

The illustration shows an improved flexible insulated coupling manufactured by the R. D. Nuttall Co., Pittsburgh, Pa. The coupling consists of two interlocking spiders of cast-iron, insulated by solid rubber cylinders. The only other parts are two steel rings



Nuttall Flexible Insulated Coupling.

used to hold the rubber cylinders in position. The rubber members provide ample insulation and at the same time give the desired flexibility. It is furnished in sizes from 5 h.p. up.

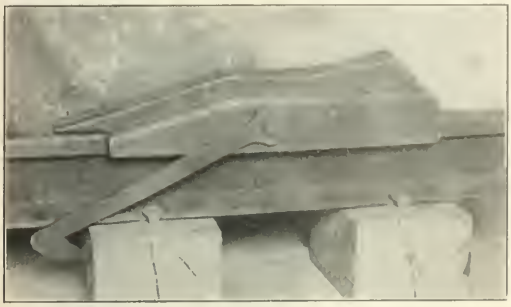
This coupling is especially desirable where electric motors are direct-connected to machinery subject to vibration; for example, a tube mill or a coal pulverizer in a cement plant, where the coupling relieves the motor from the shocks and jars of the machine. In addition, the end thrust of the crusher is overcome and the motor bearings run without heating.

Arthur Koppel.

Arthur Koppel, who died suddenly on May 13, at Baden Baden, Germany, was born in Dresden, Germany, in 1851, and started in business when he was 17 years old. He was first interested in a concern in the handling of structural iron and established his own firm in 1876, taking up the problem of making portable all kinds of material for narrow-gage railroads. In 1905 the firm was made a stock company. The American business, the Arthur Koppel Co., Pittsburgh, Pa., was established ten years ago. There will be no change in the company.

Davidson Locomotive and Car Raiser.

The accompanying illustration shows the Davidson locomotive and car raiser in position. This device is a practical emergency



Davidson Locomotive and Car Raiser.

jack, upon which the wheel of the locomotive or car is run and allowed to rest in the curve shown. In cases of failure in a locomotive equalizer system, the raiser, used under the wheel, lifts the engine frame into a position when temporary repairs can be made. The raiser is made of cast steel and will handle locomotives of any size. It is made by the U. S. Metal & Manufacturing Co., New York.

University of Illinois.

Prof. Ira O. Baker, for 34 years connected with the Department of Civil Engineering of the University of Illinois, has been granted by the trustees leave of absence for one year from July 1, 1908. It is understood that Professor Baker will devote his time to revising his book on Masonry Construction. The executive duties of the Department of Civil Engineering will, during his absence, be assumed by Prof. J. P. Brooks.

INTERSTATE COMMERCE COMMISSION RULINGS.

Relation of a Particular Rate to Rates Generally.

George R. Reynolds v. Southern Express Co. Opinion by Commissioner Clements.

The defendant's rate on cream of $3.90 per 10 gallons from Columbia, Tenn., to Jacksonville, Fla., was held to be unreasonable, and a rate not exceeding $2.75 for the movement of the cream and the return movement of the empties was prescribed. The law requires that the several classes of common carriers subject to its provisions shall fix reasonable charges for transportation, and the authority of the Commission to prescribe a reasonable rate is not restricted by the terms of any agreement between an express company and a railroad company. It is not sufficient, says the commission, for a carrier when called upon to justify a rate to assert that its rates generally are fair and just and that no change may properly be made in any particular rate because it would disturb the integrity of the system as a whole. In dealing with a particular rate the commission may consider such other rates as affording a basis for comparison, but where a given rate is found to be unreasonable the commission will not hesitate to order such rate reduced, although the reduction might disarrange the relative adjustment existing between this and other rates.

TRADE CATALOGUES.

Light Locomotives.—The H. K. Porter Co., Pittsburgh, Pa., has issued the tenth edition of its catalogue of light locomotives. The volume contains 224 pages bound in cloth and describes 559 locomotives, covering a wide range of sizes and designs up to engines of 17-in. cylinders. Attention is called to the fact that during the interval since the publication of the ninth-edition catalogue, there has been an increase in power and efficiency and in the quality of the locomotives greater than during any similar period in the history of the company. The catalogue also gives a large amount of engineering data concerning locomotive performance and track work.

Idaho & Washington Northern.—A folder describing the country through which this road runs is illustrated with striking photographs of standing timber and scenery along the Pend d'Oreille river, on which a line of steamers is operated in connection with the railroad. It also calls attention to the silver-lead mines, lumbering and farming opportunities and fishing and hunting. Other photographs show the solid vestibuled passenger trains of Pullman coaches operated by the road.

Electric Headlights.—Under the title "Two Aids to Better Service," the General Electric Co., Schenectady, N. Y., has issued a neat folder, No. 3,654, calling attention to some of the reasons why the G E Luminous Arc headlight has been adopted. On the front page are pictures of the headlight and the Belmont tunnel, New York, the "Two Aids." A list of a few of the roads now using the light is included.

Locomotive Raiser; Locked Clevis.—The U. S. Metal & Manufacturing Co., New York, has published a leaflet describing the Davidson locomotive raiser. Another leaflet describes the Hillman locked clevis and turnbuckle, reference to which was made in the *Railroad Gazette* of Feb. 7, 1908.

Derails.—Catalogue No. 51, of the Hayes Track Appliance Co., Geneva, N. Y., is a full catalogue of Hayes derails. The different styles are described and illustrated by photographs and drawings, and plans are also shown for operating the derails by pipe line from main track switch stands. Rules for installing and maintaining the devices are included.

Tanks.—The W. E. Caldwell Co., Louisville, Ky., recently issued the twentieth annual edition of its catalogue. The pamphlet contains 36 pages of useful information regarding tanks which have been installed and built by the company; these include both wooden and metal tanks of various designs, as used by railroads and manufacturing plants.

Industrial Railways.—Pamphlet No. 077 of the C. W. Hunt Co., West New Brighton, Staten Island, N. Y., briefly describes and illustrates industrial railways and rolling equipment for them, including many styles of cars and electric storage battery locomotives. References are given to other catalogues describing the company's products in more detail.

Jacks, Tool Grinders, Track Drills and Brake-Beam Clamps.—Topping Brothers, New York, have issued a pamphlet describing Burrows ball bearing jacks. These are made in 25 styles, in sizes from 15 tons to 50 tons. The Lightning tool grinder, the Lightning track drill and the Totten brake-beam clamps are also described and illustrated.

Signal Supplies.—Catalogue No. 13 of the Bryant Zinc Co., Chicago, has 160 pages and is bound in cloth. The products described and illustrated include battery materials, crossing signals and bells, relays, battery chutes, wire, track drills and other supplies and tools for the signal department.

Denver & Rio Grande.—The passenger department is sending out a circular, No. 55, giving a list of hotels and boarding houses on the lines of the Denver & Rio Grande, the Rio Grande Western and the Rio Grande Southern. Location, rates, capacity and similar information are given.

Pump Valves.—A circular which is being distributed by Jenkins Brothers, New York, calls attention to pump valves made of various compounds suited to water at different temperatures and pressures, as well as other liquids and also to air compressors.

Weatherproofing.—A circular issued by the H. W. Johns-Manville Co., New York, describes Keystone hair insulator, showing its application for sound deadening and weatherproofing.

MANUFACTURING AND BUSINESS.

The Chicago store of Jenkins Bros., New York, has been moved to larger quarters at 226-228 Lake street, corner of Franklin street.

Jerome & Elliott, Chicago, makers of Jerome metallic packing, have moved to 351 and 353 West Monroe street into larger quarters.

W. R. Toppan, for many years General Manager of the Kennicott Water Softener Co., Chicago, has resigned. His present address is Chicago Athletic Association.

Herbert C. Petty has been elected a Director of the Crocker-Wheeler Co., Ampere, N. J. Mr. Petty entered the sales department of the company in 1903, and is now Contract Manager.

David Newhall has been appointed manager of the department of supplies for railroads, manufacturers and contractors of the George M. Newhall Engineering Co., Ltd., 136 South Fourth street, Philadelphia, Pa.

William A. Pitcher, for two years the Eastern railroad representative of S. F. Bowser & Co., Fort Wayne, Ind., was one of the 12 who lost their lives in the burning of the Aveline Hotel in Fort Wayne on May 3. Mr. Pitcher was 48 years old.

The General Railway Signal Co., Rochester, N. Y., recently closed a contract with the Northern Pacific Railroad Co. for two electric interlocking plants at Duluth, Minn. These plants are for interlocking at two drawbridges about 2,200 ft. apart, and electric locking is provided between the towers.

The U. S. Metal & Manufacturing Co., New York, has just completed arrangements with the United Railroad Equipment Co., Baltimore, Md., by which it becomes the sole selling agent in the United States for the I. X. L. automatic track sander. Among the roads having engines equipped with this sander are the Philadelphia & Reading and the Central of Georgia.

The American Blower Co., Detroit, Mich., has bought the foundry of the Northwestern Foundry & Supply Co., Detroit, maker of cast iron soil pipe and fittings and plumbers' specialties. The foundry will be used for making blower, exhaust fan, engine and heater castings, and it is desired to dispose of all soil pipe fitting patterns and foundry equipment complete; also a large stock of finished pipe fittings, bell traps and other material.

George E. Pratt, formerly sales representative of the Hicks Locomotive and Car Works, Chicago, has been elected President of the H. A. Clark Co., New York, dealer in passenger and freight cars and car specialties and Sales Agent for the Middletown Car Works, Middletown, Pa. Mr. Pratt is also Vice-President and General Manager of the Central Inspection Bureau, 17 State street, New York, inspector of railroad equipment, iron and steel, bridge materials and kindred lines.

The C. I. F. Company, 11 Broadway, New York, takes its name from the three terms, cost, insurance and freight, used in the export trade. The method of the company, which acts as export commission merchant of machinery, tools, etc., is to simplify the complicated system of discounts and other factors entering into selling prices which often prevent foreign buyers from ordering from American firms. The C. I. F. Company puts before the prospective buyer in a standard form the actual net prices of the articles it deals in and also distributes easily understood indexes of these articles. These are published in English, French, German and Spanish.

OBITUARY NOTICES.

William J. Murphy, Vice-President of the Cincinnati, New Orleans & Texas Pacific, and Third Vice-President of the Alabama Great Southern, died at his home in Cincinnati, Ohio, on May 10. He was born in 1848, at Greenfield, Mass., and entered railroad service on the Erie, in 1862, as messenger in the telegraph office at Susquehanna, Pa. Two years later he became telegraph operator and ticket clerk at Deposit, N. Y., and the next year he was made train flagman, station agent and yardmaster at the same place. In 1866 he was transferred to the train despatcher's office, and in 1870 became train despatcher on the Delaware division. Three years later he was promoted to chief train despatcher of the same division, and in August, 1882, was made Superintendent. In 1887 he was promoted to General Superintendent. During 1890 he was out of railroad service, but in the next year he became Superintendent of the Brunswick division of the East Tennessee, Virginia & Georgia, now part of the Southern. In 1893 he went to the Cincinnati, New Orleans & Texas Pacific as Superintendent of the Cincinnati division, and in 1899 was appointed General Manager. On April 30, 1903, he was elected Vice-President of this road, and Third Vice-President of the Alabama Great Southern.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Brotherhood of Freight and Baggage Men.

This brotherhood held its third biennial convention at Lancaster, Pa., May 12, about 200 members being present.

American Society of Civil Engineers.

At a meeting of this Society, May 20, a paper on the "Effect of Temperature Changes on Masonry," by Charles S. Gowen, was presented for discussion. This paper was printed in the proceedings for April, 1908.

Canadian Railway Club.

This club has elected officers: President, L. R. Johnson, Canadian Pacific; Vice-President, H. H. Vaughan, Canadian Pacific; Second Vice-President, A. A. Mayer; Secretary, James Powell; Treasurer, S. S. Underwood.

The Franklin Institute.

At a stated meeting of the Institute, May 20, there was an address by Dr. Geo. Flowers Stradling, of Philadelphia, Pa., on "John Fitch, Pennsylvanian, Inventor of the Steamboat." The address was supplemented with illustrations.

International Brotherhood of Railway Employees.

This association met at Boston May 12, 120 delegates being present. The President of the association in his report said that the Canadian Government (operating the Intercolonial Railway) had agreed to recognize the union.

Railroad Special Agents.

The Railway Association of Special Agents and Police, of the United States and Canada, held its twelfth annual meeting at Lexington, Ky., May 11, about 150 members being present. The meeting was presided over by W. F. Riley, of Chicago, President of the association.

American Society of Mechanical Engineers.

At the semi-annual meeting of this society to be held in Detroit, Mich., June 23-26, an entire session will be devoted to the discussion of papers on the conveying of materials and hoisting and conveying machinery, including belt conveyors. At this meeting there will be a continuation of the paper on "Clutches," with special reference to automobile clutches, by Henry Souther, from the meeting of May 12. The other papers are as follows: "Some Pitot's Tube Studies," by W. B. Gregory and E. W. Schroder; "Thermal Properties of Superheated Steam," by R. C. H. Heck; "Horse Power, Friction Losses and Efficiencies of Gas and Oil Engines," by L. S. Marks; "A Journal Friction Measuring Machine," by Henry Hess; "A Simple Method of Cleaning Gas Conduits," by W. D. Mount; "A Rational Method of Checking Conical Pistons for Stress," by G. H. Shepard, and "The By-Product Coke Oven," by W. H. Blauvelt. There will be the usual excursions to points of interest in and around Detroit, including a visit to the University of Michigan, at Ann Arbor. The Society for the Promotion of Engineering Education and the Society of Automobile Engineers will hold a meeting in Detroit at the same time.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Indiana Harbor Belt.—R. M. Huddlestone, Auditor of the Lake Shore & Michigan Southern, has been appointed also Auditor of the Indiana Harbor Belt, succeeding John Stewart, resigned.

Lake Shore & Michigan Southern.—See Indiana Harbor Belt.

Operating Officers.

Chicago & Alton.—F. C. Runnels has been appointed Trainmaster at Dwight, Ill., succeeding C. F. Smith, transferred.

Delaware, Lackawanna & Western.—C. C. Foltz has been appointed Assistant Superintendent at Hoboken, N. J., succeeding J. G. Sickles, resigned.

F. W. Bennings, chief train despatcher, has been appointed Passenger Trainmaster at Hoboken, N. J., succeeding Frank Cizek, transferred.

El Paso & Southwestern.—S. R. Kennedy has been appointed Trainmaster at Tucumcari, N. Mex., succeeding H. H. White.

Mexican Central.—C. W. Everett has been appointed Assistant to the General Manager, with office at Mexico City.

C. E. Carson has been appointed Superintendent of Terminals at Tampico, Tam., succeeding J. J. Lewis, resigned.

Traffic Officers.

Chicago, Burlington & Quincy.—Mark Ford, Foreign Freight Agent in Chicago, has been appointed Texas Freight and Passenger Agent, with office at Dallas, Texas, succeeding C. W. Andrews, resigned. The position of Foreign Freight Agent in Chicago has been abolished.

Grand Trunk Pacific.—J. E. Dalrymple, the new Assistant Freight Traffic Manager, was born in 1869 in Montreal, Quebec and began railroad work in 1883 in the Treasurer's office of the Grand Trunk. In 1890 he was made secretary to the Traffic Manager of the Chicago & Grand Trunk, now the Grand Trunk Western. Six years later he became secretary to the General Traffic Manager of the Grand Trunk and was made division freight agent at Hamilton, Ont., in 1899. Later in the same year he was transferred to Detroit, Mich., and was also made Manager of the Grand Trunk Despatch Fast Freight Line. In 1900 he went to the Central Vermont as General Freight Agent, but the next year went back to the Grand Trunk as Assistant to the Second Vice-President and General Manager. In 1902, he again became General Freight Agent of the Central Vermont, where he stayed until August 14, 1905, when he was appointed General Freight Agent of the Grand Trunk. He remained in this position until his appointment on May 1 of this year as Assistant Freight Traffic Manager.

J. E. Dalrymple.

Iowa Central.—E. B. Johns, soliciting agent of the Piedmont Air Line, has been appointed General Eastern Agent of the Iowa Central, with office at New York, succeeding A. W. Osborn, resigned.

Southern Pacific.—M. O. Bicknell, district freight and passenger agent, has been appointed Assistant General Freight and Passenger Agent at Tucson, Ariz., with jurisdiction over the lines in Arizona and New Mexico, and his former office has been abolished.

Engineering and Rolling Stock Officers.

Arkansas, Louisiana & Gulf.—J. M. Marshall has been appointed Superintendent of Bridges and Buildings, with headquarters at Monroe, La.

Chicago, Milwaukee & St. Paul.—P. C. Hart, until recently Superintendent of Terminals at Chicago, is now on construction work on the Pacific extension, under the direction of the Chief Engineer of the C., M. & St. P. of Washington.

Lehigh Valley.—E. B. Ashby, Engineer of Maintenance of Way, has been appointed Chief Engineer, with office at New York, succeeding W. G. Berg, deceased.

Mexican Railway.—C. H. Burke, Assistant Superintendent of Machinery, at Aguascalientes, Aguas., has been appointed Locomotive Superintendent at Orizaba, Vera Cruz, succeeding W. Cockfield, resigned.

Illinois Central.—J. G. Neuffer, the new Superintendent of Machinery, was born in February, 1854, at Chillicothe, Ohio, and began railroad work in 1869 as machinist's apprentice on the Marietta & Cincinnati, now part of the Baltimore & Ohio Southwestern. He served as machinist, fireman, engineer and shop-foreman on the same road, and in March, 1880, was made road foreman of engines on the Baltimore & Ohio Southwestern. Two years later he was appointed Master Mechanic on the same road and from December, 1893, to November 1, 1903, he was General Master Mechanic and Superintendent of Motive Power. In November, 1903, he resigned from the Baltimore & Ohio Southwestern to become Assistant Superintendent of Machinery of the Illinois Central. He held this office until his recent appointment to the office of Superintendent of Machinery.

J. G. Neuffer.

LOCOMOTIVE BUILDING.

The Iowa Central has ordered six mogul locomotives from the Baldwin Locomotive Works.

CAR BUILDING.

The Bloomington, Pontiac & Joliet Electric is in the market for three interurban cars.

The Chicago Railways have increased their order from the Pullman Co. from 300 to 500 cars.

The International & Great Northern is in the market for 1,250 cars instead of 750, 500 of which are box cars.

RAILROAD STRUCTURES.

Chicago, Ill.—The Illinois Central, it is said, will build a bridge over the tracks of the New York, Chicago & St. Louis.

The Chicago, Indianapolis & Louisville, it is said, is in the market for bridges. The Chicago, Burlington & Quincy will soon give contracts for bridge material.

Fort William, Ont.—By an order of the Canadian Railway Commission, the Grand Trunk Pacific will have trackage rights over the Canadian Pacific from Port Arthur to Fort William, and a union passenger station will probably be built for the joint use of the Canadian Pacific, the Grand Trunk Pacific and the Canadian Northern.

Vera Cruz, Mexico.—Contract is reported let by the Vera Cruz Terminal Company for the extensive terminal improvements to be made here to S. Pearson & Son, who have an office at Mexico City. Work is to be started at once. (April 17, p. 559.)

Woodstock, Ont.—The Canadian Pacific has given a contract to Power & Brewer for concrete work on its proposed bridge at Upper Woodstock. The value of the contract is about $125,000.

Contract is also reported let to Power & Brewer, by the Grand Trunk Pacific at about $350,000 for concrete work involving 75,000 cu. yds. of concrete.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Buffalo, Rochester & Pittsburgh.—Revision work, it is said, has been resumed on the 10-mile section of this road from Carmen, Pa., south to Brockwayville. The improvements include a double-track tunnel 1,000 ft. long and a new trestle. Contract for grading work let last year to Eyre-Shoemaker & Co. of Philadelphia. (March 13, p. 390.)

Canadian Pacific.—This company, it is said, will improve its line between Calgary, Alb., and Strathcona at a cost of about $50,000.

CHICAGO, LAKE SHORE & SOUTH BEND (ELECTRIC).—This company, which is building an electric line from South Bend, Ind., west to Chicago, Ill., 71 miles, will begin operating the section from South Bend to Michigan City, June 1. It is expected that the entire line will be in operation by July. (April 17, p. 559.)

ILLINOIS CENTRAL.—On the Natchez division of the Yazoo & Mississippi Valley new 75-lb. rails and new ties have been laid from Natchez, Miss., southwest to Harrison, 28 miles. Work is to be pushed on the remaining 70 miles southwest to Jackson.

JOPLIN & PITTSBURG (ELECTRIC).—This company is said to be asking bids for track laying, bonding and ballasting about 25 miles of the line it is building from Joplin, Mo., northwest to Pittsburg, Kan. (March 13, p. 391.)

MISSOURI & NORTH ARKANSAS.—This company, which recently began operating its extension from Seligman, Mo., northwest to Neosho, 41 miles, will shortly begin running trains through to Joplin, 19 miles north of Neosho, over the tracks of the Kansas City Southern.

Announcement is reported made that this company will build a branch from Negrohill, Ark., southwest to Little Rock, about 55 miles. Negrohill is on the extension of the main line under construction southeast towards Helena, on the Mississippi river.

NEW YORK & LONG ISLAND.—See this road under Railroad Corporation News.

NORTHWESTERN RAILROAD.—See Oregon Short Line.

OREGON SHORT LINE.—Work, it is said, has been resumed by this company on the Northwestern Railroad. The Northwestern was organized to build from Huntington, Ore., north along the Oregon-Idaho state line, following the Snake river, to Lewiston, Idaho. (March 13, p. 394.)

ROCHESTER-CORNING-ELMIRA TRACTION.—The New York Public Service Commission, Second district, has authorized this company to give a mortgage to pay for the building and equipment of its proposed double-track electric line. The company was organized in 1906 to build from Rochester, N. Y., south to Elmira, 120 miles. The directors include C. O. Geer, G. Abeel, M. H. Schultze, F. Eckstein and T. S. Breckinham. The office of the company is at 42 Broadway, New York.

SARATOGA & ENCAMPMENT.—Work, it is said, has been resumed by this company on the extension from Walcott, Wyo., south to Encampment, 45 miles. Track has been laid on all but about 12 miles, and it is expected to have the entire line in operation this month. (March 13, p. 394.)

SOUTH DAKOTA CENTRAL.—This company, it is said, has placed in operation its extension recently finished from Hayti, S. Dak., north to Watertown, about 18 miles. (Feb. 14, p. 234.)

SOUTHERN RAILWAY.—See this company under Railroad Corporation News.

SOUTH OMAHA & WESTERN.—See Union Pacific.

UNION PACIFIC.—The South Omaha & Western, it is said, has finished the new double-track line from South Omaha, Neb., to Lane, 11.60 miles, and the line is now in operation. (March 13, p. 395.)

YAZOO & MISSISSIPPI VALLEY.—See Illinois Central.

RAILROAD CORPORATION NEWS.

CHICAGO & ALTON.—This road, together with the Toledo, St. Louis & Western, has secured trackage rights from the Baltimore & Ohio Southwestern, which gives a connecting link for through freight trains between Springfield, Ill., and Cowden.

CHICAGO & EASTERN ILLINOIS.—William Salomon & Co., of New York, are offering Chicago & Eastern Illinois equipment trust 5 per cent. notes of Oct. 1, 1907, and due $124,000 semi-annually, Oct. 1, 1908, to Oct. 1, 1917, inclusive. The authorized amount of the notes is $2,480,000, of which there are $2,356,000 outstanding. The maturities after 1910 are being offered at prices to yield $5\frac{1}{2}$ per cent., and the earlier maturities to yield from $3\frac{1}{2}$ to $5\frac{1}{4}$ per cent. The issue is secured on 2,000 steel frame cars costing $2,737,912, equal to 16 per cent. margin on the outstanding notes.

CALUMET & SOUTH CHICAGO (ELECTRIC).—This company has taken over the Calumet Electric Street Railway and the South Chicago Street Railway, and has increased its capital stock from $1,000 to $5,000,000.

DENVER & RIO GRANDE.—Of this company's new mortgage of $150,000,000, which the stockholders will be asked to approve, $90,000,000 is to be reserved to refund the bonded debt of the Denver & Rio Grande and the Rio Grande Western. The total outstanding funded debt of the company is $84,843,900.

HAVANA CENTRAL.—A special meeting of the stockholders has been called for June 15, to authorize an issue of $3,500,000 bonds.

MANHATTAN RAILWAY (ELEVATED).—This company, which owns the elevated lines in Manhattan and the Bronx in New York, has applied to the Public Service Commission of the First District for permission to issue $11,712,000 bonds to be used to pay the first mortgage bonds of the Metropolitan Elevated, which fall due on July 1, and to repay the company for the cost of extending lines in the Bronx.

NEW YORK & LONG ISLAND.—This company—the "Belmont tunnel," New York City, has secured from the New York State Court of Appeals a decision sustaining the validity of its franchise. The litigation over this tunnel, which crosses the East river at 42d street, has been in the courts for more than two years, the city having steadily denied the right of the corporation to construct and operate the tunnel under the old Steinway franchise. Justice Blanchard at the outset of the litigation refused to grant a temporary injunction restraining the construction, holding that if the franchise had really lapsed and the city was entitled to the tunnel rights no harm could come if the construction went on at the risk of the company claiming the right to construct. In November last the Appellate Division sustained Justice Blanchard's contention, holding that a project of such great public importance should not be delayed on the mere possibility that at some future time it might be determined that the old franchise was invalid. It is this decision which has now been affirmed by the Court of Appeals. Meanwhile it has been rumored steadily that the city was about to purchase the tunnel from the Belmont interests, and a formal offer to sell for $7,239,476 was made in February by President Shonts to the Public Service Commission. That offer is still under consideration.

NEW YORK CITY RAILWAY.—The U. S. Court of Appeals, in a decision handed down May 20, sustained the order of the Circuit Court authorizing the Receivers to issue $3,500,000 certificates to put the roads in their charge in shape.

NEW YORK, NEW HAVEN & HARTFORD.—Kidder, Peabody & Co., Estabrook & Co., and R. L. Day & Co., of New York and Boston, Mass., are offering $4,000,000, first mortgage, 4 per cent., 50-year bonds of 1904-1954 at 98. This is the balance of $15,000,000 bonds authorized under this mortgage.

NORTHERN TEXAS TRACTION.—Estabrook & Co., and Lee, Higginson & Co., of Boston, Mass., are offering $500,000 three-year, 6 per cent. notes of May 1, 1908-1911, at $97\frac{1}{4}$, yielding 7 per cent. The Northern Texas Traction runs a street railway in Fort Worth, Texas, and an interurban line between Fort Worth and Dallas.

SEATTLE ELECTRIC.—Lee, Higginson & Co., N. W. Harris & Co., and Estabrook & Co., of New York and Boston, Mass., are offering $2,500,000 Seattle Electric consolidated and refunding mortgage sinking funds 5 per cent. bonds of 1907-1929 at $93\frac{1}{2}$, yielding $5\frac{1}{2}$ per cent.

SOUTHERN RAILWAY.—J. P. Morgan & Co. are offering $15,000,000 6 per cent. three-year convertible notes of May 1, 1908-1911, at $98\frac{1}{2}$. Holders of the Southern Railway two-year, 5 per cent. notes maturing on June 1 and July 2 may deposit their notes and will receive preference in the allotment of new notes. Preference will also be given to holders of the Southern Railway stock trust certificates. The new notes are secured by $20,000,000 Southern Railway development and general mortgage 4 per cent. bonds, Series A; $25,000,000 Tennessee Central, prior lien mortgage 4 per cent. bonds, and $2,000,000 Virginia & Southwestern first consolidated mortgage 5 per cent bonds. The notes may be converted into Southern Railway development and general mortgage bonds.

TONOPAH & TIDEWATER.—It is said that this company has purchased a controlling interest in the stock of the Bullfrog Goldfield railroad, and that the new company will be incorporated under the name of the Tonopah & Tidewater Railway.

VIRGINIAN RAILWAY.—Redmond & Co. and the Equitable Trust Co., of New York, have purchased $17,000,000 Tidewater Construction Co. first lien, five-year 6 per cent. convertible notes, secured by $33,500,000 first mortgage 5 per cent. bonds of the Virginian Railway and $3,000,000 first mortgage 5 per cent. terminal bonds. The notes are to be guaranteed unconditionally by H. H. Rogers. These new notes are being offered among the brokerage houses at 99, yielding $6\frac{1}{4}$ per cent.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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CONTENTS

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It has taken two years and a half to convince the prosecuting officers of New York City that a mere error of judgment on the part of a signalman is not a crime for which he should go to state's prison. Cornelius A. Jackson, the signalman at Fifty-third street junction, on the Ninth Avenue Elevated road, who, on September 11, 1905, set the switch for the wrong track, was sentenced in the Court of General Sessions to five years' imprisonment; but the Appellate Division has now reversed that decision and set him free, holding that, as the signals (home and distant) showed, seasonably and plainly, which way the switch was set, the fault was the motorman's, not Jackson's. This, of course, is the only rational conclusion that could be reached by anyone conversant with all the facts. The movement of the train through the sharp curve leading to Fifty-third street at 25 miles an hour resulted in derailing one car and the death of a dozen passengers; and the officers of the law seemed to think that an exemplary punishment ought to be inflicted on some one, because of the magnitude of the disaster; though errors of a similar character (though not so disastrous) are no doubt committed in New York City every month. Paul Kelly, the motorman, had run away, so the whole force of public opinion, as represented by the legal department of the county, fell on Jackson. Kelly was followed, however, and after two years was caught and tried and is now in Sing Sing prison. Jackson's error consisted in leaving his post of duty for a minute or two (on account of illness, the court says), and leaving the switch and signals set for Fifty-third street. Probably he was breaking no vital rule for, as before stated, he left the signals properly set so that no motorman could excuse himself for not knowing that he was being directed to the sharp curve; but as trains follow one another every three or four minutes, or oftener, he should have allowed nothing but imperative necessity to take him away from his post until he knew which way the next approaching train was destined. To provide the utmost precaution the signalman at a place like this should not leave his post without first setting the switch for the straight track, as a runaway on that track would be less dangerous than on the curve; but, as we have intimated, this extreme precaution probably was not prescribed by the rules. The essential trouble appears to have been that Kelly was inexperienced and incautious, having never run on this division except along the straight track; and that the signals could not be set to indicate at the same time "stop" for both routes, they were disks, always showing a clear track for either one or the other of the two routes. The trouble with the legal gentlemen appears to have been that they were unable to see the necessity, or even the probable reasonableness, of a rule by which a signalman may at any time on a minute's notice safely leave his post. This rule is vital, for without it the safety of thousands of trains every day would depend not only on the lives and the sanity of signalmen, but on their unerring judgment. But everybody, including the lawyers, apparently prefers the romantic notion that every signalman repeatedly every day holds a hundred passengers' lives in his hands.

Fifty passengers have been killed in Belgium, in one of the most spectacular train accidents that ever occurred in Europe. The cause of the disaster is not clearly reported, but it seems to have been carelessness in making repairs to a switch (interlocked) while the signals had not been set to notify trains to reduce their speed. Belgium is the home of the International Railroad Congress and its railroad practice ought to embody the sum of all wisdom. In this particular feature the best wisdom may be summarized, no doubt, in the prescription of very simple yet precise rules, and rigid inspection to see that such rules are carried out; and we have no reason to doubt that in this respect Belgium stands as high as any other country. The reader will recall three recent accidents to passenger trains in this country from the same cause, one at Philadelphia, one near New York, and one at Washington.* The first one was due to the mistake of a repairman in spiking a switch the wrong way, the speed of the passenger train had been reduced but not reduced enough; in the other two cases the error was made by a contractor's employee. Happily the disaster in each case was greatly mitigated by favorable circumstances. The task of enforcing perfectly safe rules in repair work is one of the most difficult in railroad operation, difficult because in so many situations the rules seem unnecessary. Not one time in a thousand does the competent repairman need any rules, for he knows, without being told, that the signals must be set at "stop" before he disturbs the track. The rules are made for the thousandth or ten-thousandth time, when, if using his own judgment, he may not take *all* the precautions necessary. Rules which men thus are liable constantly to look upon as refinements that are

*Philadelphia, December 19, 1904; New York, August 4, 1905; Washington, November 19, 1907.

worse than useless always have been and always will be hard to enforce. Still, the only lesson is to enforce them. The ideal enforcer of rules is the military officer who so trains, governs and inspects his men that he is fully prepared for the enemy every minute of the 24 hours, but our task is even harder than the soldier's because he sometimes *knows* that the enemy is five miles away, while our enemy is *always* in ambush. The carefully prepared rules of the signal department of the Lake Shore & Michigan Southern for the conduct of outdoor repairs were reprinted in the *Railroad Gazette* of August 18, 1905, and they furnish very interesting reading for every signal engineer or supervisor who is not absolutely sure that his stable doors are locked. The English Railway Clearing House rules require that when repairs are going on the distant signal shall be disconnected from the lever in the machine. For the guidance of enginemen in running through interlocking plants where some of the functions are out of service, and the switch rails have not been spiked, the best rule is for them to reduce their speed sufficiently to be able to see by looking at the rails where they are being led to, though at many places it is difficult to enforce it. This rule is not practicable at night; but another good rule is to require the repairers to have all switches spiked some time before dark.

NORTHERN SECURITIES AND THE NEW HAVEN.

The famous Northern Securities case fills 214 pages of the United States Law Reports but its records can be condensed to a few leading points. Certain stockholders of the Great Northern and Northern Pacific railroad companies, "with competing and substantially parallel lines from the Great Lakes and Mississippi river to the Pacific ocean" endeavored to combine them in a holding corporation, the Northern Securities Company of New Jersey. Suit was brought by the government against the combination under the anti-trust (Sherman) act of 1890, and, on appeal, the United States Supreme Court held that the combination was in violation of the law and was in restraint of interstate commerce. Four judges, Harlan, Brown, McKenna and Day, interpreted the Sherman act radically and applied it to contracts in restraint of trade whether "reasonable" or not. Judge Brewer, the fifth judge, held, in substance, that they must be unreasonable and affirmed individual investment rights; but held, in the particular case, that there was an unlawful combination of individuals in restraint of trade and concurred with the four judges named, thus making a majority of one. The four other judges, Chief Justice Fuller, White, Peckham and Holmes, dissented, holding that the ownership of stock in railroads "is not commerce at all," and that the law does not apply to suppression of competition "by fusion." Such in its essence and stripped of collateral branches was the Northern Securities decision. Its narrow margins and infirm base as a precedent, especially in view of future changes on the supreme bench, are obvious at a glance.

Broadly speaking the suit just brought by the federal government against the New York, New Haven & Hartford under the same anti-trust act lies along the same lines as that against the Northern Securities corporation. There are counts which could be lifted almost bodily from one complaint into the other. The general principles run parallel. In the New Haven, as in the earlier case, the question of the legal status of a holding company may also get into the suit before it ends; and there are other external similarities. But, in details, and in what may be called physical conditions of the two cases there are striking disparities. In the New Haven case there is, strictly speaking, no combination of stockholders to suppress competition and the original agency is an old and single corporation. The Northern Securities suit related to two long and parallel lines with intensive competition while, in the New Haven case, competition is distributive and in the nature of general monopoly slowly built up. The New Haven suit involves a vast system of street railways, some originally competitive, others purely lateral and feeders and these trolleys, by the way, have, in corporate organization, been segregated to their states. This may affect the interstate question technically though the street railways are under "indirect" New Haven control. Why the marine properties of the New Haven are not named in the suit is one of the mysteries. Practically all of them are of an interstate character and of a nature to strengthen the federal suit. The omission of them is strong intrinsic evidence of the truth of the report of an original promise of the administration to exempt them. On the consistency of such federal action and attitude there need be no comment.

While so similar in the basic principles of law involved it will thus be seen that the New Haven suit is far more complicated than the case against the Northern Securities Company and it is not simplified by the coincident suit of the state of Massachusetts against the defendant corporation, saying nothing of the question of ultimate disposal of the New Haven properties should the government win a case, in which success would in many respects be more serious than defeat.

But it is not on the technical phases of the suit that the mental vision of the intelligent citizen and man of affairs pauses long. Behind law and the courts there are railroad history and a resulting situation of the deepest import. The New Haven corporation typifies a natural and inexorable law of railroad development and railroad unity. It is a corporation 60 years old. Almost 40 years ago, with the absorption of the New Haven, Hartford & Springfield line, its record of consolidation began. Since then it has absorbed in one form or another, not fewer than 50 transportation lines—railroad, street railway and marine. It has unified and expedited traffic. It has sustained and improved a host of weak subsidiary lines. Branch roads that were defective in public service conditions have been standardized. Its steam system as a whole, allowing for actual cost, improvements plowed in, and increased valuation has not only not been "watered" but has been desiccated. In the transition downward of freight rates it has, if due allowance be made for classification of traffic, surpassed both the Boston & Albany and the Boston & Maine. In passenger service it has been the only railroad corporation in the country to adopt *voluntarily* the two cents a mile rate upon its whole system. If it be rejoined that this was fiscal expediency on a system of great passenger density, the actual boon to the traveling public remains still as a truism. The corporation in the past has had sinister relations to legislation in Connecticut and Rhode Island, but they were much worse before the days of monopoly than since. It has taken in 1,400 miles of street railway, much of it in a high degree aqueous. But the policy was protective, the water had been turned on by state authority long before the street railways were acquired and, as related to absorbed parallels, the outcome has been the transfer of steam business to the street railways at lower fares and corresponding public benefit.

The question of the partial but serious disintegration of such a system, evolved in the same manner as other large railroad systems, is now at bar and the Northern Securities case has been transferred to New England. The suit is one that reaches through the years, it must pass from one federal administration into another and the courts may or may not try it out. But of its immediate unwisdom as an act of federal policy in the present exigency of the railroads and at a period of industrial and commercial stress there can be but one dispassionate opinion. In the event it may not even prove to be "good politics."

HOW TO REDUCE DAMAGE CLAIMS.

A certain railroad covering a large territory and handling a great deal of traffic has for several years been trying to classify by causes the claims it has paid out, and it has succeeded in determining causes for about half the amount of claims.

But the magnitude of unclassified losses is so great that it suggests that these losses are largely what is known as "concealed," their proportionate increase in the two years under consideration far exceeding the increase in business done. There is strong reason to believe that thousands of claims of this class are settled because of the difficulty which a carrier has in establishing proof that packages were short or damaged in contents when they were originally packed, perhaps due to the errors of shippers' employees or to more or less accidental causes, even when there is good ground for believing this to be the case. Of course, the effect of this is to make the carrier act as insurer of the contents of packages transported in condition which appears to be perfect, and to put a premium upon carelessness or even upon connivance. After careful study, this railroad has demonstrated clearly that some of these causes are more or less readily subject to cure. With others the conditions can be improved by careful attention, while in a few cases the situation appears to be growing worse rather than better, despite the best efforts of the management. Traffic congestion, which is the most prolific of all causes of loss and damage, has already disappeared, at least for the time being. During the last two years the volume of business transacted has been so enormous that it has inevitably led to carelessness in the effort to keep things moving and prevent accumulation, and this carelessness has affected not only the manner in which the freight is packed, but the way it is marked, shipped and handled on the road. It is believed that the loss and damage account from 1905 until the slackening of business occurred this year, was increased almost 50 per cent. by carelessness alone.

As regards the proper treatment of the determined causes, it has been found that car robberies by employees can be decreased substantially by care in selecting men, by closer general supervision and by specific checks; but robberies due to acts of trespassers and thieves have tended to increase, perhaps owing to the fact that it is very difficult to secure proper action from courts and magistrates on this great evil. The chances are that the local constabulary is more concerned in passing bad characters along and in getting them out of town than it is in locking them up at the expense of the community. No new laws are necessary to stop this short-sighted policy of local expediency, but small towns and cities alike should realize that the act of passing vagrants along turns them up again in due rotation, while the universality of the practice keeps the supply of vagrants always good. The trespassers steal rides, pillage freight cars and help swell the death roll of those hurt on railroad property, and this is true in the United States to a far greater extent than in any other country in the world. Unfortunately, the railroads themselves can do but little to remedy this evil—the burden rests with the communities.

As regards results to be gained by better packing, it should be observed that under prevalent practice it is the contents and not the bulk of a package which pays the freight; consequently a railroad ought to be interested in bringing about strong and compact methods of packing goods—strong, because the carrier is placed almost in the position of an insurer of safe delivery; compact, because of the saving in bulk, and because compactness itself is an element of strength. It is possible for receiving clerks to exercise some discretion about this, but anything like systematic inspection would be resented and might be made the ground of specious complaint. The apparent remedy for bad packing lies in such a modification of the classification and application of tariffs that it will be worth somebody's while to be careful.

Objections to insufficient marking of shipments, especially of packages shipped in less than carloads, are hard to sustain, above all, at competitive points, yet thousands of packages go astray for this reason. A large proportion of the claims on account of errors of employees and of delays are due to defective marking. Each package of l. c. l. freight should be marked plainly for identification and destination. The rule requiring a shipping memorandum from which the marking and the number of packages can be checked ought to be strictly enforced. This particular trouble is one in which the railroads themselves were in considerable part to blame, since they have the remedy in their own hands if they will only act with uniformity.

This remedy is now to be applied. The General Managers' Association of New York appointed a committee to consider the question of losses and damages on behalf of the Association with a view to arriving at a better standard practice among the membership with regard to receiving and transporting freight, and especially to the question of marking plainly l. c. l. packages. The committee presented a report as suggested by the General Managers' Association to the Trunk Line Association, with the result that all the roads east of the Mississippi river operating in the territory covered by the "official classification" have instructed their agents from July 1 to refuse all articles in l. c. l. lots, which are not plainly marked with the name of the consignee, and with the station, city and state, of destination. The railroads will enforce the rule not only in cases of shipments originating on their own lines, but agents at transfer points will also be instructed to refuse to receive from other roads, packages which are not properly marked.

This rule (Rule No. 3 of the classification), though it has long stood in the tariffs, is now to be filed with the Interstate Commerce Commission by each company, thus making it a part of the legal tariff, and therefore a requirement which cannot be ignored without breaking the law. To require one shipper to mark every one of a hundred bags of meal while allowing another to deliver the bags insufficiently marked, would be discrimination, which, of course, is unlawful. An officer of the Pennsylvania says that during the last fiscal year his company paid $342,520 for goods "lost in transit," which is 34 per cent. more than was paid on the same account in the preceding year. The term "lost in transit" refers, we suppose, to those losses which it was found wholly impossible to locate. More than one-half of this sum—or, to be exact, $176,260—represents losses on goods which had been improperly marked or not marked at all. During 1907 the Pennsylvania gathered at one place 18,000 packages on which there were no marks to show the proper destination of the goods, though it is not said that all of these packages remained forever unidentified. This same officer gives a further interesting item in connection with freight losses in the statement that the loss and damage payments by 17 of the principal railroads in 1907 amounted to $5,596,794, which is more than 1 per cent. of the total freight earnings of those companies for that year and more than one-fifth greater than the claims paid by the same companies in 1906. As it is estimated that 45 per cent. of the payments represent "losses in transit," it appears that losses of this class in 1907 must have amounted to about $2,500,000, and pursuing the estimating process a step further this officer concludes that one-half of this amount, or $1,250,000, was due to improper marking. Hence if the 416 roads using the official classification shall strictly adhere to their new resolution, this million and a quarter will be saved. The marking rule is, of course, entirely reasonable, but it is very hard to enforce. If a shipper sends a carload of bar iron or of bags of salt, he is allowed to omit the marks, carload shipments having been excepted from the rule since the year 1, but if he ships 100 bars of iron occupying a tenth of a car, or 1,000 bags of salt, filling only one end of it, the rule at once applies. If the bars are round and only a half inch in diameter, or if the bags are all trade-marked in large red and blue letters, the shipper feels particularly abused. Then he makes sarcastic remarks about the propriety of requiring the destination to be stamped on each kernel of corn in a 30-ton carload, and the freight agent ruminates on the diplomacy required of him by "the Hepburn law."

THE NATURE OF A PUBLIC SERVICE.

"The public does not take into account that a company, which is worked for the sake of profit, frequently understands better how to satisfy the requirements of its patrons than a less elastic official enterprise. Neither does it appreciate that it is better for the community to be sometimes in conflict, as passengers or consignors of merchandise, with shareholders over anxious for dividends, than to be compelled to pay in the shape of taxation for unnecessary facilities provided by a state service under electoral influences."

The phrases quoted above are taken from the introduction to Mr. C. Colson's "Les Travaux Publics et les Transports." At a period when the nationalization or municipalization of public services, using that expression in its most comprehensive sense, is being discussed from such widely differing standpoints, it is of interest to reproduce the views of a distinguished French writer, who has examined the whole question impartially, and whose opinions must inevitably be colored by the different relations existing in Europe between the government and other public authorities and private enterprise.

Public services can be divided into two kinds, of which the older type includes such functions as home defense, education, road making, etc. These services are usually undertaken by the state or municipality, because while they promise no immediate or direct profit to the individual citizen, their value is, nevertheless, manifest to the community in general. The maintenance of an efficient navy is a case in point. Transportation, none the less a public service, differs essentially from all other national or local services, because, as Mr. Colson aptly puts it, its inherently economic character renders it possible to figure out in hard cash, at least approximately, its value both to the nation and the individual. Therefore the impossibility of assessing the relative benefit given to the individual citizen by a standing army, for instance, has led the state to divide the expense among the community in the shape of taxation, whereas the value of the service given by a railroad can be exactly fixed and charged. The transportation of a ton of coal 50 miles constitutes a service from which the recipient obtains an immediate pecuniary benefit, the price of which can be determined and paid for by him. Incidentally, this forms one of the strongest arguments against railroad nationalization, since under private ownership the user is taxed in direct proportion to the use made by him, instead of being compelled to contribute toward the expenditure of the state railroads whether he uses them or not.

Now, according to our author, the characteristic feature of a railroad company is that it represents a public service of which the essential object is to benefit private interests. This may appear somewhat paradoxical, but it is to be remembered that in every civilized country an undertaking such as the construction of a railroad requires specific authorization, and the authorization, whether obtained by private act of the legislature or otherwise, represents in effect a delegation of governmental functions. In France the company obtains a concession permitting it to build and work the line for a given period, at the end of which the undertaking, with all its rights, passes into the hands of the state, which also exercises certain rights of supervision, of rate fixing, and sometimes of participation in the earnings during its existence as a company. The state may also guarantee a dividend, or the difference between a fixed rate of profit and that actually earned. In England and the United States there is no bargain with the state, and the charters are usually granted in perpetuity, with the exception of certain purely local concerns, such as urban railways, which the municipality may have the right to acquire after a fixed period, with or without payment. Similar terminable contracts obtain on the Indian railroads.

Discussing the relative advantages of public and private control, Mr. Colson points out that the construction of a long-distance railroad, between Paris and Marseilles, for example, not only requires governmental authorization, but is an undertaking of such general importance that the state cannot regard the matter with indifference, and must only favor the project if it can be proved to be in the interests of the public. In other words, a service involving certain alterations in the general *status quo*, such as in the ownership of landed property, must be in a position to fulfil its promises of public benefit before those alterations are sanctioned. Competition cannot be anticipated as a certainty, as the individual company possesses an absolute monopoly at least where certain localities are concerned, and can always combine, amalgamate or co-operate with competitors where alternative routes are provided by another concern. The state must, therefore, prevent this monopoly, created by itself, from abusing its powers.

Public services, he continues, are admittedly more spendthrift than private undertakings. This is owing to the fact that in a public administration the actual profits on the working are, if not a negligible, at least a secondary consideration. "Every engineer knows that public works executed by government departments cost more than when undertaken by contractors. In the case of state industries the causes of expense inherent to public administrations produce their full effect." This truism merits reflection, and it has been amply demonstrated by various municipal works departments in England. But the French railroads prove the same. For 1905 (the last year for which complete statistics were available) the ratio of expenditure of the state system amounted to 72 per cent., as against percentages varying from 46 per cent. to 57 per cent. in the case of the large companies. And, although the situation of the state lines is not ideal, from the traffic standpoint, they are, in fact, protected by just those rigid conditions of operations, *e. g.*, as regards the lowering of rates, of which the administration complains. The German system is also costly. On the surface its financial results appear satisfactory. The cost of construction was low, the traffic density is helped by that of the population, and the production of coal is five times that of France. The net profits amount to 5½ to 6 per cent. on the capital expenditure. This result has been obtained not owing to a more skilful administration, but, in spite of a much costlier one. In 1904 and 1905 the ratio of expenditure rose to 63 per cent., as against an average of 52 per cent. for the French lines. Average rates are not lower than in France when the greater proportion of mineral and similar traffic is properly allowed for.

Judicial control over operation, as distinguished from direct government interference, is the system adopted in England. The Railway and Canal Commission may be cited as an example. The Englishman regards the working of railroads, canals and harbors as a branch of industry dependent on private enterprise, and not as a public service worked under contract with the state. France, on the other hand, enjoys an administrative, as opposed to a judicial form of control. This is based on the idea that a company only utilizes the land occupied by the railroad as a delegate of the state or municipality. The privileges and duties accompanying the period of concession, always for a limited time, are clearly defined in the original agreement, and are insusceptible of subsequent legislative modification. In England subsequent legislation can always override the special acts originally obtained by each separate company. One of the weak points of the French system is that the government or other public body, represented by the Minister of Public Works or his agents, can exercise an excessive control that is not always satisfactory to the community at large. He can prescribe the hours of work, the speed, time and number of the trains; in fact, the entire organization of the service. Similar interferences on the part of the state railroad commissions is looming large in this country.

Mr Colson finally affirms that the delegation of a public service, for a limited period, to commercial concerns controlled by the state is a reasonable transaction. Such inconveniences or evils as may arise are ameliorated by the limitation of the concessions in point of duration, and the power to abridge the period of company working. In spite of the development of communistic ideas, the old system has worked satisfactorily enough, and it may be expected to continue to satisfy the needs of the future, provided that the state endeavor to obtain the greatest use from it, instead of seeking methods of destruction.

London Underground Electric Railways.

THE BAKER STREET & WATERLOO; THE GREAT NORTHERN, PICCADILLY & BROMPTON; AND THE CHARING CROSS, EUSTON & HAMPSTEAD.

The severest competitors are the motor omnibuses and the tramways. These have demonstrated their value for public comfort, but they are operated at a loss, although they occupy the streets—a right of way for which they pay nothing, in comparison with underground railways, which have cost, with their equipment, about £700,000 a mile. The effect and the limitations of this competition are now determinable. For journeys up to two miles long, at the present rates of fare, the motor omnibuses divide the traffic and reduce the underground railway earnings. It requires a nice adjustment of fares, not only to distance, but also to the tastes and requirements of people who live near specific railway stations, in order to get the maximum number of pennies. Sir George Gibb's comment is apt: "The city passenger is an elusive person. If you do not give him what he wants, or if you charge him a little too much, he vanishes in space." The competition of the motor omnibuses compels the maintenance of fares on an unremunerative basis, not alone because the omnibuses are carrying passengers at less than cost and interest, but also because unrestricted competition has lured investment into more omnibuses than are needed. They move in flocks, with too many empty seats, and form an immediate and tempting availability to a passenger to begin his journey at once without counting the time and cost of that journey. It is a condition of things that cannot last, but it is costly while it lasts to omnibus and railway owners alike. It would seem to be inevitable that the stop-loss period would soon come and that the omnibus owners must virtually increase fares by a shortening of the penny zones. This would raise the average fare for omnibus travel, without seriously diminishing the numbers traveling, and such traffic as the omnibuses might lose would probably be more than compensated for by the additional receipts from the traffic carried. In fact, the problem is to put the business on a paying basis. It is not good business permanently and deliberately to fix the price of the product of an industry at a figure which on the average cannot yield any return on capital invested.

The advantages, disadvantages and difficulties of the deep-level tube, reached by lifts, compared with those of the shallow subway reached by a short flight of steps from the street surface, have been fully and perhaps finally presented in a remarkable discussion at the Institution of Civil Engineers. Nothing needs to be added to the facts developed by Barclay Parsons' opening paper and other speeches by distinguished engineers and railway managers. In number of evenings and number of contributions to this discussion, the institution's record for 40 years is exceeded.

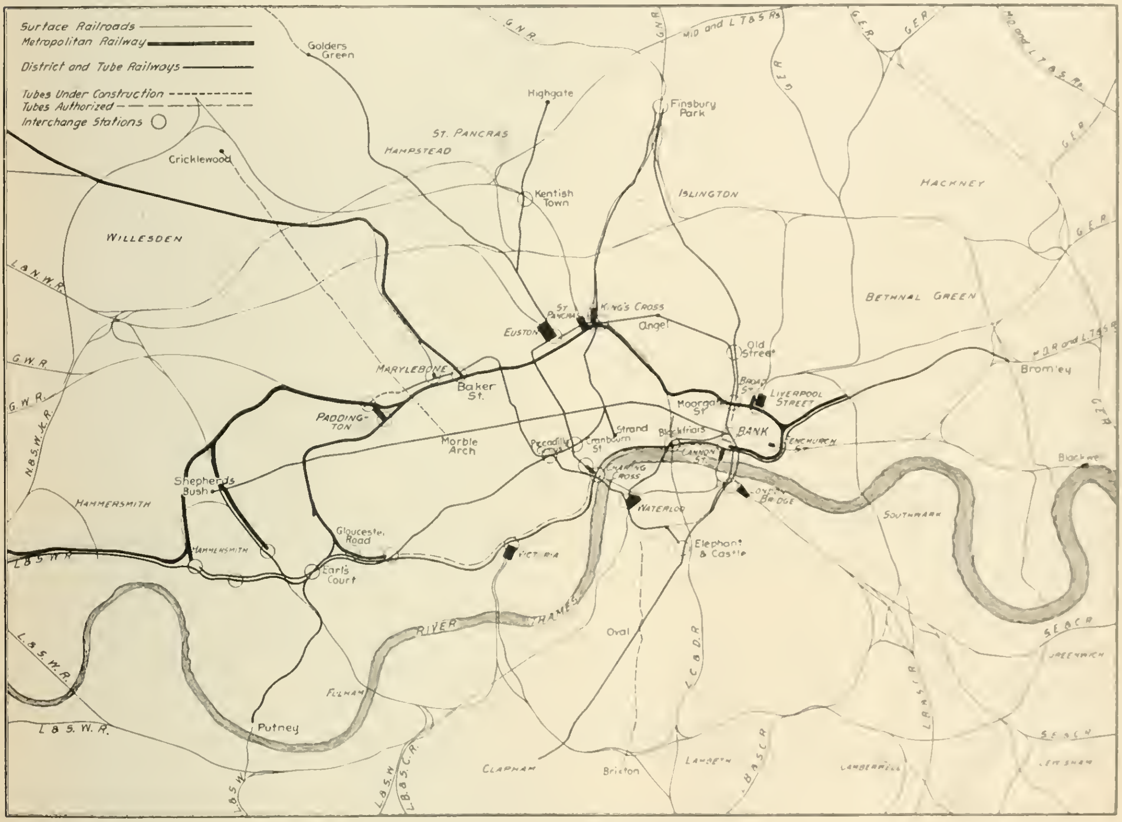
Some questions are settled. The shallow subway is the more effective competitor with surface means of transportation because of the saving of some minutes of the passenger's time on each journey, being time spent in the lifts and passages. The cost of operating lifts is an added cost. For these commercial reasons the shallow subway, where it can be built at reasonable cost, is the better money-earner. But it was made clear that in the narrower streets and congested districts in London the subway is not feasible, primarily because of the number of underground pipes to be dealt with in limited spaces. The obvious advantage of the deep level tube railway is greater comfort for passengers, due to less noise and smoother riding. There is the further important consideration that, so far as one can see in the future, the tube construction is decidedly more enduring than the subway. In the course of years the cost of upkeep, and possible costs of some subway reconstruction, are not to be ignored.

Though there are still some projects for underground railway construction in London in more or less distant view, it may be said that there is now such a fairly completed system that we may with advantage take stock of some of the results achieved, and of the lessons to be learnt from the experience thus gained. In doing so it is impossible to avoid comparisons, but with these, as indeed with all engineering works, progress is inevitable, and the later constructions necessarily obtain the advantage of the experience of the earlier ones. In drawing attention to that earlier experience, comparisons must not be regarded as invidious, for the inventive genius and practical capacity of the designers of the first works of the kind are by no means to be considered inferior to those of the later ones to which necessarily we turn for our instruction. In no profession perhaps more than in that of the railwayman, do we learn by the results of trial.

THE PERMANENT WAY.

It would probably occur to any permanent way engineer, on examining the drawings of the permanent way adopted as the standard for the three latest underground tubes (the Baker Street & Waterloo; the Great Northern, Piccadilly & Brompton; and the Charing Cross, Euston & Hampstead) that a basic principle is violated with the probable result of either breaking the sleepers or of producing unpleasant and possibly dangerous side oscillations. The result has proved, however, that here is another example of the broad fact that the engineer must not allow himself to be bigoted; that principles are based on conditions and that the conditions with the track firmly enclosed in a tube, are, in at least one respect, distinctly different to those which prevail in the open, being defective. The gangers are taught to tamp heavily directly under the rails and leave the center of the sleepers with only light filling. The reverse of this would produce what is called a "center-bound" track, likely to produce side oscillation in the vehicles and to break sleepers. In tube construction, however, there is this difference: The mass of crushed granite cubes directly underneath the sleepers, where the chairs rest, is confined laterally in the tube. The wheel pressures on the rail tend in a degree to drive this granite toward the sides of the tubes, but gravity acts in the reverse direction, tending to continually tamp the granite underneath the sleeper. The result is what might be expected: A track firmly supported but with a slight elasticity, or rather resiliency, that is useful in modifying shocks and reducing noise.

The amount of this elasticity can be accurately measured. Sawed Australian jarrah wood is used for the sleepers. Each sleeper has two fulcrums immediately beneath the inside of the inner lines of the chairs, so that the rolling loads on the rails have a leverage of a few inches, and each sleeper with its fixed center acts as a spring. The extent of this spring action in the sleeper can be ac-



London Tubes and Subways.

where the wheel pressure is transmitted through the sleepers to the ballast and can drive the ballast support downward and laterally from underneath the sleepers. The undertaking in designing this novel form of track was to prevent the jar, tremor and noise which had resulted in other deep tube construction in London, and which had proved to be not only an annoyance to passengers, but costly in damages and law suits with owners of nearby property. It was plain that if this could be avoided at any reasonable cost, the result would be a more attractive transportation machine accompanied with less cost.

The novelty consists in bedding the sleepers and fastening them to a cement grout center bearing, which clasps the sleepers firmly for a distance of 3 ft. 10 in., and furnishes a somewhat resilient support for the sleepers directly under the rail chairs. The support directly under the rail consists of clean crushed granite broken so as to pass through a $\frac{1}{4}$-in. ring. In all other permanent way construction the undertaking is to form as firm and rigid a support as possible directly underneath the rails and leave the center of the sleepers only lightly tamped. Any other method of supporting the sleepers in ordinary railway practice is rightly considered as curately indicated by attaching a pencil to the end of the sleeper in such a way as to mark on a nearby vertical board and accurately record the rise and fall as the trains pass over. Repeated records of this kind show that there is a vertical movement of about a quarter of an inch at the end of the sleeper, indicating that there is a springlike action under the wheels with a limit of movement of less than an eighth of an inch. It would be difficult for the engineer to say what amount of cushioning is ideal in taking up the shocks under the rolling loads, but in this case the results seem to be ideal. The passenger is able to observe but little jar and the wheel-on-rail sounds are slight. Careful examination with a seismograph on the street surface over the line of these underground tubes finds no evidence of tremor, and yet the seismograph was so delicately adjusted that the shocks due to a passing vehicle on the street at a considerable distance away, were easily recorded.

These records were made by A. Mallocks, of Greenwich Observatory, in March, 1906, and covered a wide range of observations in dwelling houses, street surfaces over the tubes, and station platforms in the tubes. These observations are recorded in an official report of great length. The results in general are that in dwellings over the line the vibrations produced by a person walking on the floor were something like 100 times as great as those produced by passing trains. The vibrations caused by a brewer's dray on the pavement directly over the tubes were more than five times that produced by the train underneath. Aside from the avoidance of law suits and costs, the result is nearly an ideal track, immovable, enduring, easy and economical for the rolling stock, comfortable for the passenger, and with a low cost of maintenance. It seems to be a novel undertaking; in some respects it was a bold one.

STATION ENTRANCES AND EXITS.

There is no doubt that in some of the London tubes the length of the passages between platforms and lifts and between lifts and street exits and entrances makes a serious addition to the time of the journey. It furnishes an effective argument to those who, like Sir John Wolfe Barry, are strong advocates of the shallow subway in preference to the deep tube. To avoid long passages it is obviously necessary to fix the station offices as nearly as possible vertically above the platform. The opposite condition arises from the principle so cherished in England, that the convenience of the million must give way to the rather exaggerated rights of the hundreds. To escape the costly demands of owners of property who possess not only special plots on the surface of the earth, but the pyramidical continuation of them to their apices at the center of our planet, the tube must be kept, as nearly as practicable curves will allow, under the streets, and as our mediæval ancestors who constructed them never contemplated tubes, there are curves, and sometimes sharp ones, to follow. As curved platforms are inconsistent with long cars, leaving ugly chasms for people entering or leaving them to fall through, and as they furnish obvious difficulties in the way of hand-starting signals, platforms must be kept to the straight or nearly straight portions. So much for the position of the subterranean work. As to the site of street entrances and exits, other conditions are influential. Any liquor legislation which would reduce the number of public houses would help in the convenience of approach to the tube platforms of the future. These establishments stand on most of the principal corners, a position eminently favorable for, and in the railwaymans' view, naturally much more suitably occupied by, railroad stations. The expensive acquisition of the proprietor's rights, and of these and other sites, greatly limit the choice of the engineer in fixing the position of street entrances and offices, and so these and the platforms have often to be widely separated horizontally. "Proputty, proputty," as Tennyson calls it, stands ever in the way of convenience in the route of nearly every railroad in older lands, but especially so in the particular case of tube station approaches. These difficulties have not been so much felt in the Central London line, owing to the nearly straight course of the overlying streets, which it followed without much difficulty. Nevertheless, the engineer appears to be open to criticism in not having more often succeeded in getting station entrances nearly over the platform centers and so avoiding long passages. The station entrance does not need to be at a street corner. It may be in a more obscure location, with a great saving of time for passengers.

LIFTS.

The lifts of the Piccadilly, the Bakerloo and the Hampstead Tubes are of all steel construction, except the floor, which is of the not easily inflammable jarrah wood, and have a maximum capacity of 1,000 passengers per hour in one direction. Unlike the general design which has been adopted in the earlier types, the exit of the cages at both ends of their range is at the opposite side to that of the entry, one controller in each cage controlling both doors. Of course this requires a different plan of approach passages. These lifts may certainly be considered absolutely fireproof.

THE AUTOMATIC SIGNALING SYSTEM.

The wonderful, the better-than-human, automatic, electro-pneumatic block signaling installation, and the pneumatic power interlocked movement of points and signals needs a long description in order to understand its details, but this has already been done. We are here concerned only with its purposes and results. These are: Safety in the prevention of rear-end collisions. Capacity for the greatest possible number of trains per hour. Economy in cost of operation.

The blocks on the tubes and busy parts of the Metropolitan District are only about 900 ft long. If the controlled manual system, such as is working on the Central London, were used it would require a cabin and a man for each of these short sections, and with their utmost skill not more than 30 trains an hour could be moved. In the new tubes and on the District the signals automatically set by the moving train, without man power, easily permit a safe movement of 40 trains an hour. This allows a large increase of earning power during the busy hours, and it is accompanied by a large saving in operating cost. Near each signal is an automatic train stop, a track instrument which lifts when the signal is at danger and, if the leading motor passes over it, catches a brake valve handle and sets the brakes throughout the train. This stops a Tube or District train, running at schedule speed, in a distance of little more than 200 ft.

At each interlocking station, the signalman has before him an automatically illuminated diagram which shows him the progressive movement of trains approaching him. He is also informed by an annunciator in his cabin of the route to which he should shunt a special train. This is accomplished by an electric combination called the "Magazine Train Describer."

Still another refinement and this entirely for the convenience of the public, is the "Train Destination Indicator" which is placed in plain view from the platforms of many stations on the District Railway. It tells waiting passengers the route and destination of the next three trains to the many branches of the line.

The economic results of this wonderful signaling installation are many. Like the steam shovel whose reason for existence is that it gets men off the bank and out of the way it does this and more, for it reduces the coefficient of human error. It saves something like one-third of the cost of signaling by human power. It increases the capacity of the line by one-third.

VENTILATION.

The advance has been great. In the City & South London, which was the first of the tubes, in the Waterloo & City and at first in the Central London, the subject was not ignored, but it was thought that the movement of the trains, filling as they do a large percentage of the area of the tube, would draw or push the air sufficiently rapidly, that with the help of the communication between the two tubes at stations, the outlets at the latter would become alternately exhaust and supply ducts for foul and fresh air respectively. This is commonly called "the piston action" of trains in tubes. Experiments in the Central London on the velocity and direction of the air at the mouth of a running tunnel showed that the air flowed first in a direction opposite to that of a moving train; that the velocity gradually decreased to zero just when the rear end of the train had entered the tunnel, and that the direction then was reversed. The City & South London line still trusts to this action and the air is chemically well within the limits of allowable CO_2, that is to say 13 parts in 10,000, but it must be said, taking into consideration other pollutions, there is much left to be desired in the enjoyment of the atmosphere. This defect is not so pronounced in the Waterloo & City owing, no doubt, to the shortness of the line and the fewer number of trains within the tunnel at the same time. The tunnel under the Mersey at Liverpool was ventilated by shafts midway between stations for the purpose of exhaust and intake, but taking into consideration the cost of property in London, any such arrangements would obviously be objectionable. In the Great Northern & City line, however, a space for the purpose was obtained comparatively cheaply between Essex and Old Street Stations. This arrangement was not possible on the Central London, where it was soon found, owing to its length and the enormous and continual traffic, that the train movement was insufficient, and that some other device would be necessary. The plan adopted was to install a mine fan of the Guibal type at Shepherd's Bush, by which the air from the whole six miles of the double tube to the Bank Station is supposed to be drawn out, but this is limited to the few hours at night when the traffic ceases. This proved a great improvement, but as every traveler on the line knows, the peculiar earthy smell has not been eradicated and is specially noticeable at the evening approaches, when the effects of the fan are beginning to be worked off. Whatever the chemical constituents of the atmosphere are under these conditions, they appear to have a soporific effect on the human system. The average travel on this line is probably not more than about 15 or 16 minutes, so that it is not likely that the health of the passengers is in the least degree affected, but in the face of severe competition with above-ground traffic, where, comparatively speaking, pure air can be breathed, the matter becomes of some importance to the public, and still more to the men working the trains.

Guided by these experiences, those who were responsible for the later tubes, the Great Northern, Piccadilly & Brompton, the Baker Street & Waterloo, and the Charing Cross, Euston & Hampstead, have adopted a system which is thoroughly effective. Fans are fixed at the roof of every station, except in parks, and exhaust the air by ducts of from 12 to 16 sq ft area. The intakes are the ordinary passage ways and lift wells. As the areas of these passages are much greater than the exhaust ducts, the velocity of the air in these passage ways is not found to be excessive. The fans are designed to draw off 1,000,000 cu. ft. per hour, which is sufficient to cause renewal of all the air in the average length between station and station in both tunnels every 30 minutes. In a test made at Waterloo the expenditure of power per million cubic feet exhausted was 8.1 horse-power hours, the revolutions being 240 per minute, and the quantity of air passed in the same time 1,125,000 cu. ft. The working of the fans is nearly noiseless. The results are ideal.

FIREPROOF CARS.

Electric traction escapes some of the dangers of the steam locomotive, but involves new and serious dangers to be guarded against. Fire can be caused by short circuiting of the conductors within the cars, provided there is anything in the car that will burn.

The Paris Metropolitan burning will be remembered as well as that on the Liverpool Overhead Railway when a large number of creosoted sleepers were burnt. In the Paris case, much of the material of the cars was pitch pine, untreated, which ignited readily under the fierce heat generated by the electric current, and by this catastrophe, more than any other, we have been warned of the needed precautions.

Underground travel is such that panic is easily excited at any apprehension of accident, a panic that is often in itself more dangerous than an accident. In the later London underground electrifications, practically all this danger is eliminated. The wood in the District Railway cars is treated with chemicals which render it almost incombustible. It becomes charred only under continuously applied intense heat. It does not flame, and does not by itself continue to burn. The cars of the three recent tubes—the Piccadilly, Bakerloo and Hampstead—are nearly all steel. That safety has been attained, even where all steel cars are not in use, is illustrated by the slight misadventure, for we can hardly call it more, which took place at Sloane Square, on the District line, on January 8 last. It was caused by defective insulation of the electric lighting wires. The resulting heat melted a small plug of bitumen, followed by an explosion caused by the ignition of the bituminous vapor, and making smoke and fumes. Electric flashing followed along the pipe carrying the lighting wires to the junction box under the cars, and the fireproofed timber flooring was slightly charred. All of this, though quite sufficient to create alarm, was not in the slightest degree dangerous, and it is probably due to the small number of people at the time in the car, and their self-possession, that a panic did not occur. Even the harmless explosion can be avoided by the use of an insulating material which would not emit inflammable vapor.

Though unnecessary to prevent spread of fire in the cars, which, as we have said, can be easily mastered, a provision against the consequences of collision has been adopted on the District cars which is worth notice. This is a heavy $\frac{3}{16}$ in. steel partial bulkhead at each side of the end entrance doors, transverse to the cars and stiffened with vertical angles. Though there have been many minor collisions on various occasions, not one of these has failed to protect the main portion of the car between them, and if unfortunately such an occurrence of a more important kind should take place, there is good reason to suppose that these strong plates would partly diminish bad results.

The Piccadilly and the Hampstead Tube cars are noisier than those on the Baker Street & Waterloo, although all of them run on the same nearly noiseless track. The most pronounced sounds come from the wheel pockets in the car bodies, just over the trucks, although there is an additional roaring which seems to come from the side walls. The side wall, under the window line, of the Baker street cars, consists of a continuous sheet of heavy boiler plate, thick enough to be dignified by an engineering definition as a web girder, a rigid support forming a nonvibrating structure. The walls of the other tube cars consist of a riveted truss, covered by a very thin sheet of metal. The result is what might be expected. But these tube trailer cars weigh 16 tons 13 cwt., while the Baker street trailers weigh one ton more. In electric traction the costs increase strictly in proportion to the tons hauled, so that at the present time the traction costs of an empty Baker street trailer car are 6 per cent. more than for the other tube cars. Additional comforts are apt to cost something.

AXLE BREAKAGES.

Some time ago the failure of axles on the Metropolitan District line, when the new cars were introduced on its electrification, caused some attention. There were really very few cases, but the breakage of an axle is a serious matter, and might cause derailments resulting in loss of life. It is therefore satisfactory to know that these failures arose from an easily ascertained and remediable cause, viz., the tightness of the gage of the rails at the crossings, which were found to be specially noticeable at the Mansion House station, amounting to as much, in some cases, as ¾ in. Since this defect, which put such a strain on the axle, has been corrected, the breakages have ceased.

COTTON BRAKE BLOCKS.

The use of metal brake blocks has long been a source of trouble on electrical lines. The pulverized steel resulting from the action of the brakes and ground from the blocks and the wheels accumulate in the road, and it is necessary to brush and clean the insulated rail joints carefully and frequently to preserve the track circuits. In the New York subway, the amount of metal lost from the brakeshoes is roughly about one ton per mile per month. This has been ascertained by the weight of brake-shoe metal required for renewals minus that which is scrapped. It may be inferred that the wear from the wheels is about the same. The quantity of pulverized steel collected in the Paris Metropolitan is scarcely less, and on the Boston subway these rapid accumulations are troublesome. To obviate this, brake blocks of cotton fiber have been adopted on the new London tubes, where they have been completely successful, though when used in the open parts of the District line, defects have been observed which are now being investigated. The blocks consist of five layers of heavy woven cotton impregnated with resin and asphalt. Its coefficient of friction is considerably higher than that of cast steel blocks, and in use it is necessary to train the motormen to make a somewhat lighter application than with the metallic blocks in order to avoid sticking and skidding, but when the train line pressure is reduced to 10 lbs. satisfactory results are obtained.

Trouble was at first experienced by the flowing of the sheets outwardly away from the wheel flanges so that, occasionally parts fell on the permanent way and, owing to the impregnation, clung to the rail where they usually dropped, giving rise to false reports of broken rails. Cotton fiber has no grinding effect on the wheel tire, but it has the slightly bad effect that it does not keep the wheels trued, and inexperienced motormen are liable to produce a series of small flat spots due to short-time skidding. The blocks having no cutting action, the tires remain somewhat rough to an extent that can be detected in rough riding. This is a small defect inasmuch as it can be easily obviated by training the men. On the other hand the absence of grinding action has a highly beneficial result in the saving of tire wear and the consequences of it to which we have already referred. The average life of the cotton composition brake block in the tubes is found to be on trailers about 20,000 miles, as against 13,000 miles with metallic blocks. The cotton fiber blocks have not so far been successful on the open parts of the Metropolitan District line, as shown by experiments made on their South Harrow branch, probably owing to damp. These become "clammy," in the language of the men in charge, and there appears to be difficulty in releasing the brake, showing a want of uniform adhesion and some erratic actions. The brake blocks have the appearance of having absorbed some moisture, although it should be possible to overcome this fault.

In these days of rapid retardation, on which the speed of short stop travel so much depends, it is worth the consideration of those who design city lines whether the switchback construction of station approach grades, which diminish so much the work of braking has been developed as fully as might be possible. Of course where the speed and weight are fairly uniform, it might be possible to plot a vertical grade curve, the effects of which, coupled with the ordinary train resistance, might, apart from the effects of wind, stop the train almost to a yard. In lines through city and suburbs where the level is near the surface, grades must be more or less subsidiary to existing levels of roads, streets and to other considerations, but with almost incessant heavy trains, the diminution of brake action in stopping, not to speak of assisted acceleration in starting, will, no doubt, be worth some extra expenditure in construction to attain it.

The engineering staff in charge of construction of the Baker Street, Hampstead and Piccadilly Tubes was organized as follows: Chief Engineer, James R. Chapman; Engineer of Tube Construction, H. H. D. Hay; Architect, Leslie W. Green, Substation Construction, J. W. Thomson; Construction Engineer, W. E. Hanson, Resident Engineer Power House, J. W. Towle; Electrical Engineer, S. B. Fortenbaugh; Lift and Ventilating Engineer, G. Rosenbusch, Signal Engineer, C. E. Strange; Purchasing Agent, H. B. Twyford, Rolling Stock Superintendent, E. S. Albanese.

In addition to the above there were Parliamentary engineers for the tube lines as follows: Baker Street & Waterloo Railway, Sir Benjamin Baker, Messrs. Galbraith & Church, Charing Cross, Euston & Hampstead, Sir Douglas Fox and partners. Great Northern, Piccadilly & Brompton, Finsbury Park to King's Cross, Alexander Ross, King's Cross to Covent Garden, Sir J. Szlumper & Son, Covent Garden to Hammersmith, Sir J. Wolfe Barry and partner.

The Legal Height of Freight Car Couplers.

We published last week the decision of the United States Supreme Court on a case which arose in Arkansas, in which it was held that railroads must strictly comply with the law that fixes a standard height for the drawbars of freight cars, the court holding that evidence of reasonable care on the part of the railroad company would be no excuse for failure. The information given was correct, as far as it went, but it was based on a press report which proves to have been incomplete. The full decision has since come to hand, and, in view of the differences of opinion which have existed as to the precise meaning of the drawbar rule, as it was formulated by the American Railway Association and approved by the Interstate Commerce Commission, we quote from the decision the full interpretation of this law as laid down by Mr. Justice Moody. Justice Moody says:

We think that this act requires that the center of the drawbars of freight cars used on standard gage railroads shall be, when the cars are empty, 34½ ins. above the level of the tops of the rails; that it permits, when a car is partly or fully loaded, a variation in the height downward, in no case to exceed 3 ins.; that it does not require that the variation shall be in proportion to the load, nor that a fully loaded car shall exhaust the full three inches of the maximum permissible variation and bring its drawbars down to the height of 31½ ins. above the rails. If a car, when unloaded, has its drawbars 34½ ins. above the rails and in any stage of loading, does not lower its drawbars more than three inches, it complies with the requirements of the law. If, when unloaded, its drawbars are of greater or less height than the standard prescribed by the law, or if, when wholly or partially loaded, its drawbars are lowered more than the maximum variation permitted, the car does not comply with the requirements of the law

It should be said that the supreme court decided the case in favor of the railroad company, reversing the opinion of the supreme court of the state of Arkansas. The two cars between which Taylor was killed had different types of drawbars; one a vertical plane, and the other a link and pin. So far as can be judged from the statement of facts, the case was litigated wholly on the technicality of the height of these drawbars, and the fatal injury to the man was not due to the difference in height. One of the cars was fully loaded and the other partly loaded, and the trial judge, who was sustained by the state supreme court, had charged that these cars were run in violation of the federal law, because the drawbar of the fully loaded car was more than 31½ in. high. The Supreme Court of the United States, in accordance with the rule quoted, held that the couplers did comply with the law.

The Cape Cod Canal Project.*

BY WM BARCLAY PARSONS.

In the consideration of an inside water route along the Atlantic seaboard of the United States, the link that will connect the waters of Long Island sound and Massachusetts bay is, in respect of size and character of vessels and the extent of tonnage that will use it, the most important, and historically the most interesting of all the sections that, when completed, will make possible a voyage from Maine to the Gulf of Mexico free from interference by stress of weather or attack by enemy in case of war.

A glance at the map of Massachusetts shows projecting from its southeastern corner a great arm, running first easterly thirty-five miles and then northerly about the same distance, terminating in a hook at Provincetown. To this arm the name of Cape Cod is applied. This curious geographical formation is everywhere flat, with few hills, especially to the east, and is composed chiefly of sand and gravel. Around this cape all sea-going traffic between Massachusetts bay ports, such as Boston and Portland, and all ports lying to the south must pass.

The circumnavigation of the cape is far from easy. On the south side lie Martha's Vineyard and Nantucket islands, inclosing Vineyard and Nantucket sounds, with their high tidal currents and many shoals; while to the east are the great shoals extending southeasterly to the celebrated Nantucket shoals, marked by the light vessel of that name. These shoals, the low, sandy coast, difficult to see in thick weather, the frequent fogs, and the unbroken exposure to northeast storms, have made the passage of the cape a dreaded one to all mariners, and the record of wrecks year by year, with their shocking loss of ships, cargoes and life, is ample testimony that their fears do not lack foundation.

The only place on the cape where its breadth is material is the southerly projection toward Falmouth, which, with the extended chain of islands, forms the eastern shore of Buzzards bay. At the head of the bay the distance overland to Barnstable bay is less than eight miles. This distance is made up in chief part by the Monument river to the south and the Scusset river to the north. Separating them is a ridge whose height is only 30 ft. above sea level. The deepening of the rivers and the cutting of a canal through this ridge, making thereby a direct water route, avoiding the journey around the cape, is so obvious a shortening of distance and reduction of marine risks as to cause wonder it was not long since done. The contemplation of such a channel is, in fact, almost coeval with the Pilgrim settlement at Plymouth in 1620. The records of that colony show that in 1622 a party succeeded in getting a boat around the cape, only to have it lost in Vineyard sound. The year following they discovered that from Manomet, an Indian town within twenty miles of Plymouth, there flowed a river southerly to a bay which opened towards Narragansett, and within a short time afterwards the thrifty colonists established there a trading station, between which and the Dutch settlement at Fort Amsterdam there at once developed a brisk trade, the Dutch vessels ascending the river to Manomet, whence the goods were carried the short remaining distance overland to Massachusetts bay. Before the seventeenth century was one-third gone there was thus established the beginning of the Boston-New York water-borne trade, which has since grown to such huge proportions. The old name of Manomet has unfortunately been corrupted into the meaningless form of Monument, and as such is now applied to the river which the Plymouth colonists found.

In 1791, Massachusetts having now become a state, the legislature appointed a committee to inquire into the possibility of a canal across the cape. From that time until 1824 the question was continually before the state legislature. In the latter year the government of the United States intervened, and by a joint resolution of both houses the President of the United States was authorized to cause the necessary surveys, plans and estimates to be made for a canal across the cape. As a result of this survey, detailed plans were finished for a canal which was to be 36 ft. wide on the bottom, 60 ft. wide at the surface of the water, with a depth of eight feet, the canal to be equipped with locks.

The eminent French engineer, Major William Tell Poussin, who visited this country in 1831, and who, on return to France, made an extensive report on public improvements of the United States, describes, with elaborate drawings, the Cape Cod Canal as being one of the greatest pieces of construction contemplated on the American continent. From 1830 to 1860 the project languished, but in the latter year the legislature of the state of Massachusetts once more took it up, reported, and again reported in 1864. From that date until the present the question of the canal has been at intervals under discussion. The state granted a charter under which work was actually begun; funds, however, were not forthcoming in sufficient amount, the work was abandoned and the charter allowed to lapse. In 1899 the legislature passed another charter, amended in 1900, in accordance with which plans for a canal have been prepared by the writer, submitted to the joint board of railroad and harbor and land commissioners of the state of Massachusetts, approved by them and work begun.

All the early schemes for a canal at this point contemplated locks. Brevet Major-General J. G. Foster, Lieutenant-Colonel of Engineers, U. S. Army, in 1870, was the first to call attention to the fact that, although there is a considerable difference in tidal phenomena at the two ends of the canal, nevertheless the resulting current will not be sufficient to require locks. This same view has been sustained by many eminent authorities, among them the late Colonel A. L. Rives, for many years superintendent and chief engineer of the Panama Railroad; Dr. Elmer L. Corthell, the associate with Captain Eads in the Mississippi jetties, and himself the constructor of many notable harbor developments in various parts of the world, and Mr. Clemens Herschel. The plans that are under construction therefore contemplate a canal free from locks or dams. The law requires that the bottom width shall be not less than 100 ft., with passing places where the bottom width shall be twice as great, and with a minimum depth at any point at mean low water of 25 ft. In actual construction it is probable that the minimum width will be greatly exceeded, in fact, it is most likely that the passing places, instead of being made three in number, will be connected so that the canal will have everywhere a bottom width of 150 to 200 ft., and a width at the surface of from 250 to 500 ft., depending upon the slope that the banks will take. These dimensions can be compared with a bottom width in the Suez canal of 147 ft., in the Kaiser Wilhelm canal at Kiel of 72 ft., and in the Manchester canal of 120 to 200 ft.; the depths of these canals vary from 26 to 30 ft.

From the shores of Barnstable bay to shores of Buzzards bay is a distance of eight miles. The sharpest curve is projected to have a radius of 7,640 ft., so that navigation for vessels of any size within the limits of depth will be simple. At the south end Buzzard's bay is land-locked and affords an excellent harbor, at the north end the canal will flow directly into the open waters of Barnstable bay without any natural protection. This bay is open to storms from the north and northwest. It is proposed to provide protection against winds coming from this direction, to build a breakwater for a distance of 3,000 ft., running easterly and extending to the six-fathom curve at low water, so that vessels entering from the open bay, even in rough weather, will be able to obtain smooth conditions before entering the canal. In addition, the United States government should construct a harbor of refuge by the building of other breakwaters, so that vessels, after having passed the canal, may lie at anchor in the waters of Barnstable bay until such times as they are ready to continue their voyages, if delayed by stress of weather, accident or other cause. Such harbor is so obviously a part of open sea navigation that it logically should be done by the government as similar works are done along the coast, and not by a private company.

This canal is not a channel for local traffic, but is essentially a ship canal for ocean-going vessels in through service. The figures of proposed depth and width of the Cape Cod canal show that it will be of the same general character as to size as the great ship canals of the world, and the dimensions are amply sufficient to accommodate all vessels engaged in the coastwise traffic at any stage of tide, and permit them to pass each other in opposite directions without hindrance. In fact, the canal will be of really greater capacity than the above figures would indicate, which are based on mean low water conditions. Since the tide rises in Buzzards bay about five feet, the depth of water in the canal when there is high tide in Buzzards bay will be 30 ft., a depth that will be substantially maintained at that time through the canal, as mean tide at Sandwich, which occurs when there is high tide in Buzzards bay, will also give 30 ft. depth at the north end. Available draft can therefore be said to vary from 25 ft. as the minimum to 30 ft. as the ordinary maximum. The latter depth would suffice to carry vessels of the battleship class, should the government ever have occasion to send such vessels through the canal.

*From a paper read before the Atlantic Deeper Waterways Conference, Philadelphia, November, 1907, and reprinted in the *Annals of the American Academy of Political and Social Science*, January, 1908

The general trend of the Atlantic coast is northeasterly. A straight line drawn from the mouth of the Chesapeake, or the mouth of the Delaware, or from Sandy Hook, to Boston, will cut the land well to the westward of the proposed canal. The actual saving in distance will therefore be the same for any vessel trading between a Massachusetts bay port and practically any of the ports on the Atlantic seaboard. Vessels now making this journey have two courses open. In going from New York they can pass through Long Island sound and Vineyard sound around the cape; or they can go by sea past Sandy Hook, and then from Montauk Point either through Vineyard sound, as before, or to the southward of Martha's Vineyard and Nantucket islands around the cape. Vessels from Philadelphia, Baltimore, Newport News, Norfolk, Wilmington, Charleston, Savannah, Brunswick, or any other port, can pass Montauk Point and go either through Vineyard sound, as above, or to the southerly of the two islands.

Taking a common point of departure by the inside route through Vineyard sound, there would be a saving in going through the canal of 66 miles in distance; or, by taking another common point of departure outside of Montauk Point, there would be a saving of 63 to 71 miles for vessels going through the canal instead of passing to the south of the islands, according as bad shoals are crossed or avoided. Or, if in the latter case, a vessel should wish to escape all the Nantucket shoals and make a complete circuit rather than go across, there would be a saving of 129 miles between New York and Boston, and 105 between Philadelphia and Boston. For points south of Philadelphia, the saving in distance would be substantially the same, although, as compared with the journey length, necessarily proportionately less. The saving in distance is not, however, the only saving that would be realized, as the worst part of the journey is the journey around the cape, whether it lies across the shoals or goes around them.

Fogs, storms and adverse currents frequently keep vessels storm-bound either at Provincetown or in Vineyard sound for days at a time, so that no certain time of arrival can be predicated even for vessels in tow, still less for vessels under sail, while the terrible list of wrecks on the shores of the cape attest the foolhardiness of attempting to make the journey in bad weather. During the year 1905, the last for which statistics are available, 11 vessels were lost on the shoals and the short stretch of 35 miles of Cape Cod coast. The tonnage of these wrecks composed 24.1 per cent., or say one-quarter, of the total tonnage of wrecks reported on the whole coast line of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut and Long Island. So measurable is the danger of Cape Cod transit, as compared with the quiet navigation of Buzzards bay and the canal, that inquiries addressed to the marine underwriters in New York elicited the response that insurance rates on the cargoes of sailing vessels and barges would be reduced from 10 to 25 per cent. to vessels using the canal.

The traffic that would seek the canal route is of three classes:

First—Passenger steamers between New York and Boston. This business is now handled in two ways: by vessels running to Fall River, Providence, New Bedford, or other sound ports, and thence by rail to Boston, or by vessels going around the cape. The first method requires but one night for the journey, but it involves a transshipment of passengers and freight inconvenient to the former and expensive for the latter. The second method requires usually 18 to 20 hours, or say a night and the forenoon of the following day, unless further delayed by thick weather. The canal will permit the journey to be completed in 13 to 14 hours, or comfortably between evening and early morning. To show the extent of this traffic, there are running regularly every night between New England ports, exclusive of any north of Boston, 24 large steamers both ways, of which 16 carry passengers. During the summer not only is the total increased, but also the percentage carrying passengers. Of the 24, the New England Steamship Company controls 16. All these steamers pass out through Long Island sound, and by far the greater portion of the passengers and freight would be more expeditiously, economically and comfortably handled through the canal.

Second.—Steamers carrying chiefly freight, but also some passengers, between Boston and ports south of New York. Lines are regularly established from Boston to Philadelphia, Baltimore, Norfolk, Charleston, Savannah and Jacksonville, with 20 sailings weekly both ways, offering an annual freight capacity of more than 2,000,000 tons. In addition there is a large volume of freight traffic, chiefly fruit, from the West Indies and Central America, steamers from such ports entering at Boston custom house to the extent of over 200 annually. All this traffic could save by the canal, and much of it will use it.

Third.—Freight traffic of raw materials transported in sailing vessels or barges. This traffic would furnish the major volume of the canal business, and it consists chiefly in coal, southern lumber for New England, Maine lumber, such as spruce for points south of the cape, stone from Massachusetts and Maine, ice south-bound, cement, brick and lime north-bound, oil and oil products, cotton reshipped at New York, and other bulky commodities. Such articles must be transported cheaply. The New England railroads leading from New York are now so congested with passenger traffic and the carrying of high classified freights that such articles as those stated above cannot be given the low rates that their value demands—such traffic must go by sea.

In point of tonnage, the biggest item in the above list is coal. During the year ended June 30, 1907 it is estimated that the coal shipments to Massachusetts bay ports, of which Boston and Portland are the chief, amounted to no less than 12,000,000 tons, which were shipped from New York, Philadelphia, Baltimore and Norfolk. Exclusive of the freight carried in the regular coastwise steamers, it is estimated that the other commodities aggregated during the year some 5,000,000 tons, making a gross total of about 18,000,000 tons.

From these statistics, and the diversified points of origin of traffic, it will be seen that this canal is of national importance. Although nominally the bulk of the cargoes that will use it north-bound start from New York, that port is not the originating point. The cargoes represent the produce of the many states seeking their market through a convenient channel—coal from Pennsylvania and West Virginia, tobacco from Virginia and the Carolinas, timber from Georgia, cotton from the whole of the great South. It is an enterprise in which every state on the Atlantic seaboard from Maine to Florida and Texas, is interested.

If the volume of traffic already in existence is so great and the saving in distance, delay and danger of such importance, the question naturally arises why, after 300 years of agitation, the canal was not built before. The answer to this very natural question will be found in the change that has been taking place in water transportation, a change which has made it possible for the state of New York to throw away its enormous investment in the existing canal system of the state and build an entirely new system from Lakes Erie, Ontario and Champlain to Albany, at a cost of over $100,000,000.

As long as the coastwise traffic was controlled by schooners, with a recognized unknown length of journey and an amount of delay impossible to forecast, the value of the distance and time saved was not of so much importance as to overcome the expense to a sailing vessel in traversing the more or less narrow waters of Buzzards bay and being towed through the canal. Steam, however, within the last few years has been making the same inroads into the methods of coastwise traffic that it has already made in ocean traffic, so that the schooner is following in the footsteps of the picturesque clipper ship, and is giving way to the tug and tramp steamer.

As soon as a vessel owner adopts as a motive power an agent that will enable him to send his vessel on a schedule he at once begins to take account of delays, and places a money value against the time lost. This method of reasoning—and it is sound—warrants the expenditure of large sums in the improvement of waterways, such as the Cape Cod canal, that would not have been, and were not, justifiable one or two decades since.

To-day the greater part of the coal traffic between New England, New York, Philadelphia and Norfolk is handled in barges, usually two or three in number, behind an ocean-going tug. To show the extent to which the new methods of transportation are superseding the old, the statistics compiled by the chamber of commerce for the port of Boston each year are at hand. In 1902 there arrived in Boston from domestic ports south of Cape Cod 1,033 steamers, 1,209 sailing vessels, 909 tugs and 1,879 barges; total, 5,030. In 1906, four years later, there were 1,148 steamers, 900 sailing vessels, 1,166 tugs and 2,458 barges; total, 5,672. The aggregate vessel tonnage of the former years was a little over 5,000,000 tons, and of the latter nearly 7,000,000 tons.

The thing that strikes one in these statistics is the small increase in vessel number and yet the large increase in vessel tonnage, indicating an increase in average size of unit. While the total number of steamers remains substantially the same, sailing vessels have decreased 25 per cent. in number and the barges have increased more than 33 per cent. in number.

In 1902 of the total entrances at Boston, steamers comprised 20.5 per cent., tugs 18 per cent., sailing vessels 24 per cent. and barges 37.5 per cent. The same division in 1906 was: steamers 20.3 per cent., tugs 20.6 per cent., sailing vessels 15.8 per cent. and barges 43.3 per cent. Or, taking the United States government figures for 1905 and comparing them as a matter of convenience with the census returns for the year 1899, of the total tonnage carried to Boston, 53.9 per cent. went in steamers in 1899, and exactly the same in 1905; but while barges carried but 21.1 per cent. in 1899, they carried 31.3 per cent. in 1905, and the sailing vessel tonnage, which had accounted for 25 per cent. of the whole in the first year, had fallen to 14.8 per cent. in the second.

This same general change in traffic conditions will apply equally to all waterways that are to be hereafter constructed, and any waterway that is either to be constructed anew or to be made by the improvement of existing conditions must be undertaken with the view of its exploitation by vessels whose power will be for the most part something other than sails. With the Cape Cod canal established, the great source not only of danger but of delay will have been removed and the towing companies, whether private or part of the various coal companies' equipment, can estimate with reasonable certainty upon the time of departure and arrival of their tugs, in fact with a much greater certainty than for similar shipments by rail.

Its national rather than local character is to be impressed on the attention of this convention, as this canal will do more than make a water route from New York to Boston. It will at once, by means of the Raritan, Delaware and Chesapeake and other canals, complete an inside route safe at all seasons for all boats from North Carolina to Maine, and that without a single dollar more to be invested by the nation or any state. From that point the labors of this convention can be exerted to deepen, widen and develop the existing links and construct others that are now lacking, so that this inside route may be continuous and of sufficient size for modern requirements. To this end not only must canals be built and small rivers enlarged, but the attention of those in authority must be directed to the further increasing of the capacity of the limiting conditions of some of the main arteries. The port of New York is the country's largest gateway. The general government has been at work for years, and has at last completed a new deep channel to sea. That channel is, however, for foreign commerce. The harbor has another entrance from the sound through the East river; this is the channel for internal commerce. It is the channel on which three states—New York, Connecticut and New Jersey—look directly, and it is the one used chiefly by the domestic ocean commerce of the Atlantic states. Although much improved over conditions existing twenty years ago, it is still much restricted by islands, reefs and narrow channels. If any great inland route is to be established it becomes the throat where all traffic will be congested; it is the one place which all are interested in having developed; it is one of the improvements to be most urged by this convention upon the national authorities.

Westinghouse Double-Flow Steam Turbines.

The turbine equipment of the Brunot Island station of the Pittsburgh Railways consists of one 3,000 k.w. and three 5,000 k.w. Westinghouse double-flow units. The smaller unit has been in successful operation nearly one year; the larger ones are in course of erection. Each turbine is connected by a short and direct exhaust duct to an Alberger condenser of the centrifugal jet type. Both circulating and discharge pumps are mounted on the same shaft and driven by a Westinghouse compound, single-acting engine. Both condensers and pumps are beneath the engine room floor between the turbine foundations. A steam-driven, two-stage, dry air vacuum pump is also provided for each turbine. Cooling water is pumped to the condensers from an intake tunnel extending the length of the power house, at one side of the foundations, and the discharge from the condensers empties into a similar tunnel parallel to the intake. There is an adjustable gate in the intake tunnel leading from the screen house to a large central well in which the water level may be maintained at the desired point irrespective of the level to which floods may raise the Ohio river. Each unit rests on reinforced concrete plates supported entirely by six reinforced concrete columns, giving ample space around the condenser.

The principle of the double-flow turbine is not new, the original Parsons turbine, built in 1880, being of this type. Its advantages, however, can be best brought out only in large machines. For turbines above 5,000 k.w. capacity, the double-flow construction will become standard in all Westinghouse work. In sizes below 3,000 k.w., the Westinghouse-Parsons single-flow construction remains standard.

The low-pressure double-flow turbine consists simply of two similar Parsons turbines placed end to end, taking steam at the center and exhausting at both ends. The axial thrusts are balanced under all conditions of pressure, vacuum and load, without the use of dummy or balance pistons. The high-pressure machine is directly evolved from the low pressure by adding a high-pressure impulse element mounted at the center of the rotor. This element is analogous to the high-pressure cylinder of a triple expansion reciprocating engine.

Steam enters the turbine through a flanged opening in the lower half of the casing, from which it is piped directly to nozzle blocks. In the illustration, the nozzle block is shown at the top, but it may be located at any point in the periphery nearest the inlet. Expanding in suitable nozzles, the steam strikes the impulse blades, enters the impulse wheel chamber, and is distributed evenly around the casing so as to enter around the entire periphery of the rotor, the intermediate Parsons section of the turbine. As in the single-flow turbine, the steam then divides along two separate paths, one-half entering the left-hand section of low-pressure Parsons blading, the other passing through the interior of the rotor shell which forms the connecting passage to the remaining low-pressure section of Parsons blading at the right-hand end of the turbine. Discharging from the last rows of low-pressure blading, the steam passes into the exhaust connections and to the condenser in the usual manner.

As the same pressure exists on both sides of the impulse wheel disc this is not subjected to any end thrust and requires no balancing. The difference of pressure between the inlet and outlet of the Parsons intermediate section is balanced by a dummy piston of moderate dimensions, located between the impulse wheel and the right-hand low-pressure section.

All double-flow cylinders are made in two parts, the upper and lower halves each being a one-piece casting. The design is symmetrical throughout, without longitudinal flanges except those at the center required for bolting the two parts together. The castings are first rough-bored, after the flanges have been planed and drilled, and are then "seasoned" with high-pressure steam for a number of hours to remove any local casting strains in the metal. They are then given the finishing cut, assembled, and with boring bar running in the bearing housing so as to insure a truly concentric bore. Manholes are provided at each end of the cylinder for interior examination, and relief valves are fitted in each of the manhole covers to prevent the pressure in the exhaust passages rising to a dangerous point in case of failure of the condensing apparatus and sticking of the atmospheric relief valve.

A Y-connection fitted with two corrugated copper expansion joints below the base of the turbine connects the separate exhausts to the main exhaust nozzle. An atmospheric exhaust nozzle opens out of the side of the exhaust "Y" to permit non-condensing operation.

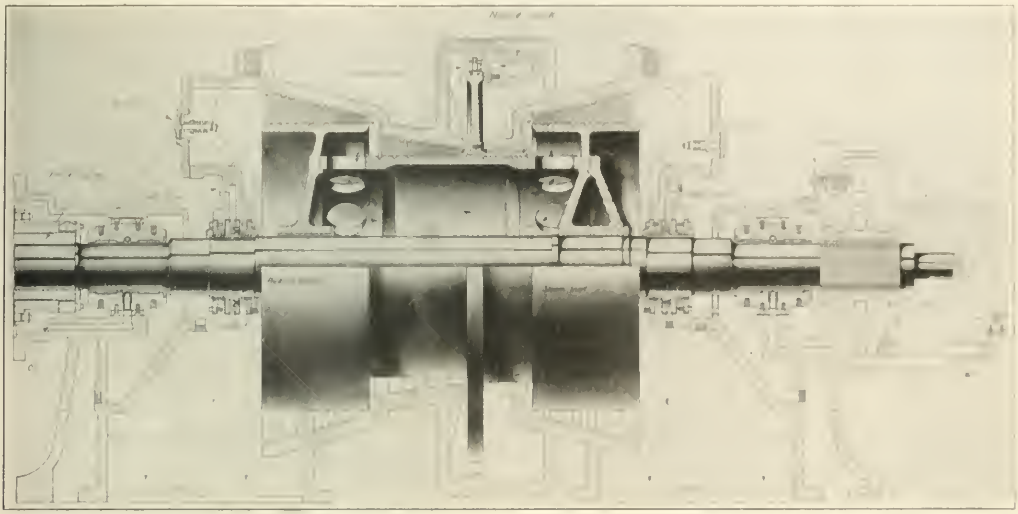
The rotor consists of five cast-steel members mounted on a through shaft. The shaft carries its load at one-third distance from the points of support, thus permitting a lighter shaft than required for distributed loading and greatly lessening the chances of deflection. The rotor is pressed on the shaft and locked at one end, and to the opposite end is fitted a bronze bushing surrounding the shaft, permitting it to move axially with any unequal expansion of shaft and rotor body.

Double-Flow Turbine Direct Connected to Generator.

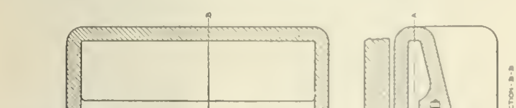
The impulse element consists of a flanged cast steel disc forced on to the rotor body with a pressed fit and securely keyed. The flange at the base is grooved and forms the dummy or balance piston for the intermediate Parsons section. A typical arrangement of blading and nozzles is shown herewith. The nozzle block is an independent casting separate from the turbine cylinder. Receiving steam from the governor valve, this restricts high pressure and high temperature to a comparatively small casting which is free to expand and contract with changes of temperature and may easily be designed with ample strength. As the steam is not expanded in the impulse element to less than about half of the initial pressure, divergent nozzles are unnecessary and simple straight-sided nozzles are used. The entire nozzle block may be removed in one piece, and the nozzle walls may be readily renewed if necessary independently of the block. As almost no difference of pressure exists on the two sides of the element, the area through the bucket increases to provide for the decreasing steam velocity in each rotating wheel. As in all high-pressure impulse turbines, the nozzle blocks cover but a small portion of the periphery of the impulse wheel, so that ample space is left around the remaining portion of the wheel to permit the free circulation of steam in all parts of the impulse wheel chamber before entering the Parsons element.

Except for the division of the low-pressure Parsons section, this part of the turbine is the same as the single-flow construction. The diameters of the low-pressure section are such that the same size blades can be used in both intermediate and low-pressure sections, thus simplifying the blading considerably.

No one metal has all the physical characteristics desirable for blading material. But recently a special, compound metal has been developed, which is exclusively used in Westinghouse turbines. This material, known as "Monnot," or duplex metal, consists of a steel core covered with a thin copper sheathing so welded to the steel that the blades may be drawn cold from the original ingot into the required finished section without in any way affecting the bond between the copper and steel. Experiments have shown that pure copper offers the maximum resistance to chemical corrosion resulting from bad feed water carried over in the steam during priming. At the same time the integrity and strength of the steel core is maintained. The original method adopted for reinforcing long blades was to insert a heavy brass wire in saw slots cut in the entrance edge of the blade, the brass wire being securely laced to the blades by a thin copper wire, and the whole then rigidly brazed together. An improved blade lashing is now used in all Westinghouse turbines. Comma-shaped holes are punched in the blades at any desired point of reinforcement. The blades are then strung on a comma-shaped lashing wire laced through these holes. After the blades have been caulked into the rotor or stator, the tail of the lashing is sheared over by a tool, wedging the tail of the lashing into the contracting space between the face and back of the adjacent blades, acting as a strut, while the lashing wire itself acts as a tie, thus securely interlocking the blades and preventing vibration. The short section remaining in the blade after being sheared off acts as a key to prevent a broken blade from swinging out and injuring adjacent rows.



Westinghouse Double-Flow Steam Turbine.



Sections of Nozzle Block and Impulse Blades.

A water-sealed gland is fitted on each end of the turbine shaft where it passes through the exhaust casings. This packing consists of a small centrifugal pump propeller running in an enclosed chamber to which water is supplied under a head of about 10 ft., which is slightly in excess of the head due to the centrifugal force acting on the water in the impeller blades. At starting, any external leakage water is caught in circular troughs and drained away. This gland always maintains a solid mass of water around the periphery of the impeller, which prevents the entrance of air to the condenser or the escape of steam to atmosphere when running non-condensing.

Picked Up on the Road.

BY GULF.

The following story concerning a fireman comes from the South, where a good many firemen are of very dark complexion, and are supposed to have very hard heads. This one, like most darkies in stories, bore the name of Sambo. He was a fireman on the principal railroad of the South. His entire term of service had been spent on a switching engine, but one day, in an emergency, he was called to fire on a passenger train. The passenger engineer gave him such instructions as he could in the short time at his disposal, and in particular told him that on a passenger engine one of the duties was to watch out for the mail bags hung out on the cranes at non-stopping stations to be taken up by the train while running at full speed. Sambo remembered this part of his instructions very faithfully and the engineer gave no further thought to the matter until, after having passed a half dozen mail stations, he was stopped by the conductor, who, at the request of the mail clerk, had pulled the air signal and then had come forward to find out what was the matter with the mail bags, no bag having been picked up at any one of the six stations which had been passed.

"Dere dey is'" said Sambo, pointing to the back part of the coal pile on the tender. He had caught each bag as he came to it. At this point the story comes to an end. The supposition is that he caught the bags by swinging out far enough to strike them with the port side of his cranium. By this process the shock was sufficiently "absorbed" to allow of the bag being grabbed and pulled in.

Speaking of the South reminds me that in returning from the South to New York one passes through Washington, a city which has just been furnished with a grand and imposing new station. The main waiting room of this station, 220 ft. long, occupies the central part of the immense building, and its ceiling consists of a magnificent and richly ornamented arch nearly 100 ft. high. At night this arch, which is decorated in white and gold, is lighted wholly by reflection from electric lights hidden out of sight at the springing lines on either side of the room, making a very pleasing effect. My reason for bringing the subject up at this time, however, has to do with the waiting room in the day time, rather than at night, and my topic is the train announcer. The reverberations completely destroy the effect of his work. Everything that he says is followed by echoes so numerous, loud and far reaching that nine-tenths of the people in the room have no idea what the man says. This particular train caller never was a shining success, even in the smaller room of the old station at Sixth street, but his uselessness is now intensified tenfold.

Possibly the satisfactory announcement of trains in a room of this kind is out of the question, it may be that the best elocutionist in the world would find himself baffled by the utterly bad acoustic properties of such a great space arranged in that shape. The main room of the Grand Central Station at New York, considerably smaller than this great hall at Washington, has proved a difficult proposition for the shouters there, and they claim that they have to wait a full second or more between every group of two or three words and the group next following, so as to give the echoes a chance to die out. If there is no remedy for this difficulty it would seem as though we might as well settle down to the conclusion that the only useful function of a train shouter is to call the attention of people in the room, at suitable hours, to the fact that it is time for at least some of them to ask themselves whether they should not be seeking their seats in the cars. An intelligent porter, of the right disposition, may do much good in a waiting room by answering questions which are asked of him by individual passengers, but to shout, where most of the shouting is unintelligible is only an annoyance to everybody within hearing distance. He would do better to ring a bell or beat a drum, and then let the people come and ask him what news he has to impart.

Another interesting feature of the new station at Washington, which confessedly has been built partly for the purpose of elevating our capital to the level of other imperialistic capitals, such as are to be found in Europe, and to give our most beautiful city a dignity which it never before enjoyed, is the magnificent scale of rates charged at the package room. These are fully in keeping with our present era of expansion. To leave a Gladstone bag, an overcoat and an umbrella there for 20 minutes costs 30 cents. The charge would be no higher for a whole day, but it is not unfair to state the case in this way; it is not extreme; for a great many people desire to avail themselves of this storage room for short periods of time. How much profit there will be in the operation of a busy coat room 8 ft. x 10 ft., in the course of a year, at rates like this, I will not stop to compute; but the average passenger will probably agree with a remark made by one of the station employees, who expressed the opinion that the directors of the Washington terminal company expect, in the course of a few years, to pay for the station out of the profits of the package room. Why should not this petty extortion be laid before our enlarged, reorganized and energetic interstate commerce commission? While it seems hardly the thing to ask seven dignified judges to give their time to the consideration of such a picayune question as that which just now grieves me, it is to be borne in mind that an important principle is involved. In a number of cities the Pennsylvania and other railroads have maintained carriages, for the purpose of taking passengers to and from their stations, at a loss to the company, the theory being that the accommodation of the passengers was the paramount consideration. This principle should (and does) apply to a coat room.

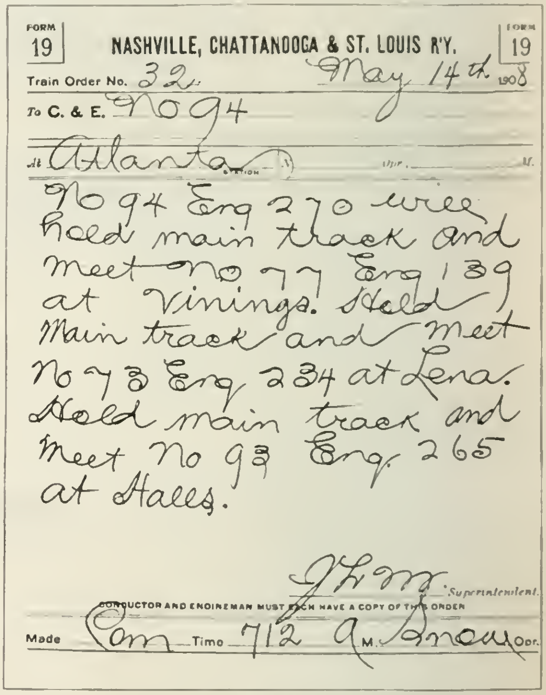
Congress itself sets the example of giving attention to small affairs by devoting its own time to the details of administration in the District of Columbia; and the House of Representatives has lately made a requirement under which the interstate commerce commission will have to follow the Congressional example; I mean the law concerning a street railway extension in Washington, which includes a proviso that the new railway must be managed under the supervision of the commission. If these ten-thousand dollar jurists can devote their time to deciding what kind of frogs shall be used at a street railroad junction, or how many cents per million may rightfully be paid for printing transfers (with a department store advertisement on the back) it will not be out of the way to ask them to relieve the irritated passenger who is held up by the coat room buccaneer.

Car Surpluses and Shortages May 13.

The Committee on Car Efficiency of the American Railway Association, Arthur Hale, Chairman, has issued Bulletin No. 23, giving a summary of surpluses and shortages of freight cars by groups from October 30 to May 13. The total surpluses of cars reaches 404,534 in this report, being a decrease of 9,071 from the report for April 29. The largest decrease is in box cars, although there is almost as great a decrease in coal and gondolas. The number of idle flat cars decreased slightly, while the number of miscellaneous cars idle remained about the same. The Eastern, Northwestern and Canadian groups show the largest percentage of decrease, while the New England, Middle Western and Pacific groups show increases. In the Middle and North Atlantic groups the reports for individual roads show some improvement, which is offset, however, by increases on other roads in these groups, leaving the total about the same as on April 29. The summary for 163 roads is shown in the double column table.

A Clearly Written Train Order.

The train order shown herewith, *reduced one-half in width and height*, is published for the purpose of putting on record, as a matter of history, the fact that legible penmanship is not a lost art in the railroad service. On many roads the typewriting machine has come into use to a considerable extent for making train orders, but at places where a machine is not available, it is refreshing to find an operator who can produce readable copy.



FORM 19 NASHVILLE, CHATTANOOGA & ST. LOUIS R'Y. FORM 19

Train Order No. 32 May 14th 1908

To C. & E. No 94

At Atlanta Station

No 94 Eng 270 will hold main track and meet No 77 Eng 139 at Vinings. Hold main track and meet No 73 Eng 234 at Lena. Hold main track and meet No 93 Eng 265 at Halls.

J F M Superintendent.

CONDUCTOR AND ENGINEMAN MUST EACH HAVE A COPY OF THIS ORDER

Made Com Time 712 a M. Brown Opr.

On the Nashville, Chattanooga & St. Louis train orders are carefully and constantly inspected by a sharp-eyed man from headquarters, and not only is slovenly penmanship rigidly subdued, but any tendency on the part of despatchers to use ambiguous wording also is nipped in the bud.

To write this order in three separate paragraphs, which would be a marked improvement in orders of this kind, the operator would have had to write a smaller hand.

Surpluses and Shortages Bi-Weekly, from October 30, 1907, to May 13, 1908, Inclusive.

		Surpluses.					Shortages				
	Number of roads.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
May 13, 1908	163	143,822	22,949	183,041	54,722	404,534	100	33	16	10	159
April 29, 1908	159	147,971	24,350	186,742	54,542	413,605	145	42	16	64	267
April 15, 1908	153	138,065	23,811	160,205	53,689	375,770	83	7	1	55	146
April 1, 1908	158	111,748	24,774	120,669	50,316	307,507	319	117	8	84	528
March 18, 1908	160	103,509	25,122	119,205	49,206	297,042	533	151	250	73	1,007
March 4, 1908	162	103,905	27,232	139,223	44,632	314,992	943	19	608	57	1,619
February 19, 1908	161	113,776	30,088	134,217	44,432	322,513	697	141	249	162	1,249
January 22, 1908	161	124,622	27,328	142,338	48,292	342,580	392	132	79	135	738
December 24, 1907	158	87,714	14,740	64,556	42,300	209,310	187	81	191	265	724
November 27, 1907	160	16,246	3,645	10,028	10,429	40,348	11,908	868	2,964	2,224	17,964
October 30, 1907	161	786	600	1,285	1,275	3,946	61,592	3,546	15,987	9,632	90,757

Strang Gas-Electric Car Irene.

The J. G. Brill Company, Philadelphia, Pa., recently built for the Strang Gas Electric Car Company, New York, the car shown in the accompanying illustrations.

The Strang system consists of a four-cycle gas engine, direct-connected to a d.c. generator, supplying current to the truck motors. Normal requirements are met by the generator, the peak loads being carried by additional current supplied from a storage battery, which is charged during stops or when coasting down grades. While current is being supplied to the storage battery only, the engine is automatically throttled on reaching the capacity of the battery. In case of accident to the gas engine, it is claimed that the car can run 15 miles on current from the battery alone.

Strang Gas-Electric Car "Irene."

The Irene is equipped with multiple unit control, so that the car can furnish current to motors in cars coupled to it. As a motor car it can haul three trailers, seating 75 passengers each.

The car is built of steel, with an interior pleasing in design and finish. Just behind the engine room the forward compartment is furnished with transverse seats, upholstered in red leather. The rear half of the car has comfortable wicker chairs, similar to those used in Pullman cars. The car is heated from the engine jacket, water being circulated by means of a motor-driven centrifugal pump, through heating pipes inside the car. During the summer season, the jacket water is passed through radiators placed on the roof of the car.

Interior, Strang Gas-Electric Car "Irene."

The first Strang car was described in the *Railroad Gazette* of Feb. 23, 1906. This car was 52 ft. 9 in. long, accommodating 41 passengers; the Irene is 66 ft. long and carries 75 passengers. The new car is designed for a maximum speed of 55 miles an hour, the average consumption of gasolene is 0.6 gallons per mile and enough gasolene is carried for a 200-mile trip. The original car had a maximum speed of 50 miles an hour; it used an average of 0.45 gallons per mile and carried enough for a 225-mile trip. The electric equipment of the first car consisted of a 50-k.w., 250-volt, d.c. generator, 400 r.p.m.; two 50 h.p. series wound motors of the street railway type; two K-13 controllers and a storage battery of 112 cells, 200 ampere-hours capacity. The Irene has an 85-k.w., 250-volt, d.c. generator, shunt wound, of 425 r.p.m.; two 100-h.p., 250-volt, series wound interpole motors and a storage battery, Plante type, of 112 cells and 300 ampere-hours capacity. The six cylinders of the first car were mounted alternately at angles of 90 deg. to each other and 15 deg. from the verticle. The six cylinders of the engine of the Irene are all vertical.

Mikado Locomotive for the Kentucky & Tennessee Railway.

The Baldwin Locomotive Works have recently completed for the Kentucky & Tennessee Railway a Mikado type locomotive, which possesses a number of interesting features. This engine is intended for comparatively short hauls on a line having grades of 4 per cent., which occur in combination with curves of 20 deg. and not compensated. In order to enable the locomotive to easily enter sharp curves when running in either direction the 2-8-2-wheel arrangement is employed. The piston stroke is comparatively short, and by using driving-wheels of small diameter a tractive force of 40,900 lbs. is developed, while the rigid wheel base is only 11 ft. 6 in.

The leading truck is of the usual swing bolster design, with radius bar, and is equalized with the first and second pairs of driving wheels. The two remaining pairs are equalized with the rear truck, which is of the Rushton type, with inside journals. A half elliptic spring, having arms of unequal lengths, is used in the equalization system between the rear driving wheels and the back truck.

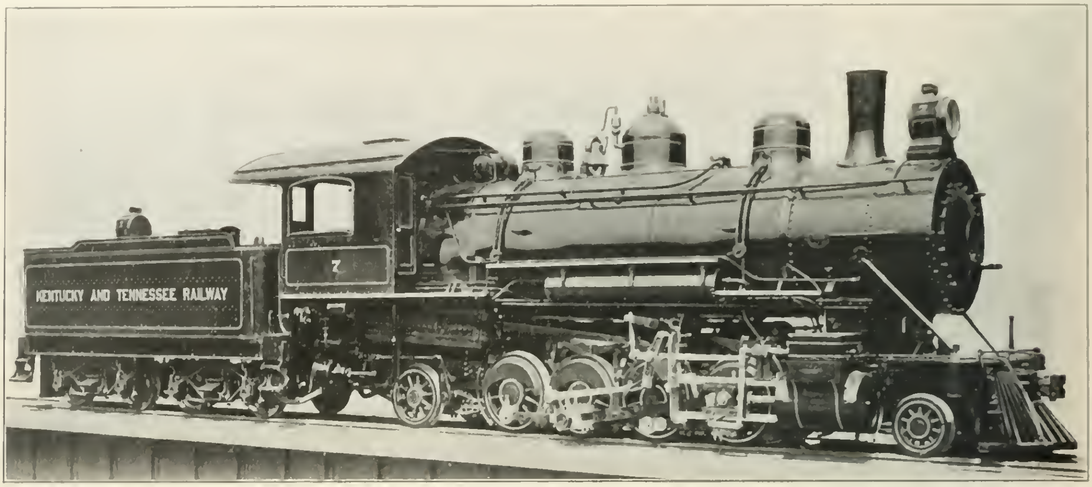
The main frames are of cast steel, with rear sections of the same material and double front rails of wrought iron. The splice between the main and rear sections is located back of the rear driving-wheels, at which point the frame is supported by the spring previously mentioned. The pedestal binders are lugged and bolted to the pedestals.

The cylinders are single expansion, equipped with balanced slide valves, which are actuated by the Walschaerts valve gear. The link is of the built up type, and is supported by a cast steel bearing which is bolted to the back of the guide yoke. The valve rod is supported by a bracket, which is bolted to the top guide bar. There is sufficient room in this design to place the combining lever in front of the crosshead, and thus use a short valve rod, which is substantially supported, adding to the rigidity of the motion. The reverse shaft is placed in bearings, which are bolted to the guide yoke. The radius rod is extended back of the link, and is suspended at the rear end. The valves have an outside lap of 1 in. and are line and line on the inside. They are set with a maximum travel of $5\frac{1}{2}$ in. and a constant lead of [illegible] in.

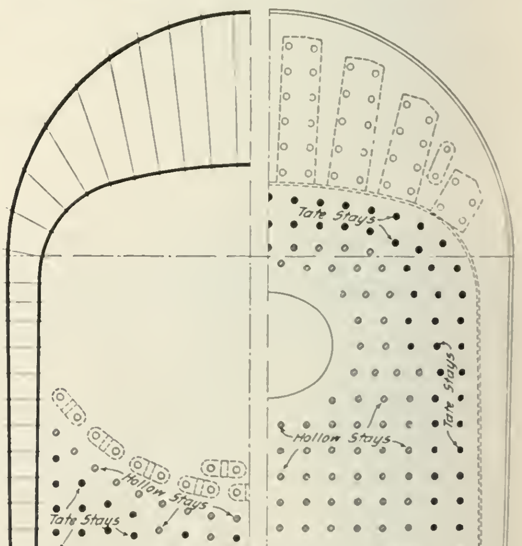
The guide yoke is made in three pieces, the lower extension, on each side, being securely bolted to the main section. This feature adds to the convenience in handling these parts. The guides are of the alligator form and the crossheads have cast steel bodies and bronze gibs.

The boiler is of the straight top, radial stay type, with wide firebox, having a vertical throat sheet and back head. The mud ring is supported on sliding shoes in front and a buckle plate at the rear. The front end of the crown is supported by one ⊥ bar, and 330 flexible staybolts are located in the breakage zone in the throat, sides and back, and here attention is again called to a point that has been repeatedly alluded to in these columns, namely—the variations in the use of the flexible staybolt and the tendency to increase the number used. In some engines built for the Wabash the flexible stays came down at the front and back, across the top and filled the triangular space in the throat sheet below the shell down to a horizontal line drawn through the bottom of the same. In this boiler the same area is covered with the addition of a cluster in the lower corners of the side sheets close to the foundation ring and the almost complete filling of the throat and tube sheet with them. In fact, they are used over the whole of these surfaces except in the top row next the shell and at four other points on each side where hollow bolts are used. In the side sheets, owing to the long radius of curvature at the sides of the crown, the top row of the flexible bolts are rather lower than usual, and are but just above the top of the door. The marked feature of the use of the flexible bolts in this instance is to be found in the fact that they are carried all of the way down to the foundation ring at the four corners and across the front. It is usually considered that the foundation ring holds the two sheets so firmly together that the possible variation of expansion in its immediate neighborhood is so slight that flexible bolts would be of no practical advantage. Their use, therefore, in this place indicates a growing conviction of the necessity for a greater flexibility between the sheets than was formerly regarded as essential.

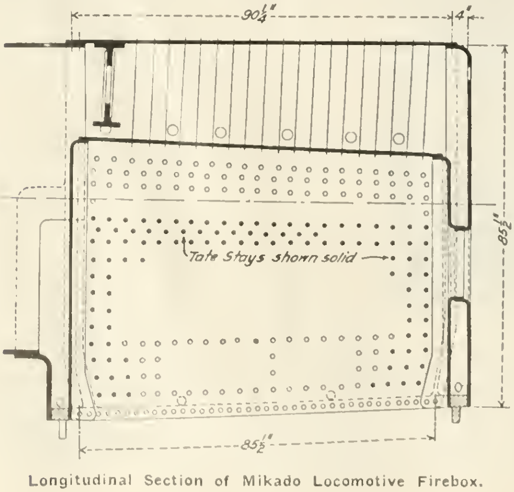
The boiler barrel is built with three rings, the dome being centrally located. The longitudinal seams are welded at the ends, except on the dome ring, where the seam is placed on the top center line and is welded throughout its length on either side of the dome opening. The seam is reinforced by a heavy inside liner.



Mikado Locomotive; Kentucky & Tennessee.



Cross Section and Rear Elevation of Mikado Locomotive Firebox.



Longitudinal Section of Mikado Locomotive Firebox.

The tender is carried on arch bar trucks, which are equipped with cast steel bolsters and chilled cast iron wheels. The tender frame is built of steel channels. A pilot is provided at the rear end.

This locomotive, although not intended for long hauls in main line service, is an interesting example of a design built to operate under difficult conditions. The 2-8-2-wheel arrangement is particularly suitable for roads having light rails and many curves, while it allows the use of a larger boiler than could be applied to a consolidation locomotive with the same weight on driving-wheels.

The following are some of the principal dimensions of this engine:

Cylinder, diameter	21 in.
Piston stroke	24 "

Boiler, diameter shell	72 in.
Boiler, thickness of sheets	¾ in.
Steam pressure	200 lbs.
Firebox, length	90 in.
" width	66 "
" depth, front	66½ "
" depth back	59 "
" thickness, side, crown and back sheets	⅜-in
" thickness tube sheets	½ in.
" water space front	4 in.
" water space sides and back	3½ "
Tubes, material	Iron
" thickness	No. 11
" number	315
" diameter	2 in.
" length	15 ft. 5 "
Heating surface, tubes	2,529 sq. ft.
" " firebox	148 "
" " total	2,677 "
Grate area	41.2 "
Wheels, diameter, driving	44 in.
" " front truck	28 "
" " rear truck	36 "
" " tender	33 "
Journals, driving axle	8½ x 10 in.
" truck	5½ x 10 "
" tender	5 x 9 "
Wheel base, driving	11 ft. 6 in.
" " total engine	25 " 5 "
" " engine and tender	51 " 10 "
Weight on driving wheels	140,050 lbs.
" " front truck wheels	16,350 "
" " back truck wheels	24,000 "
" total engine	180,400 "
" engine and tender	280,000 "
Tank capacity water	5,000 gals.
Tank capacity coal	6 tons
Tractive effort	40,900 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 3.42$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 4.41$$

$$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}} = 672.20$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 64.97$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = {}^*5.53$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 52.31$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 67.38$$

Volume of two cylinders, cu. ft. = 9.62

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 278.27$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 4.28$$

*Per cent.

Foreign Railroad Notes.

The Prussian State Railroads contracted for 3,000 twenty-ton (44,000 lbs.) coal cars last year and will order 4,500 more this year, of an improved pattern.

The production of petroleum in Rumania has increased greatly of late years and amounted to 7,910,000 barrels in 1907, while no longer ago than 1898 it was only 1,260,000 barrels.

The Chinese have built a railroad 37 miles long from the coast south of Canton to Hsin-ming, notable as being financed and constructed by the Chinese themselves. It is said to pass over a flat country, but to be pretty much made up of curves, introduced to dodge graves, etc.

In the Prussian House of Delegates a motion was adopted asking the government to pass voters free on the railroads from their places of residence to the places where their votes were to be cast, and return, and to put on special trains for this purpose when necessary.

At last the depression in business has reduced the earnings of the German railroads, whose receipts in March were 8½ per cent. less from passengers and 2½ per cent. less from freight this year than last. The decrease in passenger earnings is largely due to the fact that the Eastern holidays were in March last year and in April this.

Old and New Interlocking at Batavia.

Although railroad signaling is still looked upon as rather young, as regards American railroads, its youthfulness is not extreme after all. The accompanying illustrations, Fig. 1 and Fig. 2, show a Toucey & Buchanan eight-lever interlocking machine, which until a few months ago was in service on the New York Central at Batavia, N. Y. We do not know the exact date that this machine was built, but the first one of the kind was put up at Spuyten Duyvil in 1874 or 1875. Other designs came into use within a few years thereafter. The Batavia machine has now been superseded by a 50-lever all-electric interlocking machine, made by the Union Switch & Signal Company. The old machine after being taken out was set up in the store-room and photographed, as here shown.

The Toucey & Buchanan interlocking was described in the *Railroad Gazette* of October 16, 1875. The unlocking of the lever was done by pressure of the signalman's foot; the downward movement of the treadle tilted the "flop," thus locking or unlocking the proper dog or dogs. The connection between the treadle and the "flop" is shown at *a*, *a*, Fig. 2. The cranks connecting the levers with the locking bars are shown at *a*, *a*, Fig. 1.

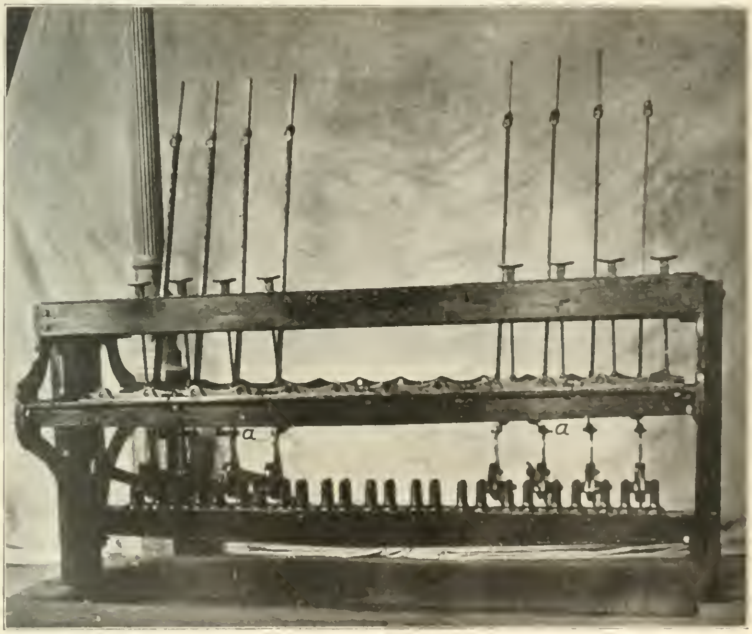


Fig. 1

Fig. 2

Toucey & Buchanan Interlocking Machine.

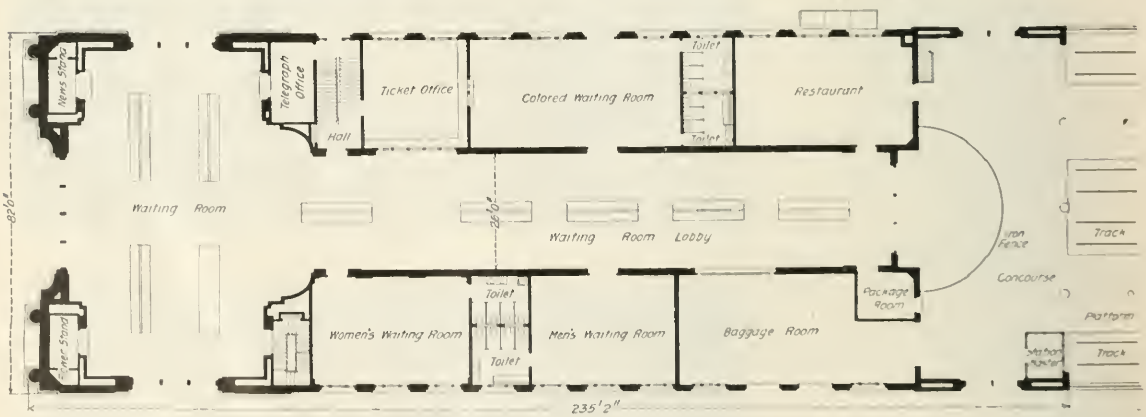
In service at Batavia, N. Y., about thirty years.

The New Union Station of the New Orleans Terminal Company.

Work on the new union station at New Orleans, La., of the New Orleans Terminal Company, which was begun about the first of June, 1907, is now about completed. The terminal is being built for the Frisco system and the Southern. Preliminary to its construction a large amount of property was acquired, as both the station and the track facilities in connection therewith are on ground not previously used for railroad purposes. As will be seen from the accompanying map of New Orleans showing all the railroads and their passenger terminals, the new station fronts on Canal street, the principal business street of the city, and is quite near the center of the business district. The site was previously five blocks of Basin avenue, a attic carrying an inscription. The main entrance archway is 30 ft. wide by 40 ft. high. It opens directly into the main waiting room, which is 80 ft. long, 40 ft. wide and 52 ft. high to the soffit of the central dome. There is also an archway 30 ft. high at each end of the waiting room, giving entrance from the two side streets. The main motive of the building is thus a large vestibule which can be entered freely from all sides. Each of the side entrances is protected by a marquise for the convenience of passengers using carriage or motor.

Extending centrally through the building from main waiting room to concourse is a lobby 26 ft. 4 in. wide. It is provided with benches like the main waiting room, which it is intended to supplement. Ranged along the two sides of this lobby are the principal

New Passenger Station at Canal and Basin Streets; New Orleans Terminal Company.



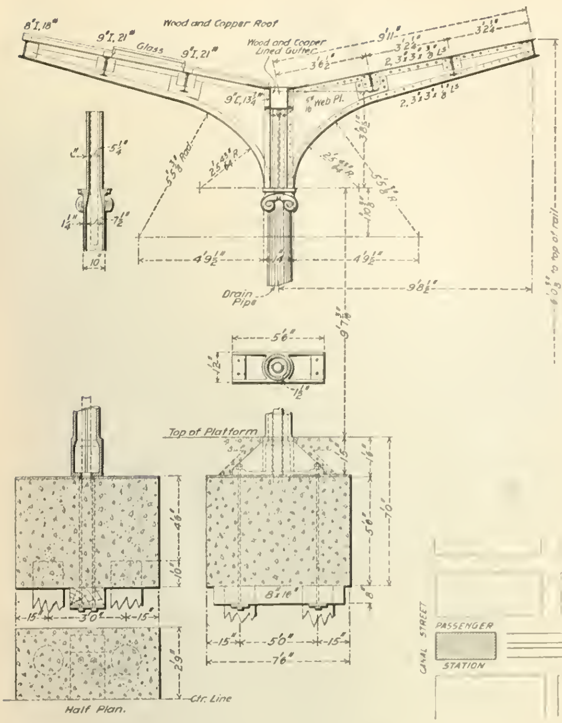
Plan of Passenger Waiting Room; New Orleans Terminal Company.

short avenue 172 ft. wide extending from Congo square to Tulane street. The new station occupies 82 ft. of this width, leaving a 45-ft. street on each side, called respectively East Basin and West Basin street. The portion of Basin avenue from Canal to Tulane street gives an open area fronting the station, providing an unusually favorable setting and a wide parked approach to the station two blocks long.

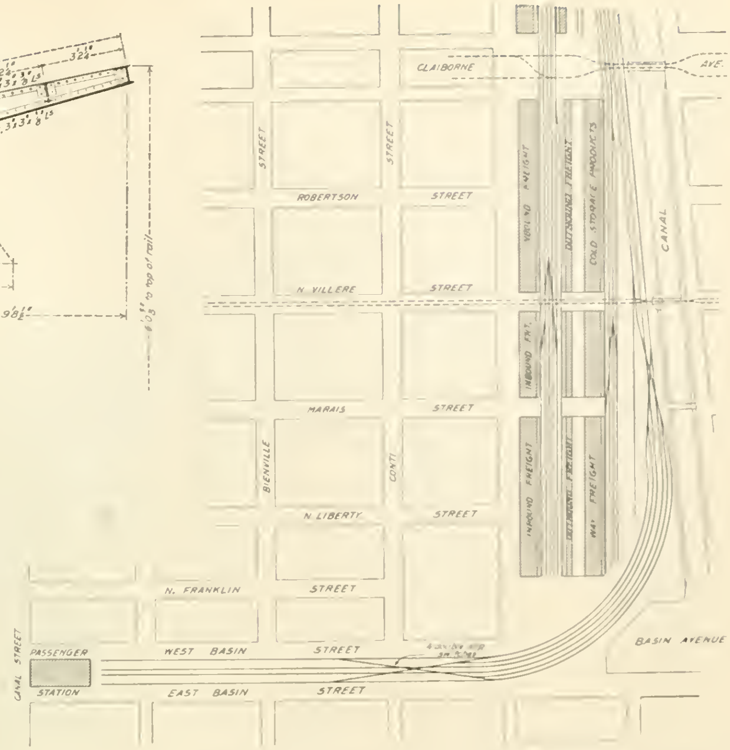
The station building is 82 ft. wide by 235 ft. long. The style of architecture is a sober treatment of the modern French. A primary aim of the design was to give an impression of openness, in keeping with the function of a station handling large crowds of people. The front of the building is therefore treated as a single large archway flanked by coupled columns and crowned by a high services, including ticket office, restaurant, baggage room, women's retiring room, men's smoking room and colored waiting room, the latter having a separate entrance from West Basin street. The telegraph office, news-stand and flower stand are in the main waiting room.

The concourse is 80 ft. long and 35 ft. wide. It has large doorways leading to the street at each end so that incoming passengers can make their way directly to the street without passing through the station and thus interfering with outgoing passengers.

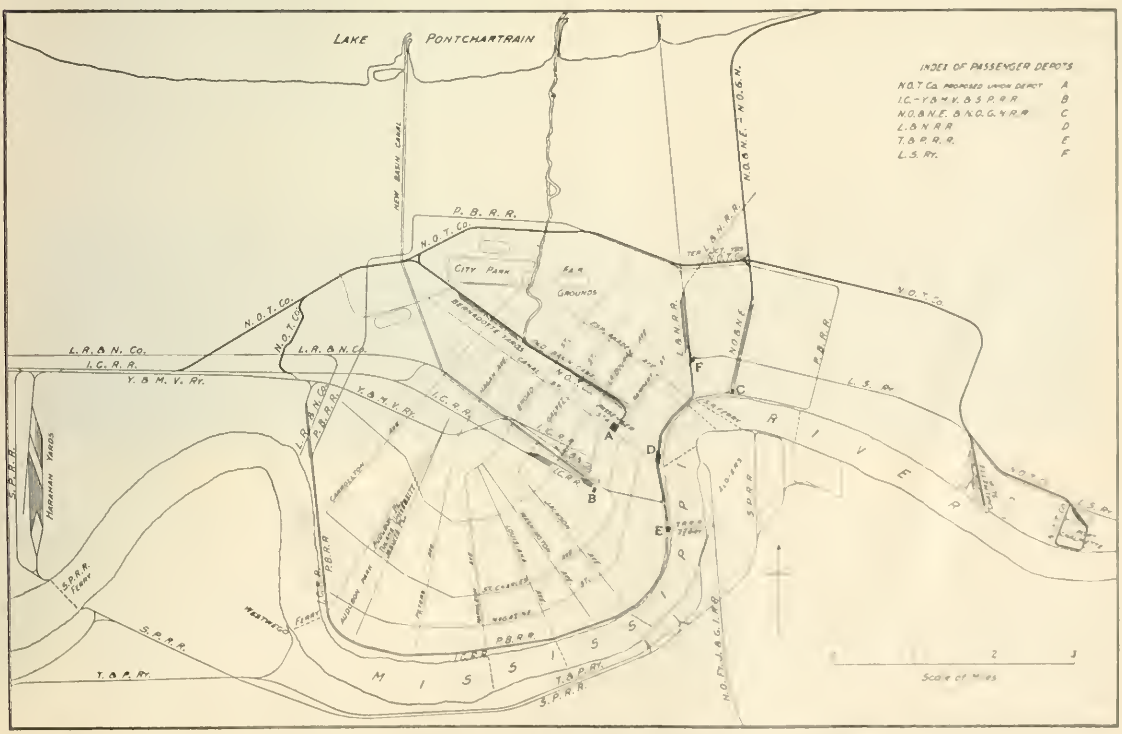
The building will have a concrete foundation resting on piling. A special feature in connection with the foundation is the difficulty of taking care of an old drainage canal 22 ft. wide running lengthwise under the center of the building.



Details of Inverted Umbrella Shed Over Platforms.

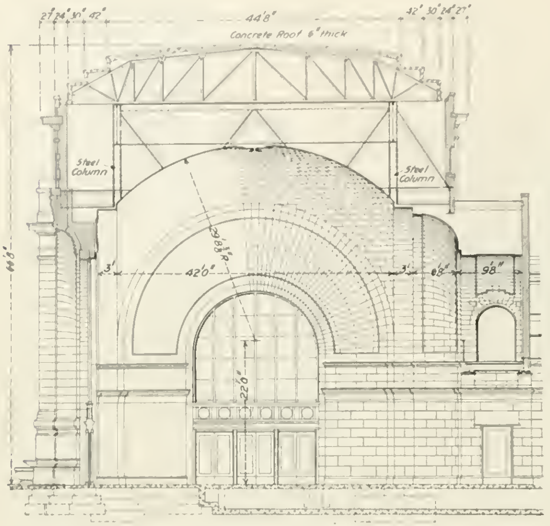


Plan of Freight and Passenger Terminals and Approaches; New Orleans Terminal Company.



Map of New Orleans Showing All Railroad Terminals and Connections.

The Canal street, or main waiting room section of the building, will have its exterior lower portion of granite and the upper part of Bedford stone. The remainder of the building exterior will be brick and stone, the brick being a special gray color to match the Bedford stone. The type of the interior of the main waiting room has already been indicated. There is a large central dome from which a barrel vault extends to each of the four sides of the room. The scheme of treatment is a masonry effect, consisting of marble



Cross-Section Through Dome of Waiting Room, Showing Steel Framing; New Orleans Terminal.

to a height of 12 ft. above the floor, the remainder being done in cement in imitation of light-colored stone to harmonize with the marble. The floor is mosaic tile. The central lobby will have the 12-ft. marble wainscot, with plaster walls and ceilings. The smaller rooms will have plaster walls and ceilings and mosaic tile floors. The portion of the building through which the lobby runs has a second floor for offices. These all have outside light and open on a corridor encircling an inside light court above the lobby. A small basement room will contain the heating plant.

The main waiting room has a steel frame to carry the dome and attic roof. This presented something of a special problem in adapting it to the floor plan and to the form of superstructure. The frame is supported at four points only, these four steel columns being symmetrically placed at the four points indicated on the first-floor plan—the inner corners of the four small rooms in the corners of the waiting room. These points of support are well within the lines of the attic walls and the latter are carried by cantilever members and suitable girders, as shown in the sectional view of the main waiting room. Above the girders, and resting on them, are the steel roof trusses, of which there are six—three in each direction. These carry a concrete roof 6 in. thick, including a skim coat of 1 in., the concrete spans being arched between I-beam purlins, as shown.

There are four tracks, separated from the streets by ornamental iron fencing and protected by umbrella sheds 704 ft. long. These latter are the "butterfly" type, with roofs sloping upward from a central gutter, and quite similar in general design to those used at the new Washington terminal. A detail of the shed design is included in the illustrations. The cast-iron supporting columns are anchored to concrete blocks 7 ft. 6 in. x 5 ft. 6 in. in plan and 5 ft. 6 in. high, each resting on four piles. A track plan is also reproduced, showing the six curved approach tracks from the west, and the proposed freight terminal layout.

The cost of the station building and train sheds, exclusive of all track work and interlocking, will be $250,000. The plans were prepared, and the construction work done, under the direction of J. F. Hinckley, Chief Engineer of the Frisco system. The architects were D. H. Burnham & Co., Chicago, and Jas. Stewart & Co., St. Louis, Mo., are the contractors. F. L. Jonah is Terminal Engineer, in immediate charge of the work.

Reinforced Concrete Bridge Over the Sangamon River.

The Wabash line formerly crossed the Sangamon river valley, 3½ miles east of Decatur, Ill., on a single-track line with 1 per cent. grade and 4 deg. maximum curvature. Two years ago work was started revising the alinement and double-tracking the section from Decatur to Sangamon, six miles. This was completed in December, 1907. The new alinement has only two 1-deg. curves and the maximum gradient is 0.3 per cent. so that heavy construction was necessary.

The track was carried over the valley formerly by a steel bridge approached by sharp curves and heavy grades. This has been replaced by a double-track reinforced concrete bridge, drawings of which were published in the *Railroad Gazette* of December 21, 1906. The new line crosses the river at such an angle that the bridge is built on a skew of 45 deg. There are four spans, each 100 ft. center to center of piers. The clear opening, parallel to the tracks, at the springing line of the arch is 85 ft. 10 in., and at the bottom of the pier, 82 ft. 5¼ in.

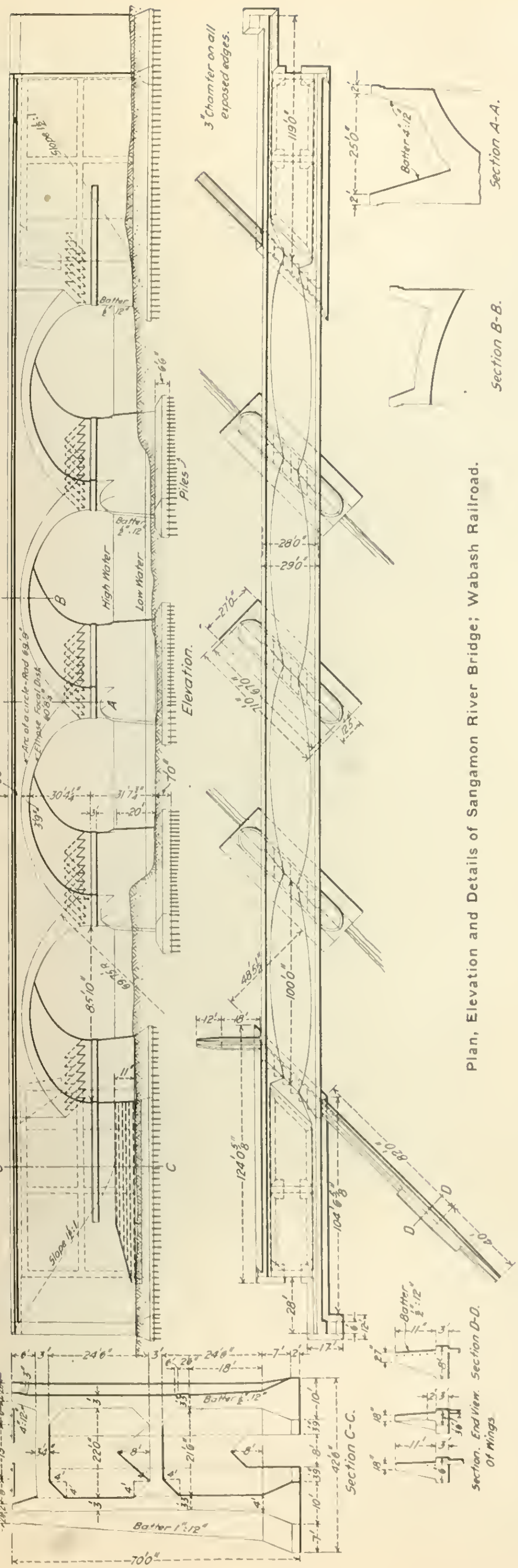
The extrados of the arch is an arc of a circle, and the intrados is an ellipse. This ellipse is, in reality, the projection of a circle on a plane set at an angle of 45 deg. to the plane of the circle. Thus the form required for molding the concrete arch is cylindrical, its axis being at an angle of 45 deg. to the track and its radius being 30 ft. 4¼ in. at right angles to the line of the piers. This makes the false work construction quite simple.

The piers and abutments were so built with concrete skew-backs as to give square bearings for the arch ribs instead of skew bearings. This is shown in the accompanying drawings and is noticeable in the photograph, as it resulted in a saw-tooth effect at the springing line of the arch.

The foundation of the bridge rests on gravel, overlying a layer of very stiff clay. Piles were driven through the gravel into the clay and on them, for the pier foundations, were laid reinforced concrete slabs of such sizes as to distribute the load over a large area and also tend to prevent scouring. For each pier, 259 piles, spaced 3 ft. on centers, are used. Each abutment rests on 395 piles, also spaced 3 ft. apart. Because of the height of the bridge the cost of ordinary abutments would have been excessive. The drawings show the abutments used. They are hollow, four chambers on two levels being formed; the rear lower chamber is filled with earth. The wing retaining walls are 10 ft. high (the height of maximum flood) and the fill rests against them. These prevent scouring of the toe of the high banks.

In erecting the bridge, concrete was built to the top of the skew-backs and allowed to harden. Then each arch ring was laid in one block by working night and day without stopping. The arch rings are heavily reinforced with 1-in. corrugated bars near the inner and outer faces. Throughout the structure, 1-in. rods furnished by the Expanded Metal & Corrugated Bar Company, St. Louis, were used. The abutment walls are reinforced with vertical ribs of three bars each, the ribs being spaced 2 ft. on centers; and with hori-

Reinforced Concrete Bridge over the Sangamon River; Wabash Railroad.



Plan, Elevation and Details of Sangamon River Bridge; Wabash Railroad.

zontal four-bar ribs, 3 ft. centers. The arches are reinforced on both extrados and intrados with longitudinal five-bar ribs, 1 ft. on centers, and with two-bar ribs, from 2 ft. to 3 ft. on centers, parallel to the center line of piers. The reinforcement of the spandrel walls consists of horizontal two-bar ribs only, spaced 2 ft. on centers. Where the bars were spaced close together the concrete mixture was one part cement, 2½ sand and five gravel. The plain concrete and the concrete in which the bars were spaced 12 in. or more apart was a 1·3·6 mixture. There are vertical joints in the spandrel walls over the centers of the piers and at the skew-backs, to allow for deflection of the arch rings.

The bridge is designed to carry a dead load consisting of concrete at 150 lbs. per cubic foot and earth fill at 100 lbs. per cubic foot. The live load capacity is 9,000 lbs. per lineal foot of track for each track. The permissive unit stress was 600 lbs. to the square inch in the concrete and 12,000 lbs. for the rods. The permissive load on the piles was 25 tons per pile.

The building of the bridge required 8,320 cu. yds. of earth excavation and 36,775 lineal feet of piling. A total of 16,170 cu. yds. of concrete was used, as follows:

	Cu. yds.
Foundation slabs for piers	1,300
Piers proper, with skew backs	2,270
Arch rings	2,370
Spandrel walls of arches	2,180
Foundations for abutments	1,580
Abutments above foundations, including slabs and intermediate walls, together with spandrel walls	5,930
Retaining walls	540

There were 215 tons of bars used and the cost of the whole bridge was slightly less than $124,000.

It was designed by A. O. Cunningham, Chief Engineer of the Wabash. The cement was made by the Wabash Portland Cement Company, Stroh, Ind., and the contractor for the work was the William P. Carmichael Company, Williamsport, Ind.; this company also designed the false work and forms.

The Capacity of the Interborough Subway.

On May 22 Bion J. Arnold presented to the New York City Public Service Commission the fourth of his reports dealing with the Interborough Rapid Transit subway. The last one of these reports, dealing with the signal system of the subway, was reviewed in the *Railroad Gazette* March 20; the general report on the operation of the subway was printed in the *Railroad Gazette* March 6, and the report on the cars was printed February 28.

In the report on the capacity of the subway, Mr. Arnold first calls attention to the fact that the previous reports dealt with minor changes which could easily be put into effect, such as improvements in the matters of despatching trains, changes in the signal system and the installation of additional side doors in the cars, some of which changes have already been adopted; but the present report analyzes the fundamental design of the subway, points out how further increase in its capacity can be obtained and directs attention to certain fundamental defects or omissions in the present subway which the author believes should be avoided in future subways. Mr. Arnold says that the spirit which prompts him in preparing these reports is to heartily commend the engineers who built the subway for the many excellent ideas embodied in this work and for the character of its construction, rather than to criticise them adversely for the few things which now seem to him advisable and which they did not do. He says also that it should be remembered that the pioneers in any field, acting without precedent to guide them, must overcome obstacles which are often lost sight of in subsequent criticism, and that it is always easier for those who follow these pioneers to point out what should have been done than it was to foresee them and to do them in advance. Mr. Arnold says that New York City has in its present subway the finest and most efficient example of underground railroad construction in the world; but this fact does not preclude the advisability of adoption of improvements if it can be shown that such improvements can be made, not only in the present subway, but in future subways.

An abstract of the report follows:

In considering an enterprise of this character it should be borne in mind that it should be the aim to establish and maintain a proper relationship between the fundamental elements entering into it, viz., safety, comfort, capacity, speed and a fair return on the investment.

In all of these elements, I find the present subway lacking. The absolute safety has been sacrificed to secure extra capacity, whereas even greater capacity than is now secured can be obtained by safe methods. The capacity of the subway decreases as the load, after it has reached a certain point, increases, which is exactly contrary to what should be expected. The speed of the trains is not maintained during rush hour periods just at a time when an advantage of speed would be of benefit not only to the greatest number of subway patrons, but also to the operators of the subway.

The comfort of the patrons is seriously interfered with by the arrangement of entrances and exits, both in the cars and in the stations themselves. With the present type of subway car, the conflicting lines of passenger movement in and out of the cars actually subjects passengers at times to danger of personal injury during certain hours of the day. Finally, the returns on the investment are not sufficient to pay the necessary operating and maintenance expenses, interest at a reasonable rate on the investment, the sinking fund as required by the city, and at the same time allow a sufficient fund to be set aside to take care of depreciation.

A study of the present subway will reveal the fact that one of its fundamental defects, as far as its capacity is concerned, is that it fails to carry sufficient passengers upon a fixed five-cent fare to justify the large investment which was finally found necessary to produce this splendid means of transportation. The total investment required to build and equip the subway as it exists to-day amounts to approximately $75,000,000, of which $50,000,000 may be charged to the cost of the permanent way and $25,000,000 to the cost of equipment. Should it be contended that these figures include an excessive construction profit, it is but fair to state that it is quite probable, in fact almost certain, that were the subway to be constructed now, the open cut method of construction would not be allowed and thus the actual cost of reproducing the present subway would be increased by a greater amount than is represented by any amount which may be included in the above figures as a construction profit.

In 1907 the subway carried 182,000,000 passengers and during the present year it may possibly carry 200,000,000 passengers, resulting in an annual income of $10,000,000. Thus the gross income per annum from passenger traffic will be equal to only about 13 per cent. on the actual investment, as compared with surface and elevated railway systems, many of which take in an amount equivalent to 20 per cent. to 25 per cent. of the costs necessary to reproduce them.

For the last two years the operating expenses of the subway have amounted to an average of approximately 45 per cent. of the gross receipts. On this basis the annual operating expenses, with a gross income of $10,000,000, will amount to $4,500,000, leaving $5,500,000 to be applied toward the payment of interest, depreciation taxes, sinking fund and profit. This amount is only 7.33 per cent. upon the above investment of $75,000,000, and it is thus apparent that the present subway, which is now overloaded, is not built in such a way as to furnish sufficient capacity, with the conditions under which it has to operate, to produce financial results consistent with the investment.

Another serious defect of the present subway, under present operating conditions, is that it is capable of serving only about 50,000 passengers in one direction during each hour of the rush periods, and has no overload capacity. One high building in the business district will accommodate fully 10,000 people and high buildings are being erected much faster than subways can be financed and built. As the configuration of the island of Manhattan provides room for only a limited number of north and south subways, it is apparent that each route occupied should be utilized to its greatest practical capacity.

TRAIN CAPACITY.

The time schedule now in use calls for 30 trains per hour both on the express tracks and on the local tracks south of 96th street during rush hours. This schedule corresponds to a time interval between trains or headway of 2 minutes. In actual practice, on busy days, the headway at Grand Central station often reaches an average of 2 minutes and 10 seconds, which corresponds to a rate of 27.7 trains per hour.

It has been shown in my report upon the subway signal system that, with the present subway, it will eventually be possible to maintain a headway of 90 seconds, which will allow 40 trains to pass a given point in one hour, and that for future subways with suitably designed stations, it is not unreasonable to expect a capacity of 60 trains per hour over each track.

Upon the local tracks, which are not at present fully equipped with a block signal system, it is possible at the present time to operate on a headway of 72 seconds, thus providing for 50 trains per hour, but on account of the traffic being lighter on the local tracks and the difficulty of operating two schedules with different time intervals, for the local trains than for the express trains, and at the same time fitting in the trains in their proper order at 96th street, it has been and in my judgment will be found better practice to maintain the same headway upon both the local and the express tracks.

CAR CAPACITY.

Eight cars now constitute an express train and five cars a local train during the rush hours. The present maximum schedule of 30 trains per hour will thus provide 30 x 8 or 240 cars per hour on express tracks, and 30 x 5 or 150 cars per hour on the local service; a total of 390 cars per hour, and this may be taken as the limit of the car capacity of the subway under present operating conditions. On account of the delays due to heavy travel during the rush hours, this rate of car movement is not maintained throughout the entire rush-hour period.

The maximum capacity of the present subway under the best conditions practicable, without rebuilding all the express stations, will be shown to be 40 express trains per hour, of 10 cars each (400 cars) and 40 local trains per hour, of 7 cars each (280 cars), or a total of 680 cars per hour, as compared with the present schedule of 390 cars; in other words, it is possible to increase the capacity of the present subway up to a total car capacity per hour 75 per cent greater than is attained at present.

SEATING CAPACITY.

Of the present cars, 800 are provided with 52 seats each, and the last 50 cars ordered, and recently put in service, are provided with 48 seats each. On a basis of a 2-minute headway upon both the local and the express tracks, the number of seats passing a given station can be taken at 370 cars with 52 seats each and 20 cars with 48 seats each, or 20,200 seats per hour.

It is possible to redesign the seating arrangement in the cars and to provide at least twice this seating capacity without adding to the number of cars operated, but for every additional seated passenger at least two standing passengers must be displaced. The present seating arrangements strike a fair balance between the two extremes of maximum seating capacity and maximum standing room.

PASSENGER CAPACITY.

During the rush hours the express trains carry an average of 125 passengers per car; that is, nearly twice as many passengers stand as are seated. Counts have been made showing as many as 180 people crowded into one car. If the 2-minute schedule could be maintained on the express tracks, the maximum carrying capacity under present conditions might be said to be 30 trains x 8 cars x 125 passengers per car, or 30,000 passengers per hour on one express track, and 30 trains x 5 cars x 125 passengers per car, or 18,750 passengers per hour, on one local track; a total of 48,750 passengers in one direction in one hour for both classes of service.

If 10-car express trains can be operated on a 90-second headway, each car carrying 125 passengers, then each express track should carry 40 trains x 10 cars x 125 passengers, or 50,000 passengers per hour in one direction, and this is the limit to the carrying capacity of each express track in the present subway. At the same time, if local trains of 7 cars could be operated on a 90-second headway, each local track should carry 40 trains x 7 cars x 125 passengers, or 35,000 passengers per hour in one direction. This would make a total carrying capacity through any one station, in one direction, of 85,000 passengers per hour, as compared with 48,750 passengers at the present time. In both cases the average loading of the cars has been taken at 125 passengers instead of at 150, as is frequently found at present on express cars.

HEADWAY.

The capacity of the subway is primarily a question of headway. Headway may be defined as the time interval between trains, it being understood that the time is taken at the instant the corresponding parts of each train pass a given point, i.e., the time elapsing between the instant the head end of one train moves by a signal until the head end of the following train moves by the same signal, or the headway may be easily determined by noting the time elapsing between the starting of one train from a station platform until the following train similarly starts.

This headway is influenced by two factors, which are independent of each other. The headway must therefore be determined in two different ways, and the operating, or actual headway, is found by taking the longest headway shown by either of the results. The two elements which influence the operating headway are the running headway and the station headway.

The safe time between trains running between stations which may be termed "running headway" is maintained by the block signal system. Under this arrangement, the time spacing of trains due to the running headway equals the time required to run three times the length of one block, plus the time required for two signals to clear, plus the time required for the train to run its full length at the maximum speed which it can run at this particular part of the road, plus the time required for the motorman to act after the distant signal has cleared from caution.

The time required for the train to clear a station block, which may be termed "station headway," is determined at present by the total time required by a train to enter the station block; to come to a stop; to open the doors; to unload; to load; to close the doors; to start, and to clear the platform.

The two headways are thus determined by entirely separate sets of conditions. A train in making a trip is influenced, first, by the "running headway," and then by the "station headway." The train, therefore, is constantly meeting varying conditions which influence the length of time which should elapse before the next train can follow. The minimum actual, or operating headway, is determined by the maximum length of time required to overcome these conditions at any limiting point throughout the entire trip.

As at present operated, these limiting points in the subway are now at the stations, that is, the station headway governs. The minimum running headway is considerably less than the minimum station headway, so that trains can get up to certain express stations faster than they can get through these station blocks.

As already shown, the problem of increasing the capacity of the present subway resolves itself into a study of and the removal of the delay at the limiting points. The most serious delays at present occur at the following points:

a. At Grand Central station and other express stations.

b. Combined station and cross-overs at 96th street.

c. In addition to these critical points, there is a situation at South Ferry station which must be changed before the extension of the subway to Brooklyn can be used most effectively.

At the present time the delays at Grand Central station, which are typical of the delays at all other express stations, are due to a combination of causes, including confusion in the methods of handling the passengers, inflexibility in the signal system and defects in the car design. These disadvantages have been pointed out in detail in Reports Nos. 1, 2 and 3, in which it has been shown that the headway between trains, which now often reaches 2 minutes and 10 seconds (130 seconds), can be reduced to 90 seconds by means of the following improvements:

	Saving over present method.
1—Close the doors promptly and give signal for starting trains to motorman by an automatic train signal................	10 seconds
2—Install a speed control signal system as an auxiliary to present signal system so as to allow the following train to reach the station platform more promptly than at present.......	15 seconds
3—Provide extra doors in the sides of the cars and guiding railings on the station platforms so as to avoid the present conflict of unloading and loading passengers and enable both operations to be carried on at the same time............	15 seconds

These suggested improvements will make it possible to maintain at all times a train movement of 40 trains per hour upon the express tracks of the present subway, whereas as at present operated there are times during rush hours of every busy day when this rate falls to 27 trains per hour, due to the defects referred to above, all of which have been completely analyzed in the reports previously mentioned.

COMBINED STATION AND CROSS-OVERS AT 96TH STREET.

In addition to the regular combined local and express station platforms at 96th street, there are two cross-overs between the local and the express tracks just north of the station platform. These cross-overs are used by every Broadway express train and by every Lenox avenue local train, and therefore wherever one of the Broadway express trains and one of the Lenox avenue local trains going in the same direction approach the cross-over at approximately the same time, there must be a delay for one of the trains, which may amount to as much as 40 seconds, as one train must necessarily wait while the other uses the cross-over. During rush hours there is a Broadway express train scheduled to use the cross-over every 4 minutes in one direction and a Lenox avenue local scheduled to cross over to or from the local tracks in the same direction every 4 minutes, so that the opportunities for a conflict at these cross-overs are numerous. The delay in the train movement due to the cross-over acts exactly like the delay due to a prolonged station wait, and often has a cumulative effect upon the train schedule. The records show that the delays at 96th street are fully twice as serious as those at Grand Central station, due to the fact that at this station there are not only transfer platforms but also these cross-overs.

To remove the effect of the grade crossings, a rearrangement of tracks has been proposed by the engineers of the Public Service Commission. When the work, which has been authorized, or the suggested modification of it, is completed, the trains passing through 96th street can reach their respective tracks without making use of a grade crossing. When the same improvements in regulations, signal system and cars which have been suggested for improving conditions at Grand Central station and other express stations have also been put in effect at 96th street, and the tracks have been rearranged as described, then 96th street will cease to be a limiting point and the proposed 90-second headway can be maintained at this part of the system without difficulty.

THE SOUTH FERRY LOOP.

The two tracks which pass through the tunnels under the East river to form the Brooklyn extension to the subway, leave the express tracks at Bowling Green station. The two express tracks continue to South Ferry station, where they form a loop—both loop and station being directly over the point where the Brooklyn tracks pass into the tubes leading under the river. Since the subway has been opened to the Atlantic avenue station (May 1, 1908) the Lenox avenue express trains and the Dyckman street express trains run through the tunnel to Brooklyn, and the Broadway Kingsbridge express trains continue on around the loop at South Ferry. During rush hours, the Lenox express trains are scheduled for a headway of 3 minutes and the Dyckman express trains are scheduled for a headway of 8 minutes through the Brooklyn tubes, that is, for a short time each day the Brooklyn schedule calls for a headway of an average of 2 minutes and 10 seconds. The Kingsbridge express trains, which continue on around the South Ferry loop, run every 8 minutes during the busiest part of the rush periods. This service to Brooklyn will not be as satisfactory as the service on the rest of the line and as the facilities offered by the complete extension will attract a large patronage through the Brooklyn tubes, there will be a demand and need for running all the express trains directly through to Brooklyn. To meet this demand it will first be necessary to work out some plan for serving the South Ferry station, which accommodates a certain number of patrons using the ferries leaving Battery Park, for until some plan is devised and adopted for accommodating these patrons it will be impracticable to run all the express trains to Brooklyn.

There are three plans which should have consideration in connection with this problem—

1—A double-decked station at South Ferry. This plan would involve changing the present 3 per cent grades of the tracks between the bulkhead of the tubes and Bowling Green station in order to provide an approximately level stretch of track at the stopping point or one upon which the grade does not exceed 0.5 of 1 per cent. in order that trains may remain at rest in case of failure of the brakes.

2—A shuttle-train service between South Ferry and Bowling Green station.

3—A moving platform either in the present subway between South Ferry and Bowling Green station or in an areaway just outside of the subway.

In my opinion it is advisable to install the shuttle train service first in order to give immediate relief, as this can be done at moderate expense, but when considering the subject in connection with future subways leading to the Battery, the other plans should receive careful attention.

INFLUENCE ON HEADWAY OF MORE EFFICIENT BRAKING.

A series of tests were made upon the rate of braking and these tests were compared to the results upon the Boston elevated electric road and upon other roads provided with improved braking equipments. These tests indicate that so far as efficiency is concerned the braking equipment of the subway cars is capable of producing results as effective as any that have been secured up to date with brakes acting upon the wheels. The tests showed, however, that these results were not always actually secured on account of the carelessness or timidity of the motormen. The tendency seems to be for a motorman to begin to apply his brakes too quickly—thus prolonging by perhaps four or five seconds the time that should be devoted to bringing the train to rest at the platform. At least five seconds can be taken from the headway by instructing the motormen to bring their trains up to the express station platform at a speed of at least 30 miles per hour, which will require that the trains be brought to a stop in from 16 to 17 seconds instead of the 20 to 22 seconds usually required. The fact that some of the motormen do this now shows that it can be done. There is no improvement which will show such effective results in proportion to the time and expense involved as will additional attention paid to this detail of operation.

Should it be determined to use platform railings as shown in Report No. 3 upon the "Subway Car," the saving of time which can be accomplished by this improvement in braking will more than offset the few seconds which may be required to accurately stop the trains.

INFLUENCE ON HEADWAY OF IMPROVED ACCELERATION.

It is but natural to expect and in fact it is contended by some, that considerable improvement could be made in the time required for accelerating the trains and that a number of seconds could be saved by moving the trains out of the stations more promptly.

As a matter of fact the actual acceleration tests show that in starting the trains and in moving them a distance equal to the length of the platform, there is but about two seconds difference between the best acceleration and the slowest acceleration observed. This would indicate that there is little improvement to be expected from training the motormen to be more skilful in using their controllers.

The tests indicate that the acceleration varies between 1.1 miles per hour per second and 1.4 miles per hour per second, and between these two figures fall all of the observations which have been made with varying loads and with different motormen.

The theoretical values of acceleration, which calculations based upon the motor curves indicate should be expected, fall between the values of 1.15 miles per hour per second for trains loaded with 150 passengers per car to 1.55 miles per hour per second for all cars empty and these theoretical figures agree very closely with the results of actual observation.

All eight-car express trains are provided with five motor cars each equipped with two 200 h.p. motors, and all five-car express trains have three motor cars similarly equipped.

Examination of other systems shows the following values of acceleration as the results of an average of a large number of observations:

Company	Description of train.	Per hour. per second
Metropolitan Elevated, Chicago...3 car	train light, 2 motor cars..	1.41 miles.
South Side Elevated, Chicago.. .5-car	" " all motor cars.	1.35 "
South Side Elevated, Chicago.....5-car	" load'd,all motor cars	1.19 "
Metropolitan Elevated, Chicago...5-car	" " 3 motor cars..	1.06 "
Northwestern Elevated, Chicago...3-car	" " 1 motor car.	0.84 "

These tests and figures indicate that the motor equipment of the present subway is doing all that can be expected of it.

If all the cars of the subway trains were equipped with motors, the initial acceleration in starting could be increased from 1.15 miles per hour per second to 1.65 miles per hour per second, with trains loaded with 150 passengers per car. This improvement in acceleration would cut down the time required for the train to leave the station platform by about two seconds, and this saving of two seconds is practically the limit of improvement which can be expected upon the headway by equipping all the cars with motors. It is apparent at once, therefore, that as far as the effect upon the capacity of the subway is concerned, the expense of increasing the present motor equipment would not be justified. The effect upon the speed of the trains of changes in the motor equipment will be discussed in a separate report.

Furthermore, if the signal system is re-arranged as recommended in Report No. 2 upon the signal system, the proceed signal will be given to the following train very soon after the leaving train starts to leave the platform and therefore the time required by the leaving train in accelerating will have no influence upon the cycle which determines the station headway.

A study of the comparative effect of improving the braking and acceleration of the trains indicates that more advantages can be expected from increasing the braking efficiency than can be anticipated from increasing the acceleration of the trains.

MORE CARS PER TRAIN.

In order to obtain the maximum practicable capacity of the present subway it will eventually be found desirable to increase the express trains from eight to ten cars, and the local trains from five to seven cars.

The easiest way to accomplish this change is to arrange to handle two more cars on each train, operating these cars on the ends of the trains, and not attempting to load or unload them directly from or to any platform south of 96th street.

These cars would soon become known to the regular patrons as through cars, and the guard in charge could discourage passengers who intended to stop at intermediate points from going into these cars.

It would be necessary to make a small number of changes in the block signal system in order to allow one of these lengthened trains to push a similar but disabled train to a terminal yard, an operation which is sometimes required, that is the block signal system must be slightly re-arranged, so that a double train of a total of 20 cars on the express tracks could be operated in case of accident.

Plans have been prepared to lengthen the platforms at 16 local stations south of 96th street from the present length of 200 ft. to 350 ft. each, so as to accommodate eight-car local trains. The estimates which have been prepared covering the cost of these changes run from $1,900,000 to $2,250,000. It is my opinion that the expenditure of this amount of money will not be justified at the present time. On account of the extensive use of the transfer privilege, the local trains are nearly always emptied of a load equivalent to their standing load at the present time at every express station stop, and the standing passengers, therefore, have an opportunity to find seats. Judging from present tendencies, the two through cars on each local train would prove attractive to a number of passengers who now use the express trains, and who would probably be glad to secure a seat on a local train running but a few minutes slower than the express in exchange for uncomfortable and crowded standing room upon an express train.

The increased car service on the local trains, should, therefore, tend to decrease the crowded condition of the express service. It would appear, therefore, that, if the added cars on the local trains can be devoted to through business, which originates and ends at or near their terminal stations, it will *not* be necessary to invest approximately $2,000,000 to provide an extension of the local platforms, which are now arranged to accommodate only five cars.

A similar line of reasoning will indicate that 10-car train service can be instituted on the express tracks without making a corresponding increase in the length of the platforms. To lengthen these express stations sufficiently to accommodate 10-car trains would also mean the extending of all station platforms north of 96th street. This would mean a large investment in order to do this work without interfering with the operation of the trains. In my judgment it is entirely feasible to operate 10-car trains on the express tracks and seven-car trains on the local tracks. A decided effort should be made to do this first without extending the platforms. If the difficulties attending this through-car service cannot be overcome in actual operation, then the platforms should eventually be extended.

WIDER CARS.

After the maximum practicable length of train has been reached and such trains operated at the rate of 40 trains per hour with the present subway, and through the use of double decked or reservoir stations at the rate of 60 trains per hour for future subways—there are apparently but two ways left for increasing the possible capacity of a subway without adding tracks and that is to widen the cars or to double deck them.

With the present subway, on account of the changes in stations, tracks, terminals and in the cars themselves the adoption of a higher or a wider car would be impracticable. For future subways the use of a wider car should be seriously considered but in my opinion greater advantages can be obtained by double decking the subways than by double decking the cars themselves.

In Report No. 3, "The Subway Car," I have discussed the proper design for a car at least 18 in. wider than the present car to be used in future subways, and as this wider car will add at least 25 per cent. to the possible carrying capacity without adding materially to the amount of the investment, it should be used unless reasons other than engineering and operating ones compel the adoption of cars having approximately the same width as those in the present subway.

MAXIMUM POSSIBLE CAPACITY OF SUBWAYS.

The minimum headway to be expected with the present subway upon tracks equipped with a block signal system is 90 seconds, corresponding to 40 trains per hour. It has been shown further that this limitation to the headway is due to the delay in the express station blocks. In future subways, this limitation to capacity should be eliminated by providing two station tracks at each express station to serve each main line track, so that one train at a station platform will not delay the following train, as is the case at present. In this way the tracks at the express stations would be arranged on the reservoir principle, so as to equalize and maintain at its maximum the rate of movement of the trains passing from one station to another. In other words, the stations which represent but a small portion of the cost of a subway system should be designed in such a manner that the great investment in the subway between the stations could be utilized to its fullest extent

If the tracks between stations can be worked up to a capacity of 60 trains per hour (60-second headway) then the train capacity of future subways will be 100 per cent. greater than the capacity obtained under existing operating conditions in the present subway. If 10-car trains can be run every minute, a car capacity of 600 cars per hour can be secured with each track of a future subway. If each car carries 150 persons, the possible carrying capacity of a single track will be 75,000 passengers per hour or 150,000 passengers for two tracks whereas the possible capacity of two tracks in the present subway, as now operated, is less than 50,000 passengers per hour.

To determine the possibility of running 10-car trains on a 60-second headway, it is necessary to analyze the elements entering into the determination of the "running" headway of a train.

RUNNING HEADWAY OF TRAINS.

It is safe to operate 10-car trains every minute, even with the present type of signal system and brake equipment This rate of train movement will be possible, however, only with railways where the stations are provided with two station tracks for each main line track, as the trains cannot operate on a 60-second headway if they are delayed in getting up to and through each station.

To increase the train capacity of the subway, improvements may be expected along the following lines:

(1) The present braking data upon which the signal system have been designed indicate a rate of deceleration or rate of braking of slightly less than two miles per hour per second. It is not improbable that tests made under subway conditions would show that an emergency stop at a rate somewhat in excess of this can be safely relied upon, provided the latest type of brake is used. A decrease in the length of the blocks of from 10 per cent. to 20 per cent. might be possible as a result of this revised information, and it is, therefore, important that a series of reliable tests showing the actual distance required to stop a loaded subway train by means of the automatic emergency trips be made before the block distances of future subways are decided upon.

(2) The signal system should allow the trains to run closer together than the minimum distance of three times the length of a block section, as is the case with the present subway. This can be done most effectively by arranging a series of caution signal lights, which will follow the movement of the preceding train more closely than the present caution signals which are now a full block distance apart. A traveling caution signal, if perfected, would allow the following train to encroach upon the overlap section of the block and approach nearer the danger signal, and thus safely reduce the minimum time interval between trains.

(3) Recent improvements in the signals themselves have been made by which the movable colored discs have been replaced by two sets of electric lights whereby the signal indications become practically instantaneous. In the figures from which the curves in the appendix have been prepared, a period of 2½ seconds was included to allow for these signal movements and the headways shown can therefore be reduced by this 2½ seconds in considering the absolute minimum headway possible for future subways.

These various improvements should make it possible to eventually maintain a 45-second "running" headway corresponding to a car capacity of 800 cars per hour with 10-car trains—but as it is impracticable to expect any system to be kept in operation for any great length of time up to its full ultimate capacity, I have based my calculations for the capacity of future subways upon a practicable maximum capacity of 600 cars per hour for each express track, which would only require trains to run on a 60-second headway.

If it were practicable to rebuild and double deck all of the express stations of the present subway, there is no good reason why the above capacity of 60 trains per hour could not be secured, but the difficulties which would be encountered in changing the stations while keeping the road in operation combined with the expense of undermining the foundations of certain high buildings under which the subway runs, make this improvement now practically prohibitive, although the expense of this change may some time prove advisable in order to get capacity.

The maximum train capacity, therefore, of any properly signaled track of the present subway is 40 trains per hour as previously shown.

CARRYING CAPACITY OF A MOVING PLATFORM.

It is possible to install and operate a moving platform for the transportation of passengers under sub-surface conditions, and this method of solving the transit problem has been often advocated, but has never been put into practical every day operation for city transit. Such a platform would have a number of loading and unloading platforms moving at different speeds, usually varying in steps of three miles per hour. The platform carrying the seats can thus be made to move at either nine or twelve miles per hour, the latter speed being in excess of the average speed of a surface car.

A moving platform can be arranged to seat one passenger per lineal foot or 5,280 passengers for each mile of platform. If this platform moves at the rate of 12 miles per hour its carrying capacity will therefore be 62,500 passengers per hour and each of the patrons will have a seat. This capacity is more than twice the possible seating capacity of 10-car trains running on 60-second headway with 50 seats per car—but the platform only moves at the rate of 12 miles per hour, whereas the train can move its patrons at an average schedule speed of 25 miles per hour. In other words, the train method of operation has the advantage of having double the speed of the platform method and the platform method on the other hand has the advantage of having twice the seating capacity of the train method. The question is, do patrons of an underground system of transportation prefer speed or comfort; that is, would they prefer to patronize trains traveling at 25 miles per hour, but with only half enough seats to accommodate them in preference to a moving platform traveling at the rate of 12 miles per hour, but provided with seats for all?

It is probable that for short distance when speed is not an important element the moving platform with its "seat for every passenger" would be preferred, but that for comparatively long distance speed, even at a sacrifice of some capacity, is the result desired and there is therefore in my opinion no question as to the advantage of the train method of operation, for long haul subway conditions

DESIGN OF STATION FOR FUTURE SUBWAYS TO SECURE MAXIMUM CAPACITY.

It has been shown that, with the present type of subway stations where the trains stop on the main line, the train capacity is limited to a 10-car train every 90 seconds or to 40 trains per hour, whereas if each station is provided with two station tracks for each main line track the trains could be handled at the rate of one every 60 seconds or 60 trains per hour. Therefore, the capacity of future subways can be materially increased by double tracking the stations, and this should be done at least on the express tracks at all express stations. Whether or not the local tracks should be double tracked depends entirely upon the use to which the local tracks are to be put. If, as in the present subway, these local tracks are to be used more as a collecting and distributing system for the express service than as a separate system of transportation, then there will be but little need of increasing the possible capacity of the local tracks above the capacity which will be provided by a single local track at each station. If, however, an effort is to be made, as it should be, to cultivate the short haul business by means of the local systems and at the same time encourage the use of the local trains for a certain amount of through travel, then arrangements should be made for double tracking the local as well as the express tracks at all transfer stations.

This arrangement of double tracks for the local service at the express stations would not necessarily mean double tracks for the local trains at intermediate local stations as the stops at these stations would not require over 15 seconds and this station wait would not materially affect the headway. At transfer stations, however, the local trains are liable to be held at the platforms as long as the express trains are held and therefore if there is a demand for frequent train service over the local tracks, these tracks should be provided with double tracks at the transfer stations, thus making each transfer station a double decked station with four tracks on each deck.

The question as to the best arrangement of the tracks in a station provided with double tracks for each main line track is an important one.

In the first place such a station must, as a rule, be "double decked"; that is, the express track platforms will be on a separate level (preferably a lower one) from the local track platforms.

In the next place, a decision must be reached as to whether or not separate platforms are to be provided for loading and for unloading the passengers. The policy of the extent of the transfer privilege from local to express service, and *vice versa*, must also be decided and, lastly, the question of how intimate a connection should be arranged between two intersecting subways must be settled.

CONCLUSIONS.

The facts brought out in this report upon the capacity of the subway may be briefly recapitulated as follows

(1) The present subway, although carrying more passengers than it was originally designed to handle, lacks sufficient passenger carrying capacity under the conditions that it is now operating to pay a fair return on the investment and at the same time allow for a suitable depreciation reserve.

(2) The present subway is also defective in not having sufficient passenger carrying capacity to take care of the demands of transportation along its route during the two rush-hour periods of the day; that is, the subway is lacking in what might be termed overload capacity.

(3) The headway and therefore the capacity of the present subway is governed by the station headway; that is, the number of trains is limited by the number that can be passed through the limiting station. The capacity of future subways should be limited only by the number that can safely be passed over the tracks between stations.

(4) The present rate of train movement of 30 trains per hour in one direction upon each track can be increased to 40 trains per hour by

a—Installing automatic closing door signals upon the cars;

b—Providing speed control signals auxiliary to the present block signal system at the approaches to the stations;

c—Altering the cars to provide more doors in the sides of each car.

(5) To most effectively secure the benefit of these changes the cross-overs in the tracks north of 96th street station should be removed in accordance with the plans, which have already been approved by the Public Service Commission.

(6) The 96th street changes can be made still more effective by adding to these plans, the feature of double decking, thus providing two additional express tracks in the station.

(7) To secure the same capacity for the Brooklyn extension that will eventually be obtained for the Manhattan subway, a plan for handling the South Ferry passengers should be worked out so that all express trains can be run through the Brooklyn tubes, thus increasing their present capacity at least 33 per cent.

(8) The train capacity of the subway cannot be increased by increasing the speed of the trains as the increased length of the signal blocks necessary for the higher speeds more than offsets the advantage of the increased speed.

(9) The capacity of the subway can be increased by greater care in using the brakes at the stations. Very little effect upon the capacity can be expected by improving the acceleration of trains.

(10) Considerable improvement in the capacity can be secured by running longer trains and a movement in this direction should be started as it will eventually be found desirable to run seven-car local trains and 10-car express trains, both at the rate of 40 trains per hour. When this is done the capacity of the present subway will be increased 75 per cent. which is the maximum increase in capacity of the present subway that can be expected without double decking the stations which for reasons previously given seems to be prohibitive.

(11) While double deck cars in subways are impracticable, the possibility of using wider cars should be thoroughly considered in making plans for future subways, as there is apparently no difficulty in the way of using wider cars for such subways except the question of transferring the equipment between the present subway and future ones.

(12) To secure the maximum possible capacity of future subways, tests should be made to determine more accurately than has been done, the braking distance required to bring a subway train to rest from full speed when the emergency stop is used

(13) An improvement in the block signal system which will have a material influence upon increasing the capacity of future subways can be secured by developing a traveling caution signal to act in conjunction with the present fixed one.

(14) Moving platforms have practically double the seating capacity of 10-car trains running upon 60-second headway, but on the other hand these moving platforms have a speed of only one-half the schedule speed of the train, and therefore the train method of operation is to be preferred for long distances.

(15) In order to secure maximum capacity for future subways these subways should be designed with double decked stations provided with double tracks for each main line and the cross section of the subway between stations should also where practicable be

double decked; this plan will allow the operation of 10-car trains on a 60-second headway on each track thus providing a carrying capacity of three times that of the present subway.

RECOMMENDATIONS.

The improvements suggested in this report may be summarized as follows:

(1) The changes required in the present subway to increase its capacity from 30 trains an hour to 40 trains an hour, with a marked increase in its earning capacity, should be carried out; that is, the block signal system should be improved, a speed control system developed, and the cars altered.

(2) The 96th street alterations should include not only the removal of the cross-overs as already approved by the commission, but also the altering of the station itself to provide a local track upon a lower level, allowing the four tracks upon the present level to be used by the express trains.

(3) A shuttle train service for the South Ferry station should be provided at once, and a comprehensive study should be made of a plan for a double-decked station at this point, which would not only give all South Ferry passengers a station on the main line, thus eliminating the shuttle train service, but also allow all trains to run through to Brooklyn.

(4) The braking of the trains at the station should be improved so as to save the 5 seconds which is now often lost by lack of skill in stopping the trains.

(5) One car should be added to the rear of each local train during rush hours, and the public should be encouraged to use this extra car upon the local trains, which, although not reaching the platforms, could be used for through travel, with the idea of adding even more cars to the trains if the public can be educated to take advantage of this increased accommodation.

(6) A series of braking tests showing the distance required to stop a train by means of the emergency stop from full speed should be made in order to secure reliable data for planning the block signal systems for future subways.

(7) The manufacturers of block signal systems should be encouraged to develop a traveling caution signal to supplement the present fixed caution signal, as this signal could be installed to advantage not only in the present subway but in future subways.

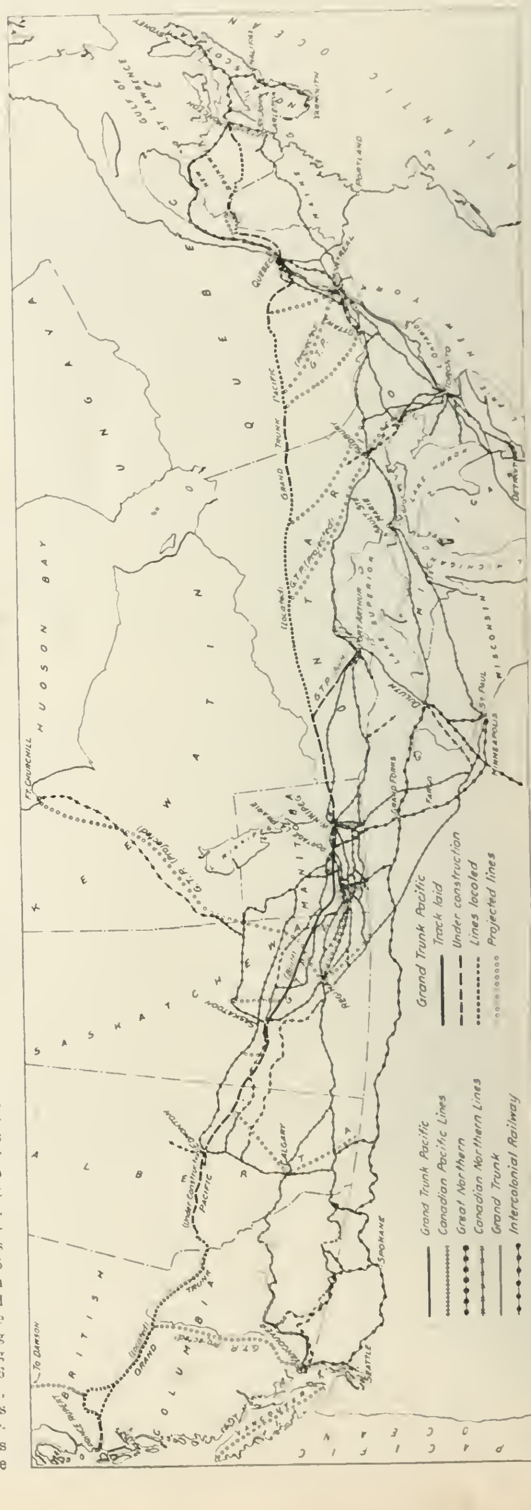
(8) If future subways are to be built and operated independently of the present one, the plans should be made with the idea of using multiple side door cars 18 in. wider than the present cars, thus adding at once 25 per cent. to the capacity of each car and increasing the possible carrying capacity of such subways without proportionately increasing their first cost.

(9) In order that future subways shall not only pay a fair return on their investment, but also allow for a satisfactory depreciation reserve, it is essential that such subways be located where there is sufficient density of traffic to justify their being built, and at the same time they should be so designed as to handle the volume of traffic which must be passed through them during rush hour periods in order to make them self-sustaining.

(10) All future trunk line subways should be designed with stations on the reservoir principle, that is, with double tracks in each station for each main line track. This can best be accomplished by not only double decking the stations, but also double decking the subways between stations, and by this method secure the carrying capacity necessary to justify the occupancy of the street, and at the same time produce a property which will justify its cost. Where a crosstown subway is to be provided for, the stations should be triple-decked.

The Grand Trunk Pacific.

The accompanying map shows the Grand Trunk Pacific lines completed, building and located, as well as the branch lines which are projected. The portion from Moncton, N. B., to Winnipeg, Man., 1,807 miles, is being built by the government under the name National Transcontinental. This is all located, except for a few miles near the Winnipeg terminals and possible revision at several other points. Contracts have been let for 656 miles from Moncton to Weymontachene, Que., and for separate sections between that point and Winnipeg aggregating 571 miles. The Lake Superior branch, running from Lake Superior Junction, Ont., southeast to Fort William, 210 miles, is being built by the Grand Trunk Pacific. On this branch grading except on eight miles has been finished and 125 miles of track has been laid. The Grand Trunk Pacific Branch Lines Co. has been authorized to build branch lines both east and west of Winnipeg. These are shown on the map as projected. The line from Winnipeg west to Prince Rupert, B. C., 1,750 miles, is being built by the Grand Trunk Pacific. This is all located. Grading is finished on the section from Winnipeg to Portage La Prairie, 56 miles, and track is laid from the latter point 500 miles to Earl, 75 miles west of Saskatoon, Sask. Work is under way from this point to Edmonton, Alb., 253 miles, and to a point 120 miles further west of Edmonton. From Prince Rupert eastward, work is under way on 100 miles of road to Kiteselas canyon, which is the junction between the direct line and the loop north of it. It is expected that the line from Winnipeg to Edmonton will be opened for traffic this year. Forces have been at work all through the winter from Winnipeg east to Lake Superior Junction, and it is estimated that during the summer about 30,000 men will be at work on the whole line from Moncton to Prince Rupert.



The Principal Canadian Railroads, Built and Building.

GENERAL NEWS SECTION

NOTES.

The New York legislature has passed a bill requiring railroad companies to pay their employees twice a month.

A press despatch from Bedford, Pa., says that the school of telegraphy maintained by the Pennsylvania Railroad at that place has graduated 60 students.

The Chicago & Alton now runs one of its trains through between Chicago and Kansas City in 13 hours, which is 30 minutes less than the previous time and 30 minutes less than the time made by any other line.

The five railroads running eastward from East St. Louis which absorb drayage charges on freight from St. Louis, will hereafter make the allowance on shipments brought by any one of 20 transfer companies, instead of only two companies, as heretofore.

Canadian papers report that the immigration into Canada this year has been smaller than last year by about 40,000 people, a result which is quite contrary to the expectations which were aroused by the heavy movement from Europe and the United States early in the spring.

A press despatch from Columbus, Ohio, says that the Brotherhood of Locomotive Engineers, now in convention in that city, has decided to admit to membership motormen on all those interurban electric railroads which operate 20 miles or more outside of an incorporated city.

The Canadian Pacific is to discontinue the 96-hour train which has been run between Quebec and Vancouver in connection with its ocean steamships. Under a new contract, the time allowed for carrying the mails from Liverpool to Hong Kong has been extended from 29½ days to 34 days.

At St. Paul, Minn., May 25, the United States Circuit Court of Appeals affirmed the conviction of the Chicago, St. Paul, Minneapolis & Omaha, and its General Freight Agent, H. M. Pearce, for having given illegal rebates on shipments of grain. The company was fined $20,000 and the agent $2,000.

The Chicago, Burlington & Quincy has announced a reduction of 25 cents a ton in the freight rates on coal carried from Wyoming and Colorado to points in Nebraska, west of Grand Island. This reduction is to meet one made by the Union Pacific in consequence of an order of the Interstate Commerce Commission.

The Black Diamond Express of the Lehigh Valley, between Buffalo and New York, which was taken off last winter, will be put back on its old schedule June 14. The train was taken off on February 9. It will leave Buffalo at 11 a.m., and New York at 12 o'clock daily, running through in 9 hours 55 minutes.

The Ohio legislature has passed a law under which the railroads of that state may, after July 7, collect from passengers paying fare on trains 10 cents more than from those who buy tickets at the offices. The law provides, however, that ticket offices at stations must be open 30 minutes before the departure of trains—which in thousands of instances will be 29 minutes more than is necessary.

A large part of Oklahoma and considerable territory in northern Texas were damaged by floods on May 23 and 24, about 20 inches of rain having fallen in 10 hours throughout a considerable part of this territory. At Dallas, Tex., a part of a bridge of the Texas & Pacific over the Trinity River was carried away by the flood and six men were drowned. Many railroad and wagon bridges were damaged in Oklahoma, and many miles of railroad suffered from washouts.

The Chicago, Burlington & Quincy will on May 31 begin running a fast limited train from Chicago, Omaha, Kansas City, St. Louis and other eastern points to the west over its Billings line, reducing the time to the Pacific coast 12 hours, arriving in Seattle in the morning instead of the evening as at present. An extra local train will be added for the accommodation of intermediate business. The train will leave all the eastern terminal points about as at present, but will cut the running time from 76 to 64 hours.

The New York, New Haven & Hartford announces that, beginning with June 10, it will make through freight rates from Connecticut points and from New York City to the west over the Boston & Maine and the Canadian Pacific (through Canada). Rates to Chicago and beyond by this route are 10 cents (first class) less than those by the direct routes, from points taking New York rates, and 5 cents (first class) less from Boston points. At present the Central Vermont, controlling the railroad from New London, Conn., northward to Montreal, and running steamers between New York and New London, is the only line which gives these low rates from places south of the Boston & Albany. Shipments by the new tariff will be sent through either Springfield or Worcester.

The gold medal offered by the *Scientific American* for the most meritorious invention in transportation, which has been competed for at the exhibition of the American Museum of Safety Devices which has been held in New York City during the past month, has been awarded to the Rich Marine Fire Detecting & Extinguishing system, which is an apparatus for detecting fires in the holds of vessels. From a glass case on the bridge pipes, 1 in. in diameter, run to each hold and coal bunker and, by means of a small exhaust fan, kept constantly running, any smoke which might be formed in a given compartment would emerge from the corresponding pipe in the glass case, and thus warn the officer in charge, of the danger of fire. Every 15 minutes a bell rings, calling attention to the necessity of looking at the pipes. In case a fire is detected, hose can be attached to the pipe and by this means the endangered hold can be flooded with steam. It is said that this device has been installed on the Cunard steamers "Lusitania" and "Mauretania."

Governor Hughes, of New York, has vetoed the Robinson bill, which was designed to facilitate the construction of rapid transit railroads in New York City by allowing the city the privilege of selling franchises to corporations for 50 years, instead of for periods not exceeding 25 years, as is stipulated in the present law. Governor Hughes says that although the 50-year provision is permissive, it would mean that all franchises would run for 50 years, for the city authorities could not be depended on to stand out for a shorter period; and the Governor believes that to surrender the rights of the city in its streets for so long a time as half a century is wrong. The exact financial status of the city as regards its power to borrow money, should be authoritatively determined, and then if the legislature takes action which shall result in the adoption of an amendment to the constitution, the city may, within a year and a half be able to build subways itself.

The proposal, embodied in a resolution by Senator Elkins, to suspend for a time the penalties which the Interstate Commerce Commission law imposes on railroads which carry their own commodities, was considered in the upper house of Congress last Friday; and, although no direct vote was taken, it is said that the subject has been laid aside finally for the present session. This leaves the penalties in full effect, so that an anthracite coal road for instance, carrying to market coal from its own mines, is subjecting itself to severe penalties, the only assurance of immunity being the promise of the President and the Attorney-General to refrain from prosecuting any road for the collection of a penalty until the constitutionality of the law shall have been decided by the Supreme Court.

A press despatch from Washington, May 25, says that the Department of Justice has agreed with the coal carrying railroads that the case involving the constitutionality of the law shall be heard before three Federal judges in Philadelphia on June 16 next. The case is to be tried upon an agreed state of facts and no prosecutions are to be begun against the railroads directly interested in the suit until a decision of the court has been reached.

Another Low-Fare Veto from Governor Hughes.

Governor Hughes of New York has vetoed a bill passed by the Legislature known as the Coney Island five-cent fare bill. His reasons are the same as those given a year ago in his veto of the general two-cent bill for the whole state, the main point being that the legislature has acted without sufficient investigation. In the present case he says:

This bill establishes a maximum rate of five cents [on electric roads from Manhattan to Coney Island] without regard to the length of the route or the reasonableness of such a fare. In other words, it is an arbitrary maximum imposed by legislative fiat. But it is clear that if the rate is not a reasonable one and if the requirement would operate as a confiscation of the company's property the legislature cannot impose it. The attempt to enforce such a rate under such circumstances would be abortive, as a successful appeal could be made to the courts. It is idle to suppose that the companies can be compelled to reduce their fare to five cents merely because the legislature says so.

Whether a five-cent fare is a fair one depends upon facts and not upon sentiment, desire or prejudice, whether the result be agreeable or disagreeable. It inevitably will be reached only after the facts have been ascertained and considered. Justice requires this and under the Constitution the requirement will be enforced. The proper way to deal with these matters is to provide for investigation in which the whole subject can be considered, specious claims sifted out, and a result just both to the corporations and to the public arrived at.

It is highly important that we should have transportation in our cities at the lowest fair rates. It is desirable that in New York City there should be low rates from the congested quarters to the breathing spots in the outlying districts and by the sea. The sure way and the only way to make real progress in this direction is through the ascertainment of the essential facts and the making of reasonable rates in accordance with the facts. This bill is wrong in principle and is not adapted to secure the desired result.

Wireless Controlled Electric Truck; Union Pacific.

W. C. Brown on Rate Increases.

I regard the present question as one of the most important that has ever engaged the attention of the business interests of the country. I firmly believe that upon its righteous solution depends the momentous question of an early return to prosperity, or a continuance of the depression of the past six months, emphasized and darkened by a struggle with organized labor such as this country has never experienced.

The issue is in the hands of the business men of the country. If the business interests of the nation shall, after mature consideration, say that railroad rates shall not be advanced, I doubt if it can be done. But it should be understood clearly, definitely and beyond all question of doubt, that in saying this they say just as clearly and definitely that the wages of the great army of 1,500,000 railroad employees shall be reduced, and they must accept their full measure of responsibility for the results which will follow.

A Lackawanna Circular to Employees.

"The principle that underlies courteous treatment of others is simply that of doing unto others as you would they should do unto you.

"In a highly complex and technical business such as that of the railroad, there are many things that you, with your training and daily experience, understand with perfect familiarity, but which the public do not understand; therefore, do not assume that the public should comprehend them without asking questions, but when they make inquiry of you give them the courtesy of a reply just as full and clear as you can make it, without any suggestion of superiority born of a greater knowledge.

"Words are only one means of expression, and manner is quite as important; therefore remember that a kindly and gracious manner is not only the sign and mark of a self-respecting man, but is to your words what oil is to machinery in making them move effectively to their purpose.

"True courtesy is no respector of persons. It gives the civil word and the helping hand quite as readily to the ill-clad stranger as to an official of the company.

"Courtesy is not only something the public have a right to expect of you, but it pays. It pays in the friends it makes you personally and as a representative of the company. It pays in minimizing the friction of your life, as well as that between the company and its patrons. It pays in raising your standing with the company.

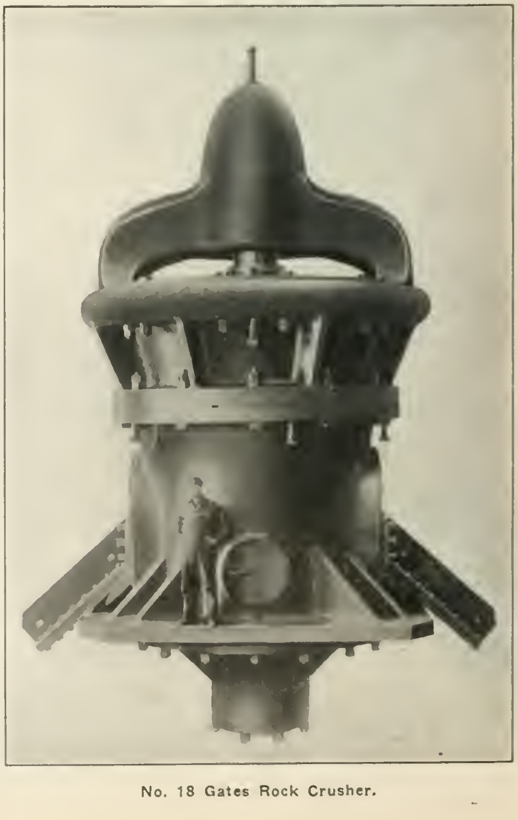
"It is the wish of the management of this company that all its representatives, whose work brings them into contact with the public, may appreciate and fully measure up to their duty and privilege in this respect."

Wireless Control of Shop Truck.

Frederick H. Millener, electrician, has for several months been working under the direction of W. R. McKeen, Jr., Superintendent of Motive Power and Machinery of the Union Pacific Railroad, on a system of wireless or remote control of a truck running on the industrial tracks of the Union Pacific shops at Omaha, Neb. The illustration shows an electric truck made by the Westinghouse Electric & Manufacturing Company, weighing about 5,500 lbs., which is driven by an electric motor supplied by a storage battery. The truck is capable of hauling a load of 10 tons at a speed of six miles an hour. It carries 144 ft. of copper wire made into a wireless wing and an antenna about 2 ft. high, by which the electric waves are picked up and transmitted to controlling devices beneath the frame. The experiments have progressed so far that it is now possible, by the use of the device, to move forward, reverse, stop, or to move at any desired speed by means of the specially shaped antenna and traveling ground communication. Similar antennae built like a cylinder and attuned to the car apparatus swing from a flag pole 65 ft. above the central controlling station. From these are sent waves that control the movement of the truck.

A Large Rock Crusher.

The Allis-Chalmers Co. has recently completed at its Reliance Works in Milwaukee, Wis., the No. 18 Gates, 600 to 800-ton capacity rock crusher shown in the accompanying cut. The machine weighs 200 tons and will reduce, to sizes suitable for railroad grouting and foundation work, rocks weighing three tons. It is said to be the largest rock crushing machine ever built.



No. 18 Gates Rock Crusher.

Disastrous Collision in Belgium.

Press despatches of May 21 report a rear collision of passenger trains at Contich, Belgium, at 8 o'clock on the morning of that day in which 50 or more persons were killed and over 100 injured. Nearly all of the killed were passengers in the three rear cars of a local passenger train carrying excursionists which, while standing on a side track, was struck by an express train running at full speed. The engineman and fireman of the express were killed. Several of the cars in the express train were badly broken, so that a number of passengers in this as well as in the local train, were injured. Contich is six miles southeast of Antwerp on the main line from Antwerp to Brussels. The reports give contradictory accounts of the cause of the accident, but at the present writing it looks as though it was the loosening by a repairman of a switch which was undergoing repairs. According to one account, the express train was derailed at this switch and its engine fell against the cars of the standing train after it had run off the rails.

New Traffic Order.

An executive order has been issued by the Interstate Commerce Commission as follows: "Under the decision of the commission in the case of '*Cosmopolitan Shipping Co. v. Hamburg-American Packet Co. et al.*,' and under rule 86 of tariff circular 15-A, carriers engaging in export and import traffic between points in the United States, and points in foreign countries not adjacent are required to publish their rates and fares to the ports and from the ports; and if as a matter of convenience to the public they publish in their tariffs through export and import rates or fares to or from foreign points in connection with ocean carriers such tariffs must distinctly state the inland rate of fare.

"Extensions of time have been granted to some carriers giving them until July 1, 1908, to comply with the requirements of said rule. It is now

"Ordered that all carriers subject to the act to regulate commerce shall comply with the requirements of rule 86, tariff circular 15-A, on or before July 1, 1908, by filing with the commission tariffs constructed in accordance with the rule and by canceling tariffs that do not conform to the requirements of this rule, and which contain rates or fares upon traffic exported to or imported from a foreign country not adjacent to the United States."

MANUFACTURING AND BUSINESS.

The Alexander Milburn Co., Baltimore, Md., recently received an order for a number of 5,000 c.p. acetylene lights for use on the Panama Canal.

William D. Ewart, the first president of the Link-Belt Co., Philadelphia, Pa., died at Rome, Italy, on May 3. Mr. Ewart was 56 years old. He invented the malleable iron detachable drive chain which was first known under his name. The Ewart Manufacturing Co. manufactured this chain, which is now called the link-belt, for many years, the product being handled by the Link-Belt Machinery Co., and the Link-Belt Engineering Co. In 1906 all three were consolidated into the present company, in which Mr. Ewart had a large interest and which is still being largely managed by his former associates. He combined inventive ability with executive capacity, being noticeably successful in harmonizing differences and getting co-operation. He retired on account of poor health and went abroad in the hope of recovery.

William D. Ewart.

Borlido Moniz & Co., P. O. Box 262, Rio de Janeiro, Brazil, wish to act as general commission agents for handling railroad equipment and supplies, electric machinery, builders' supplies, etc., in Brazil, and are asking for catalogues and correspondence from American firms.

The Glacier Metal Co., Richmond, Va., which is building a new plant at Manchester, Va., is now in the market for furnaces for the manufacture of babbitt metal, brass, etc., and also wants information on reclaiming metal from drosses and extracting tin from old cans.

The Maryland Railway & Electric Supply Co., Baltimore, Md., has opened branches at 1629 Candler building, Atlanta, Ga., and 312 Tyler building, Louisville, Ky.

F. P. Huntley, Vice-President and General Manager of the Gould Coupler Co., New York, has just returned from a several months' business and pleasure trip abroad.

Samuel E. Duff, formerly Manager of the Allegheny works of the Riter-Conley Manufacturing Co., Pittsburgh, Pa., has opened an office as Consulting Engineer in the Empire building, Pittsburgh, Pa. His specialties will be the designing of bridges, buildings, manufacturing plants, and special tools for steel work, while he will also develop his continuous steel railroad track support.

Fairbanks, Morse & Co., Chicago, Ill., have moved to their new offices at the corner of Wabash avenue and Eldredge place. The building, which is 165 ft. x 40 ft., is a seven story structure and contains the offices of all departments of the company, including the administrative, domestic and foreign sales, construction, purchasing, railroad departments, etc. The new warehouse of the company at Nineteenth and Sangamon streets is a five-story brick building, 100 ft. x 100 ft. The company's branch houses at Denver, Colo., Omaha, Neb., and San Francisco, Cal., have also moved into new buildings, and the Los Angeles, Cal., branch will do so within a few months.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Transportation and Car Accounting Officers.

The Association of Transportation and Car Accounting Officers will hold its summer meeting at the Clifton Hotel, Niagara Falls, Ont., June 23 and 24. Reports will be received from the Committees on Car Service and Per Diem, on Office Methods and Accounting, on Handling Railroad Business Mail, on Conducting Freight Transportation, and on Conducting Passenger Transportation. There will be the regular election of officers.

American Association of General Baggage Agents.

The twenty-seventh annual convention of this Association is to be held at the Hotel Plankinton, Milwaukee, Wis., June 17. At this meeting the discussions will include the following subjects: Limited Liability on Baggage; Settlement of Line Claims; Division of Excess Baggage Earnings; Uniform Excess Baggage Rates; Interline Charge for Dogs; Borrowing of Tickets for Checking Excess Baggage; Showing Junction Points on C.O.D. Checks; New Form of Baggage Checks to Prevent Mis-Matches; Should Lead Pencil be Used in Making Out Baggage Checks?

American Society for Testing Materials.

This society, affiliated with the International Association for Testing Materials, will hold its eleventh annual meeting at Atlantic City, N. J., June 23-27. The headquarters will be at the Hotel Traymore. The programme includes reports as follows:

Testing is not Inspection. W. A. Aiken.

Standard Specifications for Cast Iron and Finished Castings. Walter Wood, Chairman.

Method of Obtaining a Truly Circular and Uniform Chill in Rolls. T. D. West.

Standard Tests for Road Materials. L. W. Page, Chairman.

The Acceptance of Stone for Use on Roads Based on Standard Tests. R. S. Greenman.

Fuel Investigations, Geological Survey. Progress During the Year. J. A. Holmes.

The Structural Timbers of the Pacific Coast. R. Thelen.

Address by the President on Some Features of the Present Rail Question.

Relative Corrosion of Steel and Wrought Iron Water Pipes. H. M. Howe.

Corrosion of Iron and Steel. A. S. Cushman, Chairman.

Electrolysis and Corrosion. A. S. Cushman.

Results of Endurance Tests on Wrought Iron, Steel and Alloys. Henry Souther.

Results of Tests of Steel Columns in Progress at Watertown Arsenal. J. E. Howard.

Heat Treatment of Iron and Steel. H. M. Howe, Chairman.

Practical Applications of Metallography. William Campbell.

Tempering and Testing of Steel Springs and Standard Specifications for Spring Steel. J. A. Kinkead, Chairman.

Tests of Staybolts. E. L. Hancock.

Standard Specifications for Paving and Building Brick. L. W. Page, Chairman.

Influence of the Absorptive Capacity of Bricks Upon the Adhesion of Mortar.

Standard Specifications for Iron and Steel Rails. W. R. Webster, Chairman.

Results of Work on the Metallurgy of Steel in Progress at Watertown Arsenal. J. E. Howard.

Microscopic Investigation of Broken Rails; Manganese Sulphide as a Source of Danger. Henry Fay.

Results Showing the Behavior of Rails under the Drop Test, and Proposed New Form of Standard Drop Testing Machine. S. S. Martin.

Failures in the Base of Cold Rolled Rails. P. H. Dudley.

Rail Failures—Split Heads. M. H. Wickhorst.

Notes on the Rail Situation. L. F. Kenney.
Standard Specifications for Cement. G. F. Swain, Chairman.
Portland Cement Standards, Especially for Tensile Strength. W. W. Maclay.
Reinforced-Concrete. F. E. Turneaure, Chairman.
Sands—Their Relation to Mortar and Concrete. H. S. Spackman and R. W. Lesley.
Permeability Tests of Concrete with the Addition of Hydrated Lime. S. L. Thompson.
Tests of Reinforced Concrete Beams Under Oft Repeated Loading. H. C. Berry.
Cement Analysis. S. F. Peckham.
Formulas for Reinforced Concrete Beams in the Light of Experimental Data. W. F. Scott.
Fireproof Qualities of Concrete. R. F. Tucker.
Shearing Values of Stone and Concrete. H. H. Quimby.
Methods and Records Used in the Laboratory for Testing Cement and other Materials for the Subway and Elevated Railway in Philadelphia. S. A. Brown.
Influence of Fine Grinding on the Physical Properties of Portland Cement. R. K. Meade.
Tests of Bond in Reinforced Concrete Beams. M. O. Withey.
Cement and Concrete Work of U. S. Reclamation Service, with Notes on Disintegration of Concrete by Action of Alkali Water. J. Y. Jewett.
Preservative Coatings. S. S. Voorhees, Chairman.
General Discussion "Will 'Pure Paint' Legislation Give Us Better Paints?"
Solubility Tests on Protective Coatings. G. W. Thompson.
Analysis of Varnishes. P. C. McIlhiney.
Standard Tests for Lubricants. A. H. Gill, Chairman.
Use of the Extensometer in Commercial Work. T. D. Lynch.
Features of a 600,000-lb. Universal Testing Machine. T. Y. Olsen.
Pendulum Testing Machines. T. Y. Olsen.
Automatic Recorder for Commercial Tension Tests. H. F. Moore.
Magnetic Testing of Iron and Steel. J. W. Esterline, Chairman.
Uniformity in Magnetic Testing and in the Specifications of Magnetic Properties. C. W. Burrows.
Uniform Specifications for Boilers. E. D. Meier, Chairman.
Forest Service Tests to Determine the Influence of Different Methods and Rates of Loading on the Strength and Stiffness of Timber. (a) The Purpose and Scope of the Investigations. McGarvey Cline. (b) Analytical Discussion of Speed-Strength Relation. H. D. Tieman.
Manganese Bronze. C. R. Spare.
Standard Specifications for Hard Drawn Copper Wire. J. A. Capp and W. H. Bassett.
Structural Materials Testing Laboratories, U. S. Geological Survey. R. L. Humphrey.
Combined Stresses on the Elastic Properties of Steel. E. L. Hancock.
Fireproofing Materials. I. H. Woolson, Chairman.
Waterproofing Materials. W. A. Aiken, Chairman.

At this meeting there will be an election of officers, and the official ballot is as follows: For President, Charles B. Dudley; Vice-President, Robert W. Lesley; Secretary-Treasurer, Edgar Marburg; Member of Executive Committee, James Christie.

Special rates on the American plan at the Hotel Traymore have been secured for members of the society and their guests.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Alaska Central.—John F. Goodwin has been appointed Receiver of the Alaska Central and the Tanana Railway Construction Co.

Canadian Pacific.—Joseph Dunsmuir, Lieutenant-Governor of British Columbia, has been elected a Director, succeeding Clarence Mackay.

Chesapeake & Western.—W. E. D. Stokes has been elected President, succeeding Robert McM. Gillespie, resigned, and A. H. Gleason has been elected Vice-President, succeeding J. J. Vatable, resigned.

Operating Officers.

Missouri Pacific.—L. B. McGuire, Trainmaster at Nevada, Mo., has assumed also the jurisdiction over the Rich Hill branch, Fort Scott branch, Asbury branch and Pittsburgh district of the Joplin division. D. H. Robinson, transferred, formerly had jurisdiction over these branches.

Traffic Officers.

Buffalo, Rochester & Pittsburgh.—H. E. Huntington, General Agent of the Erie at Buffalo, N. Y., has been appointed General Passenger and Baggage Agent of the Buffalo, Rochester & Pittsburgh, with office at Rochester, N. Y., succeeding E. C. Lapey, effective June 1.

Chicago, Rock Island & Pacific.—H. H. Embry, General Freight Agent west of the Missouri river, with office at Kansas City, Mo., is to be retired on account of retrenchments, his office abolished and his duties to be assumed by G. B. Albright, Assistant General Freight Agent, with office at Kansas City, Mo., effective June 15.

Lake Erie & Western.—L. B. Sweet, General Freight Agent, with office at Indianapolis, Ind., has resigned, effective June 15, and will be succeeded by M. D. Maxwell, now Assistant General Freight Agent at Indianapolis.

San Pedro, Los Angeles & Salt Lake.—William Bogart has been appointed General Agent at Pittsburgh, Pa., succeeding H. S. Drysdale, resigned.

Engineering and Rolling Stock Officers.

Mexican Central.—W. Byrd Page has been appointed Assistant Superintendent of Machinery, with office at Aguascalientes, Aguas., succeeding C. H. Burke, resigned.

LOCOMOTIVE BUILDING.

The American Railroad of Porto Rico has ordered two compound consolidation locomotives, cylinders 14 in. and 20 in. x 20 in. from the American Locomotive Co.

CAR BUILDING.

The American Dressed Beef & Packing Co., Kansas City, Mo., has ordered 50 refrigerator cars from the American Car & Foundry Co.

The Delaware, Lackawanna & Western, which has been figuring on 26 passenger cars and 300 forty-ton steel hopper coal cars, has postponed the purchase for the present.

RAILROAD STRUCTURES.

BEAVER, PA.—Contract is reported let by the Pittsburgh & Lake Erie for the steel, also the construction of its proposed bridge over the Ohio river at this place, to the McClintic-Marshall Construction Co., of Pittsburgh, at $1,000,000. (Oct. 25, p. 598.)

BLOOMINGTON, ILL.—The Chicago & Alton is rebuilding a part of its machine shops and offices, recently damaged by fire.

CHICAGO, ILL.—The Chicago & North-Western, it is said, has bought 30,000 sq. ft. on the river front near Fifteenth street in the southern district of Chicago, on which, it is said, a dock 750 ft. long will be built.

The proposed 15 bridges over the drainage canal with operating machinery to cost $1,000,000 to be put in within 18 months, include seven railroad bridges over the main channel of the canal, and eight public bridges.

CHILDRESS, TEXAS.—The shops of the Fort Worth & Denver City, recently damaged by fire at a loss of $200,000, are to be rebuilt.

DENVER, COLO.—The Colorado & Southern, it is said, is planning to build many bridges in Colorado.

HILLSBORO, TEXAS.—The Trinity & Brazos Valley, it is said, will put up a bridge and viaduct here to cost about $16,000.

MT. STERLING, KY.—The State Railroad Commission has ordered the Chesapeake & Ohio to replace the present station with a new structure.

NEW YORK, N. Y.—The New York Central & Hudson River has filed plans for the east section of its new station at Forty-second street. It is to have a frontage of 366 ft. on Depew place and a depth of 72 ft. The building is to be seven stories high with two underground floors to be used by trains.

NORTH PLATTE, NEB.—Local reports say that considerable improvements are to be made by the Union Pacific here to include large yards, new roundhouses, coal docks and car repair shops. The work is to be finished this fall.

OMAHA, NEB.—Local reports state that the Union Pacific will resume work on its shops here. The cost of the improvements will be about $1,000,000.

OTTAWA, ONT.—Bids are wanted June 9, by the National Transcontinental Railway Commission, for the construction and erection of steel superstructures and floors for bridges in District "A," as follows: Over the Canaan river, Salmon river, Little Salmon river, Four Mile brook, Grand river, Sigas river, to be finished May, 1909. Quisbia river, Green river, Iroquis river, Madawaska river, to be finished October, 1908, and Baker brook, to be finished May, 1909. P. E. Ryan, Secretary.

SPIRIT LAKE, IDAHO.—An officer of the Idaho & Washington Northern writes that work is to be started June 1 putting up shops and a roundhouse to cost, with the machinery, $250,000. Contract let to Westinghouse, Church, Kerr & Co., of New York.

SUPERIOR, WIS.—The Wisconsin & Minnesota Bridge Company, recently incorporated, is planning to build a bridge over the St. Louis river between Wisconsin and Minnesota.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AJO VALLEY RAILROAD.—An officer writes that this company proposes to build a line from Theba, Ariz., where connection is to be made with the Southern Pacific, south to the Ajo mines, and thence to the Mexican border, about 125 miles. Surveys are made but contracts are not yet let. Plans are being pushed for financing the project, also for building the line, and it is expected that work will be started shortly. Michael Meehan, President, 10 Tremont street, Boston, Mass., and F. A. Bordwell, Chief Engineer, Tucson, Ariz.

ALBANY & SCHOHARIE.—The bill extending the time for the construction of this line, projected since 1895, has been vetoed by the Governor of New York.

Alexander & Eastern.—Organized with a capital of $100,000, and office at 806 W. Pike street, Clarksburg, W. Va. The company proposes to build a line from Alexander, W. Va., northeast to Elkins, about 30 miles. J. B. Hart is interested.

Alexandria, Leesville & Lufkin.—Organized in Louisiana to build a line from Lufkin, Texas, east to Alexandria, La., about 110 miles. M. O'Brien, President; T. T. Wingate, J. J. Hicks and W. K. Ferguson are Vice-Presidents; C. W. Schwitzer, Secretary; J. E. Duff, Treasurer; D. M. Schollars, Attorney at Leesville, La., and H. H. White, Attorney at Alexandria.

Bitter Root.—Organized to build a line from Lewiston, Idaho, east to Butte, Mont., about 350 miles. Surveys made from Lewiston to Clearwater river, 85 miles, but construction work has been indefinitely postponed. C. G. Sutherland, President; G. W. Boschke, Chief Engineer.

Chicago, Rock Island & Pacific.—The first 20 miles of this company's proposed connecting line projected from Amarillo, Texas, west to Tucumcari, N. Mex., 110 miles, has been put in operation. (March 27, p. 461.)

Colorado, Texas & Mexico.—At the annual meeting of this company, President Morris K. Locke, of Abilene, Texas, reported that 79 miles of grading had been finished. Negotiations are pending for 100 miles of track material for immediate use on the line between Mangum, Okla., and Chillicothe, and on the Hollis branch. The line is projected south to Abilene, Texas. (April 17, p. 559.)

Cotton Belt.—Organized in Georgia to build a railroad from Louisville, Ga., northeast via Vidette and Walnsboro, to a point near Shell Bluff landing on the Savannah river, about 50 miles. Frank R. Durden, of the Durden Pine Co., Savannah, is President.

Delaware, Lackawanna & Western.—An officer writes that this company is asking contractors to submit bids for building the proposed cut-off from Port Morris, N. J., on Lake Hopatcong, west to Slateford, Pa., on the Delaware river, 28.7 miles. For this main line cut-off the surveys have been made. It will save 11½ miles of distance, besides reducing grades and curves, and eliminating tunnels, of which there are two on the present line. (March 13, p. 395.)

Grand Trunk.—The tracks of the main line of this road are being relaid with 100-lb. rails on the section from Mille Roches, Ont., west to Cardinal, 33 miles. The rest of the line between Brockville and Montreal was relaid last year.

Idaho Northern Railroad.—An officer writes that this company, organized to build 76 miles of line in the Coeur d'Alene district, Idaho, for which contract was let last fall to the Pacific Coast Construction Company, of Portland, Ore., expects to begin track laying June 1. The line is being built from Enaville, Idaho, on the Wallace-Tekoa branch of the Oregon Railroad & Navigation Company, near Kingston, northeast to a point six miles east of Murray, 33 miles. Grading is about one-third finished, and it is expected the line will be ready for operation this year. Branches aggregating 43 miles are also to be built. B. F. O'Neill, President, Wallace, Idaho. W. P. Smith, Chief Engineer, Enaville. (April 10, p. 595.)

Interborough Rapid Transit.—This company, operating the subways and elevated lines of Manhattan, New York City, has sent to the New York State Public Service Commission a proposition looking to the construction by the Interborough of a subway from Flatbush avenue and Fulton street, Brooklyn, along Flatbush avenue extension to the Manhattan bridge (not yet finished), with a view to making a rapid transit line from the starting point across the bridge and thence to the Bowery and Canal street, Manhattan, where a connection can be made with the Third avenue elevated road. The Interborough offers to do the necessary construction for $1,200,000 and to operate the line under lease. The route of the proposed subway in Brooklyn is identical with a part of the Fourth avenue subway, for the construction of which the Public Service Commission has just let contracts; and the proposition of the Interborough seems to have been made on the assumption that these contracts will not be carried out for the reason that the city is not at present in a position to provide the necessary money.

Mexican Roads.—A concession is reported granted by the federal government to General Julio M. Cervantes, of San Luis Potosi, to build 100 miles of railroad. The main line is to run from San Mateo, on the San Luis Potosi divisions of the Mexican Central, to Tiletla, with a branch to Tamazunchale.

Reports from Zacatecas state that a concession has been granted to Gustavo A. Madero, of Zacatecas, to build a line from Comacho, Zac., on the Mexican Central, east to Mazapil, 60 miles.

New York, Canadian & Pacific.—The bill extending the time for this company to build its road, projected since 1866, from New York City north to Canada, has been vetoed by the Governor of New York.

New York Subways.—The New York Public Service Commission, First district, recently let contracts for six sections of the Fourth avenue (Brooklyn) subway. In each case the contract was given to the bidder whose aggregate estimate on the cost of the railroad work and the pipe galleries was the lowest. The contracts are as follows:

Sec. No.	Location and bidder	Railroad work	Pipe galleries	Total
1.	Nassau to Willoughby streets; Jas. P. Graham	$1,020,476	$101,374	$1,121,850
2.	Willoughby street to Ashland place; William Bradley	3,436,019	58,695	3,494,714
3.	Ashland place to Sackett street; William Bradley	3,392,092	208,135	3,600,227
4.	Sackett street to 10th street; E. E. Smith Contracting Co.	2,283,533	206,672	2,490,205
5.	10th to 27th streets; Tidewater Building Co. and T. B. Bryson (joint bid)	1,945,640	251,076	2,196,716
6.	27th to 43d streets; E. E. Smith Contracting Co.	2,808,983	173,665	2,982,648
	Total	$14,886,743	$999,617	$15,886,360

The total of the awards for railroad work is $14,886,743 and for pipe galleries $999,617, making an aggregate cost for the six sections of $15,886,360. The beginning of work on these contracts must await action by the Board of Estimate and Apportionment on the question of providing funds.

North Midland (Electric).—The proposed route of this projected line is from London, Ont., north to St. Mary's, thence north east to Stratford, 35 miles. A. E. Welch, 171 Dundas street, London, has a contract for some of the work, which is to be started as soon as the project is financed. There are to be two bridges. W. Scarlett, President, Princess avenue, London.

Ohio Electric Railway.—The Lima & Toledo Traction Company, which is building a line from Deshler, Ohio, north to Toledo, 30 miles, has all the track laid from Maumee south to Waterville, and it is said that the approaches to the large concrete bridge near that place are about finished. It is expected that the company will begin operation to Toledo early in June. (March 27, p. 461.)

Oklahoma, El Reno & Shawnee (Electric).—Incorporated in Oklahoma with $1,500,000 capital to build an electric line from Shawnee, Okla., west via Oklahoma City and Yukon to El Reno, 60 miles. It is estimated that it will cost $20,000 a mile to build the road. The incorporators include C. E. Huber, President; J. A. Niblo, W. M. Sawyer and S. L. Niblo, of Oklahoma City, and Charles E. Davis of Lugert.

Oregon Eastern.—See Southern Pacific.

Pennsylvania.—This company on May 24 put in operation the last section of its extensive improvements on the Conemaugh division, between Pittsburgh, Pa., and Johnstown. This marks the completion of the plans, begun in 1902, for a low grade line from Pittsburgh to the Atlantic ocean. With the exception of 24 miles on the west side of the Allegheny mountains and one mile near Freeport on the Conemaugh division there is now a freight line with no adverse grade eastward of over 0.3 per cent. The work on the Conemaugh division required the excavation of 2,000,000 cu. yds. of material, the erection of 110,000 cu. yds. of masonry, and the piercing of a 760 ft. tunnel. Every grade crossing on the revised line has been eliminated. The company now has a low grade line parallel to the main line from Pittsburgh to Johnstown, from Gallitzin, at the summit of the Alleghenies, to Petersburg, on the main line, and from Harrisburg, Pa., to Trenton, N. J., thus providing two distinct lines, one of two tracks and another of four, for about 261 miles out of the total of 388 miles from Pittsburgh to Trenton. This has been accomplished by double-tracking and revision on the Conemaugh division as before stated, by building an entirely new double-track line from Gallitzin to Hollidaysburg, double-tracking the branch line from Hollidaysburg to Petersburg; building a new double track line from Harrisburg to Glen Loch, and revising the grades on the Trenton cut-off from Glen Loch to Morrisville. In addition it has been necessary to revise the grades and take out considerable curvature on the main line between Port Royal and Van Dyke and between Mount Union and Ryde. This latter work is almost but not quite finished. On the 24 miles from Johnstown to Gallitzin the ruling grade is 1 per cent. (March 13, p. 393.)

Pennsylvania Lines West.—According to reports surveys are being made by the Pennsylvania company for a low grade freight line from the Pittsburgh, Fort Wayne & Chicago at Enon, Pa., east to the Buffalo & Allegheny division of the Pennsylvania at Brady's Bend, about 50 miles. Such a line would enable the company to avoid sending much through freight through Pittsburgh.

Rio Grande, Sierra Madre & Pacific.—This company, which suspended work last year on the extension projected from Nueva Casas Grandes, Chihuahua, west to the Pacific coast, is reported to be preparing to resume work this fall. Grading has been finished from Nueva Casas Grandes south 25 miles, and rails are on the ground. A bridge has also been built over the Guerrero river. The proposed terminus is either Guaymas or Topolobampo. (Nov. 29, p. 669.)

San Juan, Tavicue & Oaxaca.—An extension of two years from May 9, 1908, has been granted to C. A. Hamilton, of Oaxaca, to build this line. The projected route is from San Pablo Zimatlin, Oaxaca, to the Taviche mining camp, about 17 miles. Most of the construction material is already on the ground. (April 3, p. 493.)

SOUTHERN PACIFIC.—The Oregon Eastern has finished surveys for a line from Natron, Ore., south to Klamath Falls, 152 miles. Surveys also made for a line from the Cascade Mountains east to the eastern boundary of the state at Ontario. The company recently had its charter amended so as to build a branch from Lakeview, Ore., south to the California state line, about 15 miles. It is the ultimate intention to further extend this line south through California. (March 13, p. 394.)

SUGAR CREEK & NORTHERN.—See Wheeling & Lake Erie.

TERRE HAUTE, ROBINSON, OLNEY & SOUTH-WESTERN.—An officer writes that the route of this proposed line is from Terre Haute, Ind., southwest via Robinson, Ill., and Olney, to Mount Vernon, 125 miles, where connection is to be made with the Wabash, Chester & Western, running to the Mississippi river. It is the intention of the company ultimately to build an extension on the Missouri side of the Mississippi river, southwest about 60 miles. Contracts for some of the work has been let to Charles B. Duffy, St. Louis, Mo. The construction of the road depends upon the company's securing the necessary right of way within six months. There are to be steel bridges over the Wabash and Embarras rivers, and plate girders or concrete structures over other streams. Harris C. Pugh, President, Terre Haute, Ind. (May 8, p. 656.)

TEXAS & PACIFIC.—An officer writes in regard to improvements to be carried out by this company that the only work contemplated at the present time is laying heavier rails on 56 miles of the line.

TEXAS NORTHERN.—An officer writes that this company's projected line is to run from Groveton, Texas, northeast via George, Apple Springs, Vair and Peavy to Lufkin, 36 miles. Grading has been finished and track laid on 23 miles. Bridgework and tracklaying is being done by the company's men. The Trinity County Lumber Company did all the construction work on the 23 miles between Groveton and Vair, at which point connection is to be made with the Texas South Eastern, over which the T. N. will have trackage rights to Lufkin, 13 miles. The Texas Northern will take over the railroad property of the Trinity County Lumber Company and operate it. P. A. McCarthy is Chief Engineer, Lufkin, Texas.

TEXAS ROADS.—According to reports from Port Arthur, Texas, John W. Gates, of New York, is arranging to finance two projects to build new lines in Texas. One of the proposed lines is to run from Port Arthur north to Waco, about 225 miles, and the other from Port Arthur, west to Houston, about 90 miles. Some construction work has already been done on the latter, and it is said that work on the Port Arthur and Waco line is to be started this fall and pushed to completion. R. C. Duff, of Beaumont, is interested.

TRINITY LUMBER COMPANY'S RAILROAD.—See Texas Northern.

UNION PACIFIC.—According to reports from Colorado, this company is planning to build a branch from Platteville, Colo., northwest to Fort Collins, about 35 miles.

VANCOUVER ISLAND & EASTERN.—A director of this proposed line states that the charter authorizing it to build has been passed by both the House of Commons and the Senate, but has not yet been signed by the Governor-General. The organization of the company is not yet complete. The proposed route is from Vancouver Island, northeast through British Columbia to Edmonton, Alb. H. A. Munn, Victoria, B. C., and James Smith, Edmonton, Alb., are among the provisional directors. (March 1, p. 624.)

WHEELING & LAKE ERIE.—An officer writes that work has not been resumed, as stated in recent reports, on the new cut-off of the Sugar Creek & Northern from Bolivar, Ohio, northwest to Orrville, 22 miles. At the time work was stopped three-fourths of the grading was finished and track laid on about eight miles. (March 13, p. 395.)

RAILROAD CORPORATION NEWS.

ALASKA CENTRAL.—John F. Goodwin has been appointed Receiver of the Alaska Central and the Tanana Railway Construction Co.

ATLANTA & CAROLINA (ELECTRIC).—This company has filed a mortgage securing $6,000,000 5 per cent. 30-year bonds of 1908-1938. This is a projected electric road between Atlanta, Ga., and Augusta, 160 miles.

ATLANTIC COAST LINE.—A semi-annual cash dividend of 2 per cent. on the common stock was declared on May 21. The dividend last January was 3 per cent., but was paid in Atlantic Coast Line 4 per cent. certificates of indebtedness.

CHESAPEAKE & OHIO.—Kissel, Kinnicutt & Co., and Moffat & White, of New York, are offering $2,000,000 first consolidated 5 per cent. mortgage bonds of the Chesapeake & Ohio at 112, yielding 4.30 per cent. The bonds were sold by the railroad company to provide for refunding first mortgage 6 per cent. bonds maturing July 1, 1908.

CHICAGO, BURLINGTON & QUINCY.—J. P. Morgan & Co., of New York, have sold $16,000,000 general mortgage 4 per cent. 50-year bonds of 1908-1958, at 95½. This is part of a total authorized issue of $300,000,000 secured by a mortgage dated March 2, 1908. The proceeds of the sale are to be used to repay the railroad company for money spent on improvements and acquisitions.

CHICAGO, MILWAUKEE & ST. PAUL.—On May 16 the train service between Chicago and Evanston, Ill., was cut down to two trains a day each way. The line north of Sheridan Park (Wilson avenue), is operated by the Northwestern Elevated, with through service between the loop and all stations north of Wilson avenue.

MAINE CENTRAL.—Lee, Higginson & Co., Kidder, Peabody & Co., R. L. Day & Co., and Estabrook & Co., of Boston, Mass., are offering the unsold portion of $2,119,000 first mortgage, 4½ per cent. 20-year bonds of 1908-1928 of the Portland & Ogdensburg. These bonds are guaranteed by the Maine Central. The bonds are offered at 104¾, yielding 4.15 per cent.

MISSOURI, KANSAS & TEXAS.—H. W. Poor & Company, of New York, are offering a block of the first and refunding mortgage 4 per cent. bonds of the Missouri, Kansas & Texas at a price to yield 5.35 per cent. The total outstanding of these bonds is $5,182,000.

NEW YORK & LONG ISLAND.—The Frawley bill giving the Public Service Commission, Second district, and the Board of Estimate authority to buy for the state, the Belmont tunnel which runs under the East river from Forty-second street to Long Island City, L. I., has been signed by the Governor of New York. The Court of Appeals of New York recently handed down a decision sustaining the validity of the franchise of the New York & Long Island to build and operate this tunnel. (May 22, p. 718.)

NEW YORK CENTRAL & HUDSON RIVER.—William A. Read & Company, of New York, are offering $150,000 stock of the Beach Creek Railroad, 4 per cent. dividends being guaranteed by the New York Central & Hudson River. This stock is offered at 96, yielding 4.20 per cent.

NEW YORK, NEW HAVEN & HARTFORD.—A bill in equity to restrain the New York, New Haven & Hartford from exercising any control over the Boston & Maine, and to separate from the New Haven road its trolley properties was filed in the U. S. Circuit Court in Boston on May 22. The suit was brought under the Sherman Anti-Trust Law and the railroad company has 30 days in which to file an answer. (Note page 720.)

The New York State Public Service Commission, Second district, has forbidden the use of soft coal by the engines of the New York, New Haven & Hartford at the Harlem River terminal yard.

PENNSYLVANIA LINES WEST.—The Pittsburgh, Youngstown & Ashtabula has authorized a $15,000,000 4 per cent. bond issue. The proceeds from the sale of these bonds are to be used in paying off prior lien bonds and making improvements.

SAN FRANCISCO, OAKLAND & SAN JOSE CONSOLIDATED (ELECTRIC).—The shareholders have authorized a consolidated mortgage to secure $7,500,000 bonds of which $4,500,000 are to be reserved to meet the present debt on the old San Francisco, Oakland & San Jose Railway, consisting of $3,000,000 first mortgage and $1,500,000 second mortgage 5 per cent. bonds due 1933.

SEABOARD AIR LINE.—A syndicate managed by the National City Bank of New York has purchased $3,000,000 three-year 6 per cent. receiver's certificates of June 1, 1908. The proceeds of this sale are to provide for the interest payments on underlying bonds and to pay interest and principal on various car trusts, and for certain new construction and other purposes.

SOUTHERN PACIFIC.—E. H. Harriman is said to have obtained control of the Ocean Shore railroad concession. The Ocean Shore holdings include a right of way through San Francisco.

UNDERGROUND ELECTRIC OF LONDON.—Secretary W. E. Mandelick announces that the holders of over 90 per cent. of the 5 per cent. profit sharing notes have deposited their notes and assented to the plan of readjustment. The company will, therefore, proceed with the readjustment as outlined in the plan dated April 14, 1908, and published by Speyer & Co.

UNITED RAILWAYS OF ST. LOUIS—The United States Supreme Court on May 18 handed down a decision sustaining the rights of the city of St. Louis, Mo., to levy a tax of one mill per passenger on the street railways. This ordinance, which went into effect January 1, 1904, succeeds an ordinance in which the city collected a license fee of $25 per car per year. The amount of back taxes due is about $850,000.

WESTERN MARYLAND.—The Mercantile Trust Co. will sell at public auction on June 9 all but seven shares of the stock of the George's Creek & Cumberland, which stock was pledged with the trust company by the Western Maryland to secure a note of $1,101,875. The par value of the stock is $999,600.