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Methods of Mining in Indiana Coal Fields

A Plan is Suggested for Preventing Squeezes Due to Hard Roof and Soft Bottom, a Condition Which Causes Heavy Loss

BY FLOYD W. PARSONS

The methods of mining employed in western Indiana do not differ materially from the system of operation used in Illinois. The coal seams are of the same geological formation and character, and many of the mines in both States are controlled by the same corporations.

TWIN MINE No. 5

One of the interesting mines of the Terre Haute district is the Twin mine No. 5 of the Coal Bluff Mining Company, Fig. 3. This mine is located along

clay rock. The mine is generally dry so that no problems of pumping are present.

METHOD OF DEVELOPMENT

The method of working the seam is by the room-and-pillar system, with cross entries driven double, at right angles to the main entries, and 550 ft. apart. All entries are driven with 32-ft. centers, and are 12 ft. wide, thus allowing an 18-ft. pillar between; the crosscuts are driven at intervals of 45 feet.

The rooms are turned at right angles to

MACHINE MINING

The coal is mined by machines of the electric-chain and the compressed-air punching types. The machines enter the room on the left road and undercut across the face; the apparatus is then loaded for removal on the right-hand track, thus saving the labor of moving the machines over ground once traversed.

The coal is delivered to the turnout from the room by mules, and from these partings to the shaft bottom by electric motors. Empty cars are also delivered at

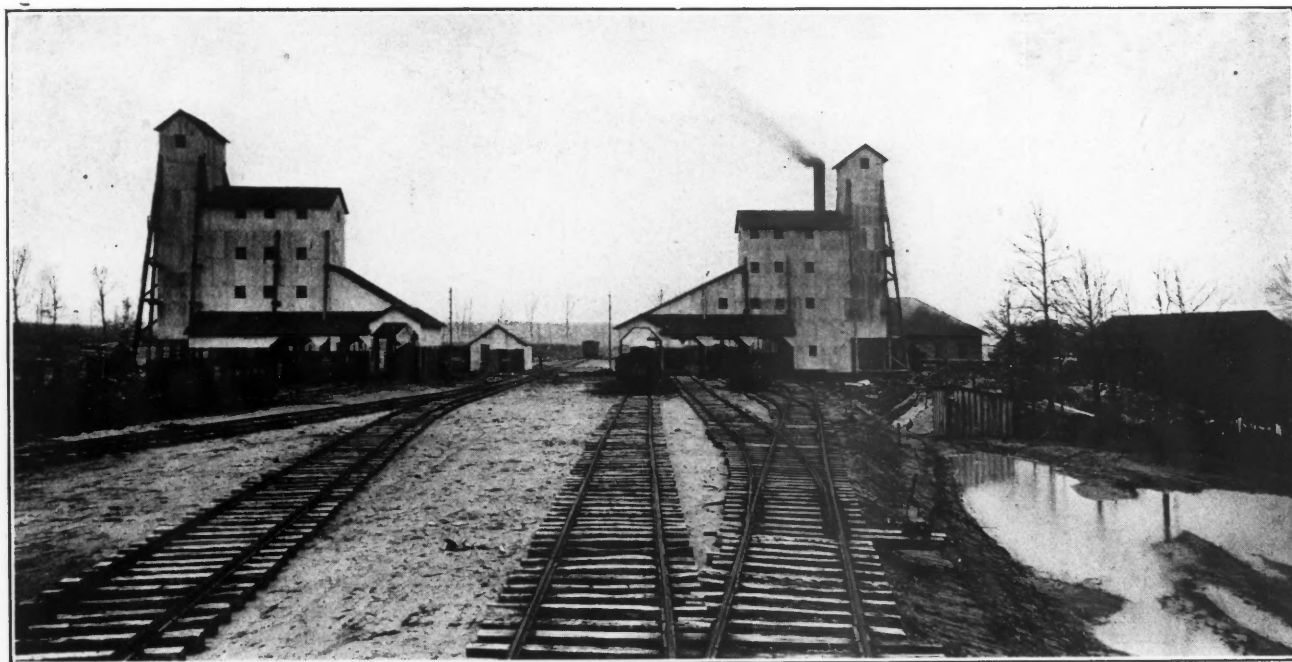


FIG. 1. VIVIAN NOS. 1 AND 2 MINES, SOUTHERN INDIANA COAL COMPANY

the western boundary of Greene county, Indiana, and operations are being carried on in the No. 5 seam of the Indiana coal, the product being used principally for steam purposes. The thickness of the seam varies from 6 to 8 ft., and lies at an average depth of about 75 ft. from the surface.

Above the coal bed is a layer of hard slate varying in thickness from 4 to 8 ft., and above this cover is a bed of limestone, which stratum affords an excellent roof for mining purposes. The underlying stratum, or bottom of the seam, is hardly less favorable since it consists of a strong fire-

the cross entries, with 45-ft. centers. All chambers are slightly necked and are 35 ft. wide, which leaves a 10-ft. pillar between. On those entries where mule haulage is employed, the track is provided with 16-lb. rails, while 35-lb. steel is used on the roads where the motors are run. The rooms in general are supplied with 12-lb. steel rails for track, each chamber having two roads, one branching off from the other inside the neck of the room. Each track is laid about 6 ft. from the rib, thus dividing the distance for the handling of the coal from the face to the car.

the face of each room by a mule which then brings out the loaded car on his return trip from the chamber. When each room is worked up to the required distance, the props are often drawn for use in other places, which practice on the part of the mine officials is rare in the operations of this district. The accompanying mine map, Fig. 2, shows the extent of the mine workings and the plan of development. It is the practice of the engineering department now in charge to place centers in all rooms as well as entries, and guided by this system of driving everything on line, it is expected to extract the

maximum amount of coal without incurring a serious squeeze.

THE LOST CREEK MINE

The Vandalia Coal Company is one of the largest operators in Indiana and Illinois, having been formed by the consolidation of a number of independent companies. The Lost Creek mine, called Vandalia No. 69, is not typical of the operations carried on by that company, and is here presented because of the difficult mining problem involved. The property is located near the city of Terre Haute, and can be reached by the Interurban trolley. The surface plant, shown in Fig

5, is in most particulars similar to the many other small mines in this district.

The power plant is equipped with three return tubular Fulton boilers, while the hoisting is accomplished with a Litchfield engine, operating a 6-ft. drum. In hoisting the coal a 1¼-in. Roebling twisted-wire rope runs over a 7-ft. sheave. The shaft is 115 ft. deep, and has a daily production of about 100 tons, although the mine has produced when working full capacity, 700 tons per day.

The ventilation is furnished by a Litchfield 12-ft. reversible fan, operating as a blower. This plenum system is preferred because the shaft is wet, and to draw the

air down the main shaft would cause ice to form on the guides and cage, retarding operations during the winter months. The fan runs 60 r.p.m. and circulates about 20,000 cu.ft. of air per min.

METHODS OF MINING

The coal seam at this operation averages about 5 ft. 6 in. in thickness, and has a hard roof, being overlaid with a 45-ft. stratum of sandstone. The bottom is of soft clay, which makes the problem of mining both unusual and difficult. The general dip of the seam is in a northerly direction, but locally the coal bed is crossed by small rolls. None of the coal

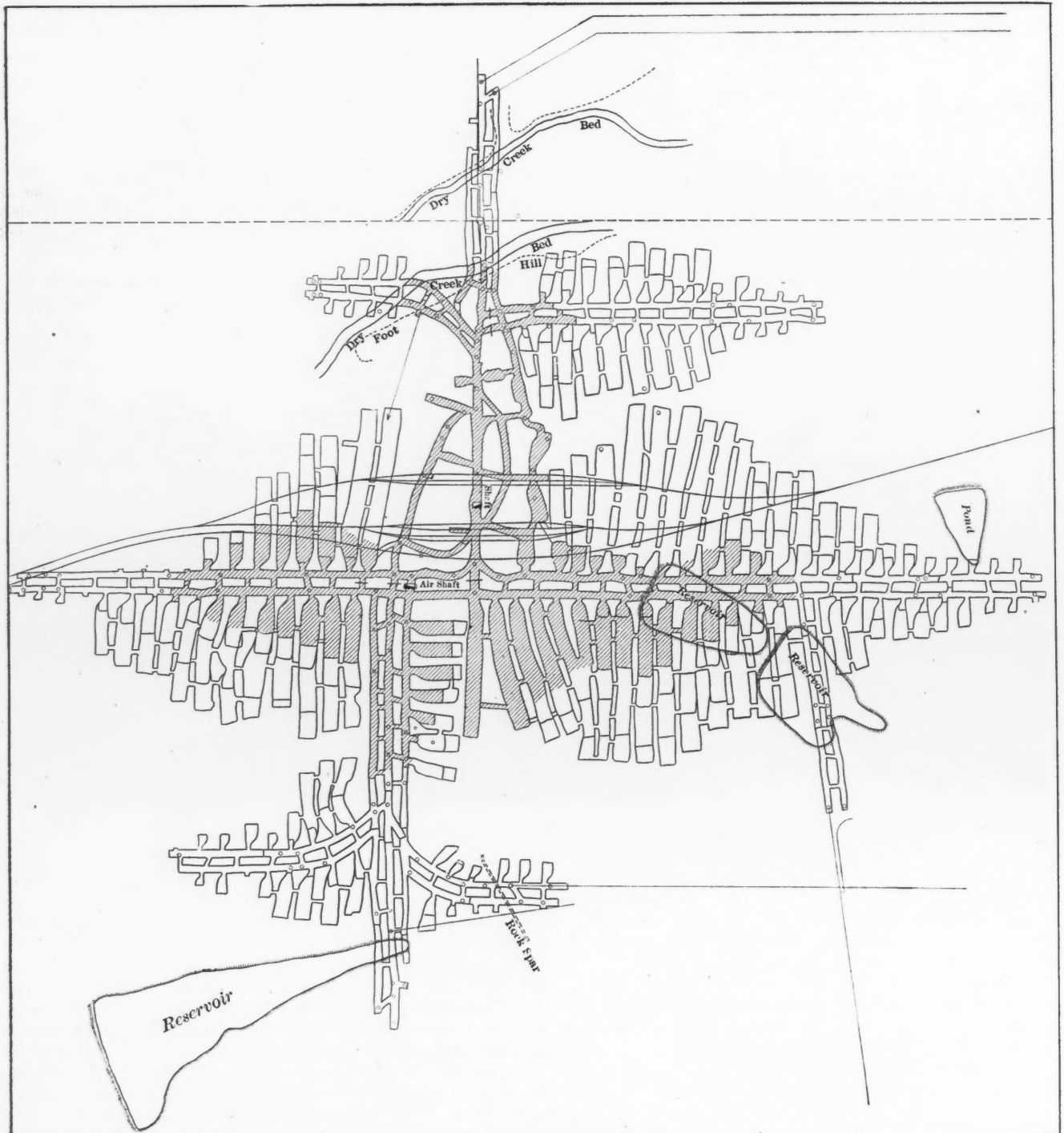


FIG. 2. TWIN MINE NO. 5, COAL BLUFF MINING COMPANY, TERRE HAUTE, INDIANA

is washed, although it contains several small streaks of blackjack, and a small amount of sulphur.

It was formerly the custom, as is usual throughout this field, to turn all rooms and entries at right angles, driving the rooms at regular intervals. The entries were made 7 ft. wide, and the rooms 24 ft. in width. The nature of the heavy, hard top and soft bottom prevented this system from meeting with success, and resulted in driving the pillars into the bottom stratum, causing a serious squeeze, closing in twelve entries, and causing the loss of 320 acres of coal.

PROPOSED NEW SYSTEM

In this serious squeeze that occurred,

after the coal has been removed. By this method, which is really the panel system on a small scale, it is hoped to prevent further squeezes and to secure a greater percentage of the seam.

Before the squeeze occurred, the mine employed 120 men, but has since used only 22 miners underground. Considerable water is encountered in the workings, and three small pumps are required to handle this flow. The present operators expect to install mining machines and electric locomotives, the dynamo for same having already been placed.

SOUTHERN INDIANA COAL COMPANY

On the Southern Indiana Railway, in Clay county, two miles northeast of Ja-

show that at Vivian No. 2, each machine produced on an average about 27 tons per day, figuring on a period of time extending over 12 months.

As to the composition of the coal in this district, an average analysis shows: Volatile matter, 38.40; fixed carbon, 45.50; ash, 9.80; moisture, 6.30. The coal is rather high in sulphur, but does not clinker to any objectionable degree.

MINERS' WAGES

The coal that is hoisted from the Indiana mines is often run over a 1¼-in. screen into the hopper, where the product is weighed and paid for by this weight. It is estimated that the run-of-mine coal loses about 50 per cent. in passing over

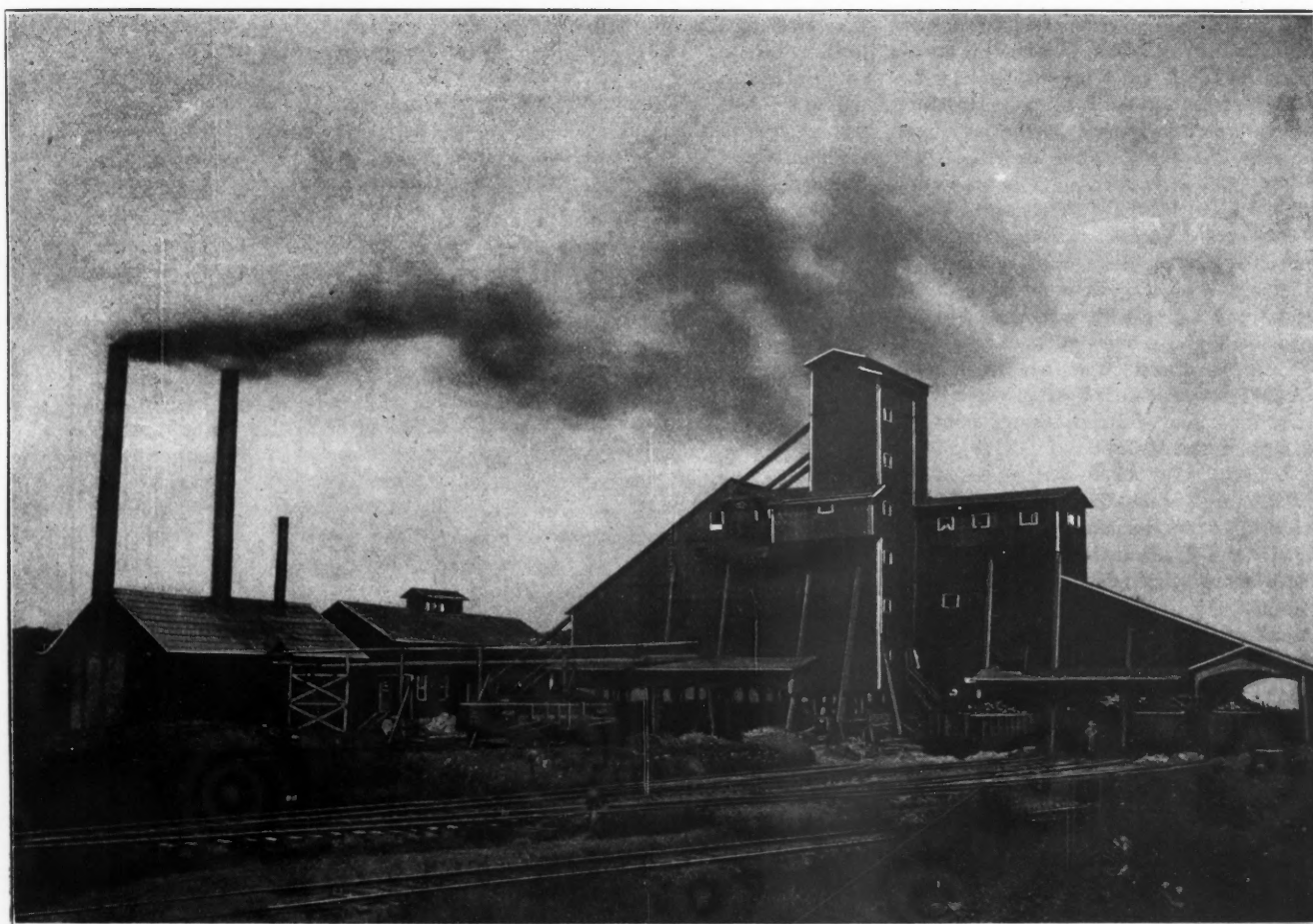


FIG. 3. TWIN MINE NO. 5, COAL BLUFF MINING COMPANY

the action was so slow that none of the miners was injured, and sufficient time was allowed to permit the withdrawal of all timber and iron. After much consideration on the part of the management, it is probable that the future method of operation will be to drive four rooms, leaving a 6-ft. pillar between each two rooms, and then after the fourth room, leave a solid block of coal 120 ft. wide, again driving four rooms beyond this. After the limits of the property have been reached in this manner, the retreat will be carried on by the longwall system, thus allowing the roof to cave in

sonville, are located the double-tippie mines of the Southern Indiana Coal Company. These operations, shown in Fig. 1, are destined to become large producers, and are now shipping from 1000 to 1500 tons per day.

The mines are known as Vivian Nos. 1 and 2, and were formerly the property of the O'Gara Coal Company. The present output is from the No. 4 and No. 5 seams, which produce a fairly good steam and domestic coal. The bulk of the production is mined with electric chain machines, while mules are used to gather the coal from the rooms. Recent statistics

this first screen. The lump coal in the hopper is paid for at the rate of 90c. per ton, which therefore makes the run-of-mine cost about 45c. per ton. In the No. 11 district, where typical conditions exist, the miners' agreement states that if the coal seam is less than 3 ft. 3 in., and more than 2 ft. 9 in. in thickness, the rate of pay shall be 98c. per ton of screened lump or 64c. per ton of mine-run. If the seam is less than 2 ft. 9 in., and more than 2 ft. 6 in., the price shall be \$1.06 for screened lump, and 65c. for mine-run.

MINE TIPPLES

The system of preparing the product at

most of the mines in Indiana is based on the same general principles. In hoisting the coal, the usual plan is to operate a self-dumping cage, arranged as shown in Fig. 4. The detailed system of screening is also shown in this illustration, as well as the hopper for weighing the coal. In many instances, the coal is dumped and run over a 1¼-in. screen, thus separating the product into only two sizes; the over-size being caught in the weigh hopper, and paid for as screened lump; in other instances the large screen leading to the hopper is covered with steel plates, so that all the coal passes into the hopper and is weighed and paid for as run-of-mine, afterward being separated into four sizes by the shaker-screen equipment.

Many operators wisely prefer to have the shaker screens supported by a separate framework, and unattached to the main building, thus preventing any unusual strain on the general structure, which would be caused by the jar of the screens.

SUMMARY

The coal operations in Indiana are confined to 14 counties located entirely in the southwestern part of the State. The total output during the past year was approximately 10,000,000 tons, coming from about 200 mines. The famous Indiana block coal is produced in but three counties, the town of Brazil being about the center of this district.

There are 30 block-coal mines, 6 of which are equipped with mining machines; of the remaining 170 bituminous operations, 83 are machine mines and produce about 49 per cent. of the total coal output. As to the use of powder in the mines of this State, it has been found that

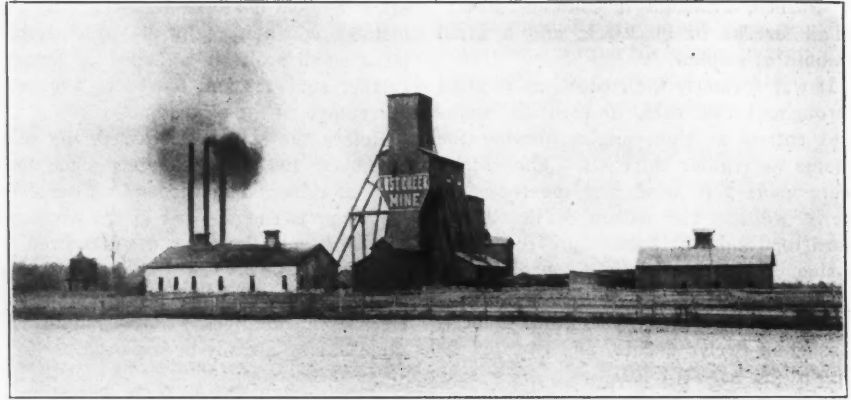


FIG. 5. VANDALIA MINE NO. 69

each keg of powder used produced 25.7 tons of coal; this means that in the production of each ton of fuel, the powder consumed cost 6.8c. For the map and data concerning the Twin No. 5 mine, I am greatly indebted to W. G. Spears, chief engineer of the Coal Bluff Mining Company.

According to *Cosmos*, an engineer of the Witkovitz society, Ostrau, has invented a liquid-air miner's helmet. A Breslau mining engineer was able to remain half an hour in a poisonous atmosphere, composed of coke-oven gas, without any ill effects. The apparatus is sim-

ple, having no valves and consists of a metal box containing an asbestos sponge saturated with two or three liters of liquid air. The latter evaporates and is conveyed to a mouthpiece. The carbonic acid exhaled congeals at a relatively high temperature, is solidified in a conduit which passes through the liquid-air receptacle, and the respirable air can again be utilized.

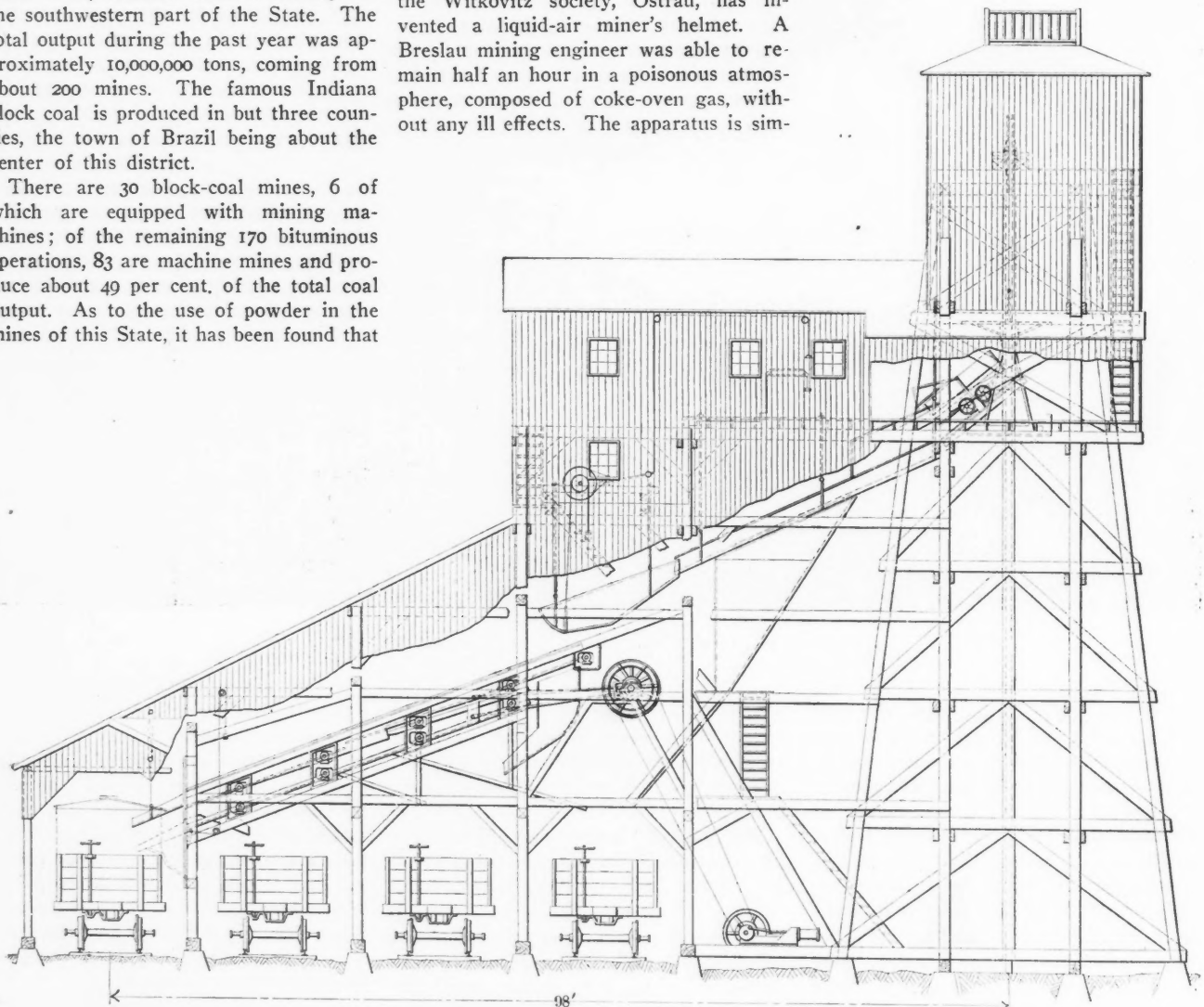


FIG. 4. GENERAL TIPPLE, WEIGHING AND SCREENING ARRANGEMENT; COMMON IN INDIANA

New Discoveries in Northern Quebec*

By J. OBALSKI†

Since last summer a number of prospectors have been in the field exploring the Chibogomo district, the valley of Bell river and the north of Pontiac county. In many cases the parties were formed under the auspices of small syndicates, the expense of traveling in these remote regions being considerable. In consequence of these investigations rather more is now known concerning the mineral potentialities of these areas, and this knowledge is strongly corroborative of the opinions previously expressed by geologists in charge of reconnaissance surveys. The writer last year personally visited the regions between the Hanicanaw river and Lake Abitibi.

In the Chibogomo district some work has been done on the big quartz vein of Portage island, showing the continuity of the vein at depth and its larger mineralization in the form of chalcopyrite. This development includes a number of open cuts on the vein, covering a distance of about 1000 ft., and the sinking of a shaft to a depth of 35 ft. From tests made the value in gold and silver appears to be greater than previously supposed. In the northwest section of McKenzie bay new discoveries of asbestos are reported, while northwest of Island bay magnetic iron has been discovered. Some large bodies of pyrrhotite carrying high copper values have, moreover, been found northwest of Lake Dore.

Northeast of Lake Assinibastot and southwest of Chibogomo river, cobalt bloom was recently discovered, but too late in the season for the significance of the find to be ascertained. The discovery, however, is seemingly confirmatory of opinions expressed by A. P. Low and J. E. Hardman regarding the similarity of the geological formations here to that of the Cobalt area. It is probable that the district will be well prospected during the coming summer and other important discoveries will doubtless be made. Meanwhile a good winter trail is now completed from Lake St. John to Chibogomo.

In the north of Pontiac the writer has explored from the Baie des Guize, following the Ottawa and Kinonge rivers, Lake Kewagama, Lake Askikwaj and northward down the Hanicanaw river 20 miles north of the proposed route of the Transcontinental Railway and thence to Lake Abitibi, White Fish river and south to the Baie des Guize. Outcrops of Laurentian gneiss occur south of Askikwaj lake, north of Kewagama lake, north of Long bay of Kinonje river and south of the Height of

Land on the shore of Lake Opasatica. The area south of that line is not all Laurentian, bands of Huronian being found in several places, as shown in Dr. A. E. Barlow's map of 1899. The country crossed by the Transcontinental Railway is covered by a thick layer of clay, but shows in places outcrops of rocks, undoubtedly of Huronian age.

The northeast shore of Lake Kewagama is Huronian, as is also the district around Askikwaj lake. Descending the Hanicanaw river, the same rocks outcrop for same distance; but further down the surface is covered by clay, with occasional outcrops of rocks. The exposures of rock down the river for the distance traveled of 40 miles, and also along the route of the Transcontinental Railway for 25 miles, were very few. Nevertheless, the rock in sight is Huronian, being diorite, serpentine, schist, and a granite similar to that found on the Height of Land, near Lake Opasatica. It is reported that chalcopyrite has been found on the shore of the Hanicanaw river, below the Transcontinental line.

In the serpentine above mentioned the writer has observed small stringers of asbestos. On the southern slope of the Height of Land, some molybdenite occurs, and it is reported that another deposit has been found in the big peninsula of lake Kewagama. In a more westerly direction, the country is rocky and less difficult to prospect, and no important discoveries have been made except in the vicinity of Opasatica lake. To the northeast of this lake, not far from the Height of Land, a very remarkable piece of quartz showing abundant visible coarse gold, was picked up, and exploration since has apparently resulted in the discovery of gold-bearing quartz in place. Two blocks of land have been purchased from the Quebec Government in that section, of which one was bought by the King of the North Gold Mines Company, recently organized to develop the property. The writer visited the district in July last, and although he did not see any visible gold in the quartz, he obtained good colors by panning the debris in the vicinity of the deposit. To the south of lake Abitibi and close to the shore, the party found some rock containing gold, and the fact was ascertained that rock of the same character, also showing gold was here *in situ*. Some indications of chalcopyrite have also been found close to the boundary line, not far from the 35th mile.

A number of lots have been prospected in the surveyed townships near Timiskaming lake, and a large variety of minerals found there, including galena, iron pyrites, copper pyrites containing some gold, cobalt bloom, and iron; one undertaking, the Jessie Fraser Mining Company, purchased a block of land in Fabre township, on which a small steam plant has been installed. The geological form-

ation of these townships appears to be a succession of bands of Huronian and Laurentian not yet accurately determined. On Bell river, some prospecting has been done, but no new discoveries of importance are reported.

Last season the Geological Survey explored from lake Abitibi, toward the east, following the surveyed lines of the Transcontinental Railway. W. J. Wilson gives a summary report of this exploration in the last publication of the Geological Survey. Dr. A. E. Barlow also reports on the geology of the eastern part of Timiskaming district, but neither of these reports indicates the occurrence there of minerals of economic value.

Method of Platinum Mining in Russia

The working of the platinum deposits of Russia is described in the *Canadian Mining Review* for January, 1907. The districts where platinum occurs in commercial quantities are situated on the eastern watershed of the Ural mountains, the richest deposits lying around the river Iss. The area is largely composed of peridotites, olivine-gabbros and their serpentine productions.

The deposits are all of placer type, averaging 4 ft. in thickness and extending from 200 to 800 ft. on each side of the river. They have an overburden of turf, which varies in thickness from 5 to 20 ft. To extract the mineral the overburden is stripped off and the gravel transported to sluices or to mechanical washers, the latter being usually employed in working on a large scale.

The washer consists of a cylindrical tub, at the bottom of which is a circular iron pan, 15 in. deep and perforated with holes $\frac{5}{8}$ in. in diameter. Round the top of the pan runs an iron pipe, from which jets of water play into the interior. In the center is a vertical shaft carrying a stirrer, which revolves at the rate of 25 r.p.m. The gravel is fed continuously and the large stones remain on the pan, while the sands and clayey matter pass with the water through the holes directly to the riffle table. Washing is carried on uninterruptedly for about 11 hours. The concentrates are then washed on tables several times until reduced in bulk to a fine gray slime, from which the gold is removed by means of mercury. The residue is sold as crude platinum.

Within the last few years, says the *Northwest Mining Journal*, the raw cyaniding of arsenical ores from the Cascade region of Wyoming has been very successful and experiments on a small practical scale have shown that the extraction of gold can be run as high as 80 to 90 per cent., at an estimated cost of \$1.50 per ton at a 100-ton plant.

*Paper presented at the Toronto meeting of the Canadian Mining Institute, March, 1907.

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Belt Elevators for Ore and Water

The Troubles of Belt Elevators Handling Wet Materials and Expert Advice as to Methods for Overcoming Them

BY EDWARD S. WIARD*

The notes in this article are an outline of the writer's experience with these very essential, though at times troublesome, machines in wet concentrating mills. What he has to say, especially as to wear and tear, may not strike with much force those fortunate millmen whose experience with this type of machine has been confined to elevators of low lift and of a capacity ample to raise a moderate burden of fine material. Such an elevator gives little trouble.

A COMPARISON

The writer at one time had in charge an elevator raising about 100 tons of ore in 24 hours, ranging in size from 4 mm. to 0 mm., to a height of 43 ft., and the belt and buckets, after being in continual service for four years, deducting occasional periods when the mill was shut down for repairs, and not exceeding 48 hours, finally fell into the boot.

It was almost a forgotten machine in the mill. Evidences of much wear were lacking, the belt giving way from the deterioration of the rubber and the breaking of the threads of the plies from much passing around the head pulley. In the same mill was an elevator which every 24 hours raised about 700 tons of ore ranging in size from 60 mm. to 0 mm., and was a constant source of trouble. Its belt could not be depended upon to last longer than six months.

These two elevators serve admirably for comparing the factor of wear due to size and quantity of material, the height, speed, quantity of water raised, etc., being very nearly the same in both. Data for these two elevators as well as for the other elevators mentioned in this article will be found in a table at the end of this article.

Elevator belts are generally of what is known as special belting, a belt with an extra heavy coating of rubber. The net prices for the various widths and plies of the highest grade with the heaviest cover, at Denver, are shown in the following table.

ELEVATOR BELTING—PRICES PER LINEAR FOOT.

WIDTH, IN.	PLY.					
	4	5	6	7	8	10
12	0.96	1.20	1.44	1.68	1.92	2.40
13	1.05	1.31	1.58	1.83	2.10	2.62
14	1.14	1.42	1.72	1.98	2.28	2.84
15	1.23	1.53	1.84	2.15	2.46	3.06
16	1.32	1.64	1.98	2.30	2.64	3.28
18	1.49	1.86	2.24	2.61	2.99	3.72
20	1.67	2.09	2.51	2.92	3.34	4.17

*Consulting engineer, Boston building, Denver, Colo.

Rubber deteriorates rather rapidly with age and for this reason an elevator belt is made up by the manufacturer upon receipt of an order for it. Belts subjected to extra hard wear cannot be depended upon to last longer than six months, and as three months will usually elapse between the receipt of the order by the manufacturer and the arrival of the belt at the mill, it is a good plan to order a second belt immediately upon the arrival of the first one. Not infrequently, owing to the exasperating delays in receiving elevator belts, the millman is forced to keep in use a belt that should properly be on the scrap heap.

On receiving a new belt the rubber should be carefully examined. The millman will prefer a tough, whitish rubber offering considerable resistance to compression by the thumb. A piece of the rubber, after being stretched, should promptly assume its original shape. Any shortness or permanent distortion of the rubber, especially when accompanied by softness and a brownish black color, should be looked upon as evidence of unsoundness. The extra coating of rubber on the back or pulley side of the belt is of very little service in belts subjected to hard wear. Particles of ore lodging between the boot pulley and the belt are driven into the rubber and soon loosen it. The writer has frequently had to remove the entire back coating from belts which had been in service only a few weeks.

POWER REQUIRED

It is possible to arrive at a very close approximation of the power required to drive elevators under normal conditions, but it must be remembered that elevators are frequently subjected to sudden and severe shocks, and this factor must be considered in estimating the power required to drive them.

The ordinary millwright usually pays no attention to the question of the power required to drive an elevator other than to assign an arbitrary horse-power, usually ten. Calculations will be entered upon here to determine the horse-power required to drive the elevator shown in Figs. 1, 2, and 3, the details of which will be found in column 4 in the table at the end of the article. This is an elevator of extraordinary size. The writer has frequently stood over the hood and watched this elevator discharge. The buckets came up in a steady line and were filled with ore and water to within 1 in. of the top. There was a heavy overflow from the boot and the aim was to

raise as much water as possible with the tailings for the purpose of sluicing. The buckets were 8x18 in. of the "AA" form and held 9.4 liters when filled to within 1 in. of the top.

The total length of the belt was 126.33 ft. and the number of buckets with 20-in. spacing was 75; 350 tons of rock were raised in 24 hours. This weight multiplied by 56.91 ft., the vertical lift, gives the number of foot-pounds of work per day, or 27664.5 foot-pounds per minute. The bucket holds, when filled to within 1 in. of the top, 573.62 cu.in.

The elevator delivers 486.11 lb. of ore per minute and the number of buckets passing any point per minute is 297; consequently the ore per bucket is 1.64 lb. and occupies 16.43 cu.in., on the assumption that its specific gravity is 2.8. Deducting this volume from 573.62 cu.in., the capacity of the bucket, we have 559.09 cu.in. of water which weighs 20.13 lb. This weight multiplied by 297 will give the weight of water raised per minute and this multiplied by the lift will give the theoretical number of foot-pounds required to raise the water.

	Foot-pounds. (per min.)	Horse-power.
Ore.....	27,664.5	0.84
Water.....	340,242.69	10.31
Total.....	367,907.19	11.15

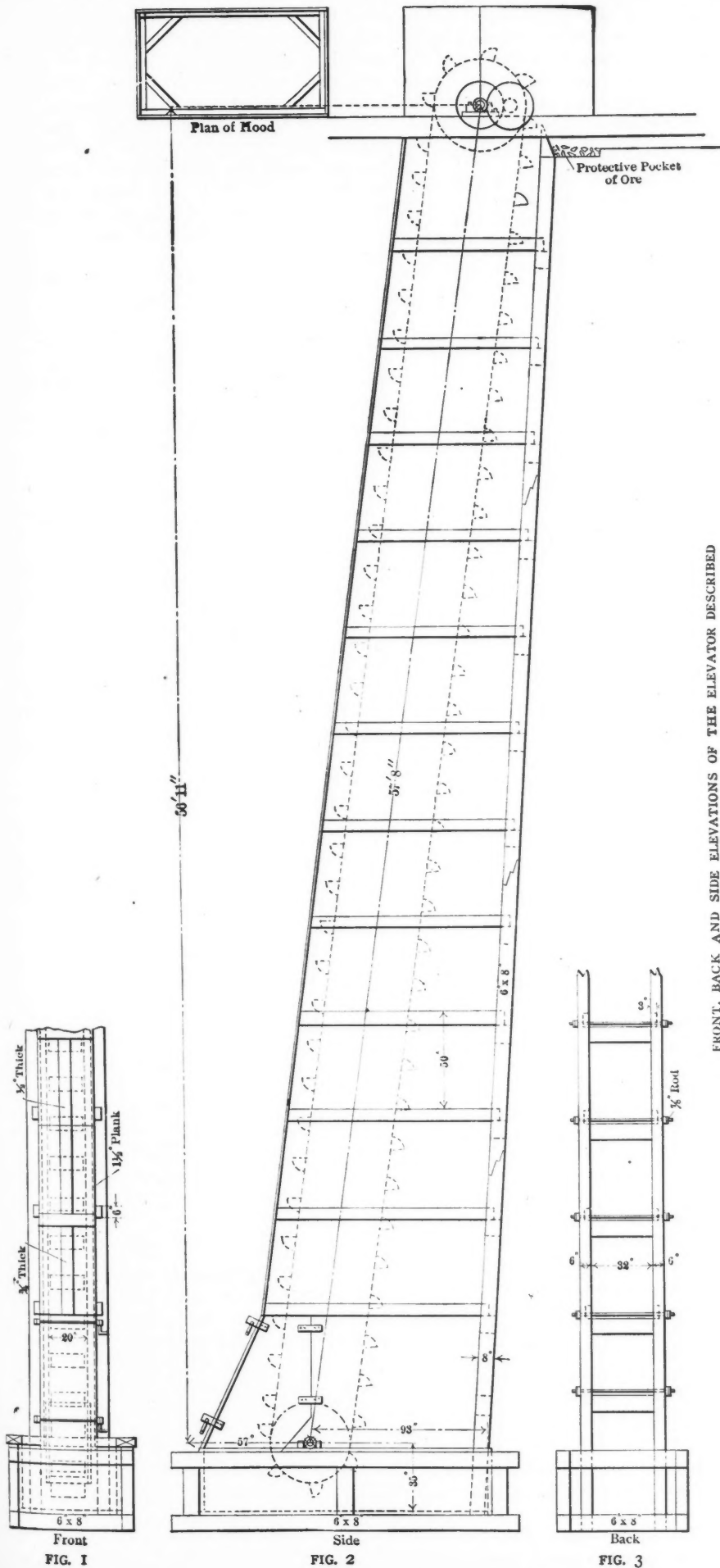
The water elevated is 716 gal. per minute or 1,031,040 gal. per 24 hours. Assuming that of the total power required to drive the elevator, 30 to 33 per cent. is used in shaft friction, the normal horse-power required would be about 15.

TENSION ON BELT

The strength of rubber belting is about 4000 lb. per sq.in. A 20-in., 10-ply belt will therefore break under a load of about 40,000 lb. The tension in the belt due to raising the ore and water will be,

$$T = \frac{h.p. \times 33,000}{V}$$

where V = velocity in feet per minute, and h.p. = theoretical horse-power. This, in the elevator under consideration, will amount to 741.5 lb. Neglecting the inclination of the elevator as it is so nearly vertical, we must add one-half the total weight of buckets and belt and, say, 300 lb. for the tightening tension applied when the belt is bolted together, giving as a total maximum tension at the head pulley, 2341.5 lb. The belt weighed 1100 lb., the buckets 20 lb. apiece. This gives a factor of safety of 17.1 when the belt is new. For this particular elevator this factor seemed to be sufficiently large.



FRONT, BACK AND SIDE ELEVATIONS OF THE ELEVATOR DESCRIBED

BOOTS AND HOUSINGS

Metal housings, boots and hoods are seldom used in ore mills. They do not adapt themselves to the wooden construction in vogue in western mills, are difficult to repair and their first cost is great. Certainly the forms of housing and boots used in the grain trade, and confidently proposed for use in ore mills, would not answer for elevating wet ore. This is especially true if the elevator is given a slope, for in that case the back must be vertical or nearly so in order to prevent undue wear of the housing. This will necessitate a long boot.

The boot should be wider than the casing so as to allow the bearings to be placed entirely outside the housing proper. The boot should be of such a size that sufficient ore can accumulate around the sides and bottom to protect the lining from the wash of the elevator. In an elevator having an overflow, a roomy boot will help to check the flow of material from the entering spout. All the rock will then be elevated and as much as possible of the water. A boot pulley 24 to 30 in. in diameter is sufficiently large for most elevators.

The rim and the rim end of the spokes should be cast extra thick since these are the places of greatest wear. The boot boxes should be covered if possible as an additional precaution against the entrance of grit. It is a custom among millwrights to place the boots of elevators below floors or in the darkest corner to be found, whereas, if possible, they should be exposed to the light on all four sides. Necessarily when in a dark and disagreeable situation, the boot bearings are neglected. A well designed and accessible elevator can be kept in as well ordered a condition as any machine about the mill.

Although he has never seen it tried, the writer believes that four bonnet-shaped collars, together with the placing of the bearings outside the housing, would amply protect them. In many mills the entrance of water between the shaft and the babbitt of the boot boxes is so great that it is impossible to keep the journals and bearings greased, in fact no attempt is made to do it. With a bonnet collar the coat of grease which would accumulate between it and the box would materially assist in keeping out sand.

VERTICAL AND INCLINED ELEVATORS

The necessity for using tightening devices is a serious objection to vertical elevators; they must also be run faster in order to discharge with the same facility as an inclined elevator. It is impossible to keep these tightening devices in good working condition. A hinged boot of the size needed for wet elevators would be a very cumbersome affair to handle, but is very serviceable for elevators of small size, which have a tendency to stall, or for making repairs. With a stationary boot provided with a number of plugs of ample

size, it is a matter of only a few minutes' work, aided by the water from a high-pressure hose, to free the pulley and buckets. If possible a line of hose attached to a high-pressure cock should be provided near all elevators that are subject to being stalled.

Elevators fed from the side should be provided with heavy plates of iron on the bottom to receive the impact of the ore. If a Blake form of crusher is used, the old worn plates will serve admirably for this purpose.

An elevator fed from the front, at first glance, appears to be far more efficient than one fed from the side; but, as has been pointed out elsewhere, a certain amount of ore must necessarily be thrown from the buckets which has to be scooped up from the boot. Elevators fed from the front cause less wear on the boot pulley, less wear on the corners of the buckets and less attack on the back of the belt due to ore being forced in between the pulley and the belt. The writer is inclined to advocate a front feed for fine material; but for coarse material, especially if the elevator is overdriven, the wear on the front side of the belt would more than offset the advantages enumerated. It is also necessary for material fed from the front to enter high, causing a loss of head room and making it rather difficult to protect the bearing from grit.

IMPROVED HOUSINGS

The housing shown in Figs. 1, 2, and 3 is the result of the experience of many millwrights and millmen. The back timbers are the only ones that enter the boot and they are at the rear end, out of the way. The doors which swing back above the bearing are the only parts of the elevator that are ordinarily necessary to open in making repairs, but if any further opening is desired, only boards need be removed, no framed timbers being in the way. The whole front of the elevator from top to bottom can readily be removed. Fig. 1 shows that it consists of 8-ft. sections screwed to the ends of the casing. The lowermost section of the front and the two doors are held securely together when the elevator is closed, by the device shown. Each door contains two lugs firmly secured at the top and the bottom. These are bored to receive the threaded rods shown. When the elevator is closed the rods are run through the lugs and plain nuts are screwed on the left-hand end. The right-hand nuts, to which have been welded handles, are then screwed on and the doors are tightened to place. The boards of the casing proper are 1½ in. thick and were grooved for tongues at the sawmill. Wherever possible the elevator casing was secured to the timbers comprising the mill frame. No foot support was found necessary for the side and front of the casing. The back timbers at the top are framed into the heavy timbers supporting the upper

bearings, the weight of the upper pulley, and the belt and buckets. These timbers in turn rest directly on the timbers of the mill frame. The diameter of the upper pulley in this elevator was 48 in. and the speed of the belt about 500 ft. per minute.

DIAMETER OF PULLEY AND SPEED

Nothing is to be gained in gripping power by increasing the diameter of the head pulley or widening the belt and the face of the pulley, the load remaining the same. But, as will be shown later, the tendency to break the plies of the belt increases as the diameter of the pulley is reduced. Since the centrifugal force would diminish as the diameter of the pulley was increased, the belt speed remaining the same, there would finally arrive a point in increasing the diameter of the head pulley, where the buckets would not discharge cleanly into the receiver.

The writer's rule for the minimum speed at which the belt should be run is four times the diameter of the head pulley in feet multiplied by one hundred. This would give as a safe speed for a 36-in. pulley 300 ft. per minute, for a 48-in. pulley 400 ft. per minute, etc. A much higher velocity than the safe speed is allowable. Elevators with head pulleys of ordinary diameters, 30 to 40 in., have been run with belt speeds as high as 650 ft. per minute on dry material.

By increasing the diameter of the head pulley we are enabled to increase the belt speed and hence the capacity of the elevator, and reduce the belt tension without unduly increasing the centrifugal force. With curved buckets and so mobile a substance as ore and water, there is no danger of material being carried back to the boot by the adhesion of the ore to the face of the bucket from centrifugal force. The effect of increasing the speed of the belt, as the writer has observed, has been to cause the ore to rise in a higher crested curve and to land farther back in the receiver pocket.

The elevator illustrated in this article threw the ore and water in a beautifully curved stream to the far or discharge end of the receiver pocket. The wear on the receiver iron was small and no coarse ore fell back into the boot. On placing the hand into the stream of ore descending into the receiver, one finds that there is a gradation from water, at the top of the stream, to the coarsest ore nearer the buckets. This seems to indicate that an elevator raising coarse material should run faster than one raising fine. The elevator illustrated in the article raised tailings from 40 mm. to 0 mm. in diameter. The writer advocates adding 100 ft. per minute to the minimum-speed rule given above.

RECEIVERS, PULLEYS AND BUCKETS

As to the placing of the receiver iron no rule would be complete without taking into account the speed of the belt, the diameter of the upper pulley, and the size

and weight of the ore particles. The writer fails to see what advantage is to be gained by placing the edge of the receiver iron much below the center line of the pulley. If the elevator discharges properly, 12 to 16 in. should be ample. Discharge from a vertical elevator into the receiver cannot take place after the bucket is completely reversed. The receiver iron is placed on a slant to prevent the accumulation of ore at the bucket end of the pocket.

The head pulley should be forced on its shaft as well as keyed. Owing to the sudden shocks to which many elevators are subjected, ordinary keying is not sufficient to keep the head pulley tight. The hood for the receiver is made in two pieces and is open at the top, the two sections fitting snugly around the shaft. The front section is tapered at the forward edges, the point being inside so that the splash of the elevator will not be cast through the opening. The two sections can of course be readily removed. It is a very great advantage to be able to look into the elevator and to be able to hear the warning sounds which it gives out. A heavy eye over the top of the elevator is a very great convenience in changing pulleys and shafts and in making repairs. The buckets used for elevators are of steel and malleable iron of the "AA" or deep form. For elevating fine ore the lightness of the steel buckets makes them preferable. Malleable-iron buckets are 3/16 in. thick. The steel buckets are of varying gage from 23 to 12, the thickness increasing with the size. The seamless steel bucket is much to be preferred to the riveted type.

DIMENSIONS OF MALLEABLE-IRON ELEVATOR BUCKETS.

Length, In.	Width, In.	Depth, In.	Approx. Capacity.	
			Cu. In.	Gals.
10	6	5	160	0.61
11	6	5	176	0.66
10	7	5.5	210	0.78
12	6	5	205	0.75
14	6	5	235	0.88
12	7	5.5	260	1.00
14	7	5.5	310	1.16
16	7	5.5	360	1.35
18	7	5.5	410	1.53
12	8	6.5	350	1.31
14	8	6.5	415	1.55
16	8	6.5	480	1.79
18	8	6.5	515	2.03
18	9	9	710	2.63

In ordering a new lot of buckets it is wise to send a templet showing the spacing desired for the double row of holes through which the elevator bolts pass.

	Number of Teeth.	Width of Face, In.	Bore, In.	Hub.		Arms.
				Width, In.	Dia., In.	
Pinion.....	15	4.0	1 1/8	.....	.....	.....
Gear.....	60	4.0	3 1/8	5 1/2	6 1/2	6
Pinion.....	12	4.0	2 1/8	.....	.....	.....
Gear.....	48	4.0	3 1/8	5 1/2	6 1/2	6
Pinion.....	18	5.0	2 1/8	.....	.....	.....
Gear.....	60	5.0	3 1/8	5	7 1/2	Web.

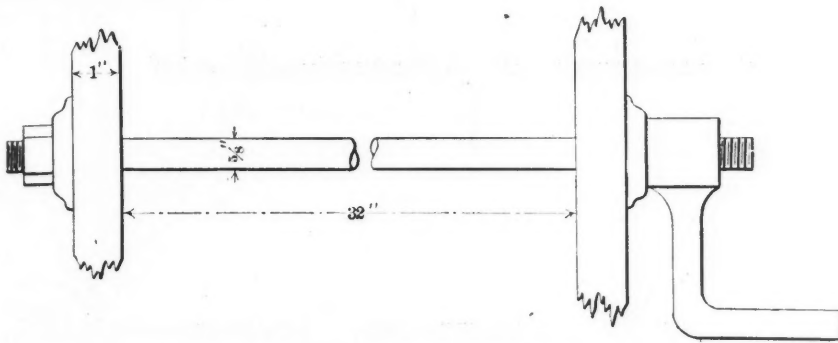


FIG. 4. DEVICE FOR HOLDING DOORS IN PLACE

The gearing to be found in mills is generally of cast iron. The accompanying table shows three examples of gear wheels and pinions, and may be of service to those constructing elevators.

Elevators of moderate length can be driven directly with a belt.

MOUNTING THE BELT

The belt is received at the mill in a coil securely sewed up in burlap. If it is to be put into place at once a piece of pipe is slipped through the center and the pipe and belt are suspended on a pair of horses. Horses are set out at regular intervals, on which is placed a line of boards. The belt is then dragged out on the boards, the pipe which serves as a shaft being prevented from advancing by a couple of cleats nailed on the horses. When a good part of the belt is stretched on the boards, it is laid off in equally spaced distances with a pencil and carpenter's square. The writer generally made the distances equal to the width of the belt from one bucket to another.

The effect of wear on the belt due to the bucket can be readily seen on any old belt lying on the scrap heap. Below the position occupied by each bucket is a deep scar due to the intensity of the scouring action in the boot on these parts, and the chafing of the buckets on the belt, the wear being accentuated by grit lodged between the buckets and the belt. Since the holes in the buckets are larger than the bolts, the buckets are able to shift about to some extent. As the buckets in passing over the upper pulley are thrown out by centrifugal force, the edge of the bucket presses into the belt and tends to break the plies. To a much less degree the backs of the bolts have the same effect. The

most dangerous breaks will generally be found just above the buckets.

Because of the effect of wear due to the buckets, and because of the smaller load on the belt with widely spaced buckets, the millman will put them as far apart as possible. It would seem preferable to space the buckets rather widely and increase the belt speed to get a greater capacity.

After the belt is laid off by equidistant pencil lines, a bucket edge is placed up to these lines, and the position of the bolt holes marked on the belt. For punching the holes only the best quality of punch should be used. Bemis & Call's punches, especially those with the extra long shank, are very serviceable. The No. 10 punch is the size generally used.

The operations of marking, punching, placing the bolts and buckets and screwing up the nuts can be done most rapidly by a number of men working in succession. The nuts are screwed on with the rounded face to the bucket. The stamping out of the blanks for the nuts leaves a bur which is not ground off by the maker. The brace for tightening the nuts is shown in Fig. 5.

SPLICING

If a scarf splice is decided upon, a cut is made across the end of the belt to the depth of the first ply, and at a distance from the end equal to the width of the belt, and the ply is torn off from the cut to the end. A cut is then made in the second ply at a distance from the first equal to the width of the belt divided by the number of plies, less one, and this is then torn off to the end. With this same width of step the lower plies are successively removed. Fig. 6 is a diagram showing the completed

scarfing for a 20-in. 10-ply belt. The writer's rule for obtaining the proper number of plies for the belt is to divide the width by two.

The writer prefers a butt joint with a covering piece equal in length to twice the width of the belt, as shown in Fig. 7. This form of joint is of course much stronger than the scarf joint and should be used on extra heavy belts. Its disadvantages are that a bucket placed on the covering piece is apt to catch on the receiver iron, or, if the covering piece is left blank, an undue strain is thrown on the bucket below the joint every time it dips into the ore in the boot.

Fig. 8 shows the method of bolting together the scarfed lap joint and the relation of the advance of the ends of the joint upon the head pulley. This is exactly opposite to the principle employed in splicing leather belts, the point being the last part to go on the pulley. There being often considerable slippage on the head pulley of an elevator, and it being

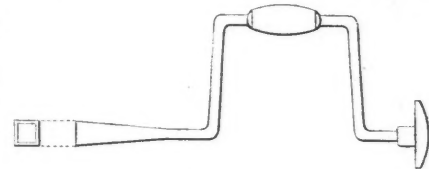


FIG. 5. BRACE FOR TIGHTENING BELT NUTS

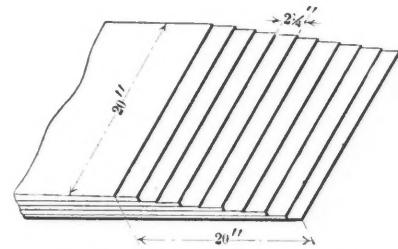


FIG. 6. SCARFING OF 10-PLY BELT

impossible to make a bolted joint lie smoothly, a slip of the belt, if the joint was the reverse of that shown in the figure, would cause the end of the belt to roll up. As shown in the figure, a slip of the belt would tend to lay the scarf piece smooth.

PLACING A NEW BELT

If the old belt is still in the housing, it will assist materially in raising the new one; for, if the new belt is attached to the old one at the boot, the latter, after being cut, will very nearly counterpoise the weight of the new one, and as the new belt is raised the old one can be drawn out. Large screw eyes should be placed at convenient points for holding snatch blocks. A rope can then be run over the head pulley and the ends dropped down through the casing and out at the wing openings at the boot, one end being secured to the end bucket on the new belt.

The other end passing out of the boot is caught on the snatch blocks and connected with the winch. Two men will generally stand at the wing openings to pass in the

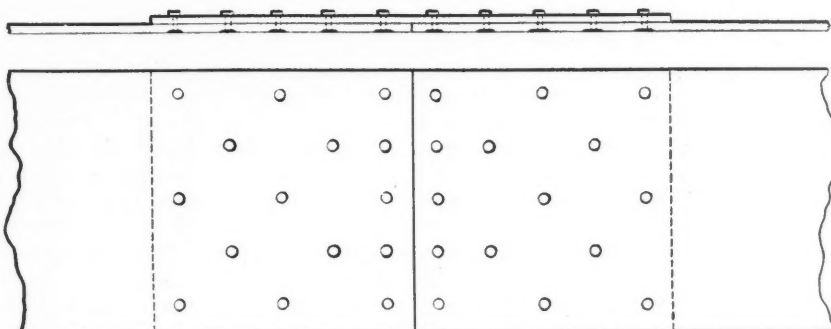


FIG. 7. BUTT SPLICE

belt, one at the head pulley to see that all is well at that point, and others will man the winch.

When the end reaches the boot pulley it is drawn up around it, and the clamps put on. Fig. 9 shows a belt clamp. A mill having a number of elevators should have three or four pairs of these clamps. For the heaviest belts a clamp with 1-in. rods with machine-cut threads should be provided. After the belt is stretched the superfluous belting is cut out and the joints are bolted together.

After the belt has been in service a short while the clamps will again have to be put on and another piece of the belt removed. If a scarf has been cut the unscarfed end is punched while in the clamps, one man holding a block behind the belt. The two ends are then laid together, and the posi-

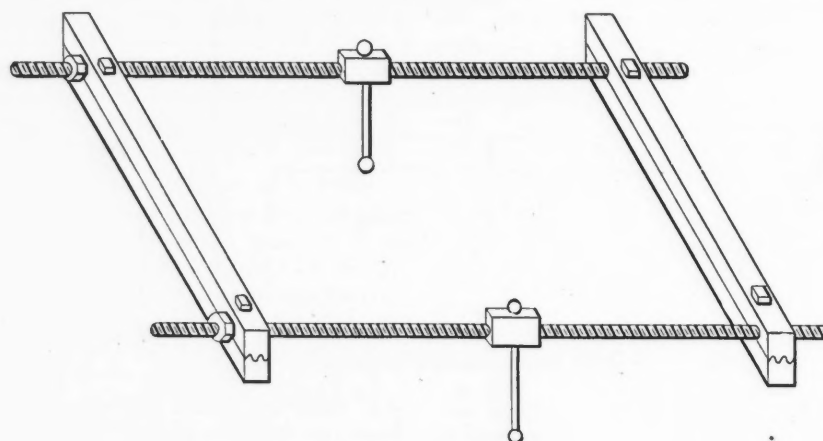


FIG. 9. ELEVATOR BELT CLAMP

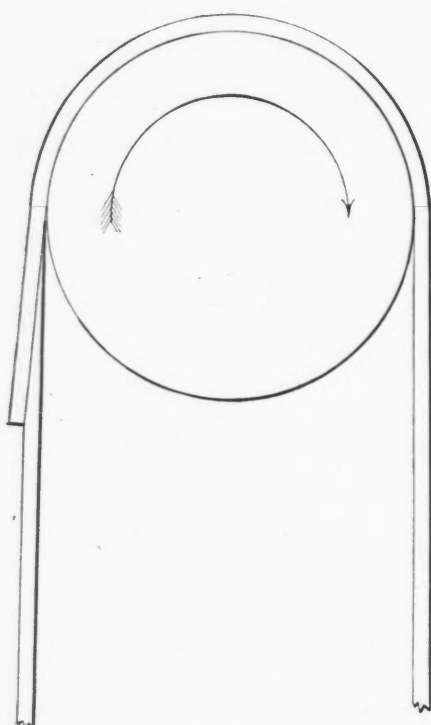


FIG. 8. ADVANCE OF LAP ON PULLEY

tion of the holes for the scarfed end are marked with red paint. The red paint consists of a little red lead mixed in linseed oil. The covering piece of a butt joint is punched before bolting into place. Wood clamps are convenient for holding the joint together while the belt is being marked.

PATCHING ELEVATOR BELTS

Patching is often resorted to to prolong the life of the belt. Not infrequently, owing to the great delays occasioned in getting belting, one is forced to prolong the life of the belt in use. The most dangerous breaks are the horizontal ones across the belt above a bucket. A break of this kind, which appears to penetrate only through the rubber, is often a number of plies deep. The back of the belt is often studded with pieces of ore, which

have been forced into the belt, giving the appearance, described by mill men, as "shot." Wherever needed the buckets are removed and a piece of new belting is bolted on to strengthen the belt. No task is so disagreeable as making repairs in a wet elevator housing or raising a fallen belt. The grit-laden drippings on the skin cause an irritation which is the acme of discomfort. While patching the belt is going on, an examination of the boot should be made for broken buckets or anything likely to stall the elevator. If the elevator is the one below the No. 1 rolls, bolts, pieces of drill steel and other iron brought in with the ore from the mine, may be found.

The receiver iron should be given attention. If badly worn it will allow ore to drop out into the boot.

BUCKETS

Elevator buckets dipping into ore wear down most rapidly at the corners. Buckets subjected to much wear and tear should be watched rather closely. After they are worn down to a certain point, putting on new ones will cause the elevator to stall or break the belt. The front of the buckets receiving no support from the worn-down corners is readily doubled up by any obstruction in the boot.

A bucket distorted outwardly is apt to catch on the receiver iron. The writer has seen heavy malleable-iron elevator buckets, of which all that remained attached to the belt was the back plate.

If the elevator is gear-driven, a spare pinion shaft, pinion and pulley complete, should be kept on hand near the receiver ready to be dropped into the boxes in case the teeth of the pinion are stripped or the pinion shaft is broken.

No. 1 elevator was subject to great and sudden shocks, Nos. 3 and 4 were subject to shocks, though in a lesser degree, and No. 2 was free from shocks.

The figures for the first set of gears, given in the table on gears, are for elevator No. 2. The second pair is for elevators Nos. 1 and 3, and the third set is for elevator No. 4.

A German company has been formed which is to exploit deposits of iron ore in Norway, says *Engineering*, of London. The iron ore is not of very high class and will have to be briquetted. The annual output is expected to be 200,000 tons, all of which will be consumed by the German firms who have acquired the deposits, and who are forced to pay the Norwegian government a considerable sum for their concessions.

FOUR ELEVATORS DETAILS AND OPERATION.

	No. 1.		No. 2.		No. 3.		No. 4.	
	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
Vertical distance between shaft centers.	47.83		42.77		31.67		56.92	
Vertical angle of line connecting centers of pulleys.....	8	20	11	6	5	7	7	34
Horizontal offset, inches per foot rise...	1.76		2.36		1.07		1.59	
Belt: Width, inches.....	16.0		16.0		16.0		20.0	
Number of plies.....	8.0		8.0		8.0		10.0	
Travel, feet per minute.....	440.0		440.0		440.0		500.0	
Buckets: Style.....	AA		Steel		AA		AA	
Size, inches.....	8x14		7x14		8x14		8x18	
Spacing, inches.....	16		16		16		20	
Tons ore raised in 24 hours.....	700		100		350		350	
Range of size of ore raised (mm.).....	60-0		4-0		40-0		40-0	
Tons water raised in 24 hours.....	601		601		2405		4305	
Gallons water raised per minute.....	100		100		400		716	
Head Pulley: Diameter, inches.....	40		40		40		48	
Face, inches.....	18		18		18		22	
Bore, inches.....	3 7/8		3 7/8		3 7/8		4 7/8	
Boot Pulley: Diameter, inches.....	30		30		36		40	
Face, inches.....	18		18		18		22	
Bore, inches.....	3 7/8		3 7/8		3 7/8		3 1/8	
Horse-power.....	3.50		1.68		4.89		15.0	

The Location of Smelting Works

The One-level Plan has Several Advantages as Compared with the Terrace Site. The Plant of the Future will be on Level Ground

BY HERBERT LANG*

The relative advantages of the side-hill or terrace as compared with the so called one-level site for smelting works were much discussed in the columns of this journal some years ago, as many readers will remember. It is an interesting question, but one that time and the experience of many builders alone can settle. Little of a really conclusive nature was said at that time, and it is scarcely probable that any converts were made to one side or the other. For my part I have always been an advocate of the one-level site, and as such I took part in the discussion; but at this late day it appears to me that neither side was presented in quite the proper light, or perhaps it may be that subsequent reflection has brought up new arguments more cogent than the former ones.

The experience of the iron-furnace men, whose widely extended operations require vast spaces for buildings, stock yards and the like, make decidedly against the terrace system, and we find them seeking, and in some cases absolutely making by filling in marsh lands and other apparently undesirable grounds, the large and level areas that they design to occupy. You never see them going to side hills to found their works. As to the lead, and more particularly the copper smelters, it seems to me that we can trace the gradual substitution of the one-level for the terrace idea, although the natural conservatism of engineers and a perhaps misplaced reverence for habit and tradition, have done much to keep them in the old-fashioned groove.

ALTERED CONDITIONS

The wide introduction of railways into mining regions and the extensive use of this means of transportation, together with certain other advances due to the progress of the times, have brought forcibly before metallurgical designers, and especially those who deal with smelting plants, several new and important considerations, and have given additional force to old ones. The most obvious effect of railway building upon smelting works in general has been their amazing increase in capacity, coincident upon their widened scope of usefulness, which now extends in some cases for thousands of miles. Several modern copper works, built or building, have a daily capacity of not less than a thousand tons of ore. The handling of this immense weight, implying as it does the handling also of a proportionate amount of fluxes and fuel, as well as of

the liquid products of the process, necessitates the use of mechanical appliances of corresponding power and range, and the discarding of the old and outworn apparatus of the past era.

The wheelbarrow and push-car age of metallurgy has departed, never to return. I think we may justly say the same of the side-hill or terrace plan of smelter location; for with the application of the railway to the transport of materials within the works themselves, and the necessity of having extensive level areas over which the rolling stock may be safely and rapidly run, the sloping grounds which were formerly almost invariably chosen as the preferable sites for such plants are now seen to present obstacles to the proper construction and development of the works.

The railway about the great steel and iron works of the East is no novelty, having for a long time been the chief means of handling the vast weights there dealt with; but even there the lay-out of the trackage does not appear to have been reduced to perfection. It is in precisely this feature that the terrace plan of smelting works is inferior to the one-level plan. In the latter, when properly laid out, all parts of the establishments may be connected together, and all the needs of transportation amply provided for by the simplest and most economical means ever discovered.

DISADVANTAGES OF GRADIENTS

It is practicable sometimes to join the different levels of the terraced works by the same means; but this implies gradients, or else the lifting bodily of the trains, or at least the cars, by means of elevators, usually hydraulic, and at an expense for installation which generally precludes the idea. We may, if the contour of the side hill permits, lay out our trackage so as to perform the elevating or lowering with the cars themselves; but no one who has ever had experience with grades about such works would fail to recognize them as a nuisance which it would be better to do without. At any rate, if we must have them they should be so laid out that the slope is away from and not toward the works, thus avoiding the imminent danger of runaway cars.

A side-hill plant, in order to get the amount of fall desirable, and to secure what are deemed to be the full benefits of gravity, must be laid out downward along the slope, or transversely to the contours. Railways, however, must follow in the direction of the contours or nearly so; thus the tracks must be transverse to the

central line of the works, or approximately so. It follows, therefore, that the roads cut the works transversely; while, in order to subserve convenience to the utmost, they should be parallel to the central line or longest diameter of the plant.

From this it follows that more trackage must be laid in order to bring all desirable parts into communication. We have then not only a longer railway, but that railway has the additional disadvantage of consisting largely of gradients, which are in themselves objectionable.

ADVANTAGES OF GRAVITY OVERESTIMATED

One of the worst features of side-hill plants lies in the fact that they cannot employ the best means of transport. When, in recognition of the force of gravity, the engineer locates his works on the side hill, he finds that certain unforeseen contingencies have to be provided against. It is customary to lay out the works with the charging bins at the highest level. The power required to bring the materials of smelting to this level, and the fact that the weights require to be lifted to it, irrespective of the plan chosen, is also ignored. If the reader will examine the plans of any given number of smelting works he will find that in every case it is necessary to elevate the materials, usually by railway gradients, and the favorable effects of gravity are, therefore, to a large extent, counterbalanced.

It appears, then, that the influence of gravity as applied to the movement of smelting materials is of less consequence than is generally supposed, and that those engineers who have advocated plans wherein this force is a predominant feature have uniformly overestimated the advantages to be derived therefrom. It is very curious that engineers who should know better have laid such stress upon this feature, and continued to advocate a form of construction wherein first cost and working economy are sacrificed to the fancied advantages of an abstract principle. There is absolutely nothing in the prevailing contention that gravity aids better in the side-hill plant than in the other, or that anything more is saved in the handling of smelting materials, when those materials have to be elevated in the first place.

RELATION OF THE DIFFERENT LEVELS

Although we may condemn the terrace plan as containing an unnecessary number of levels which are not easy of access from each other, and praise the one-level plan as the acme of simplicity, still a thorough understanding of the subject shows that the difference between them

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lies not so much in the number of levels as in the relation of those levels to each other. If we regard a level as a horizontal space upon which work is done, then there are about as many different levels in the one plan as in the other. The practical difference between them lies in that in the one plan they are or may be superposed on each other, while in the other they are set off in successive steps—facts that have a very important bearing on the details and the utility of the establishment.

The conveyance of materials from one level to another, which may be effected by the simplest means when those levels lie one above the other becomes a very different and far more complicated affair when in addition to the vertical lift we have at the same time to transfer the materials sidewise, as we must do when we employ the terrace plan. In the one-level plan the work done on the upper levels should be confined to the feeding of the various furnaces, for which no great space is necessary, nor, with proper designing, should there be any need of heavy framing or extensive roofs. The effort should be, of course, to place the apparatus entirely upon the main or ground level, called usually the slag floor, where the best foundations are secured, where there is ample room, and where the constructions are much less costly.

MOVEMENT OF MATERIAL IN SMELTING WORKS

The path of the ore through a smelting works is made up of a series of vertical and horizontal lines, after the manner of a stairway. Gravity takes care of the straight downward movements, but the horizontal transfers have to be effected by some application of mechanical force. In the simplest form of the terrace plan, the ore, having been brought to the upper level, is fed downward through hoppers, or else shoveled into barrows or cars, by which it is transferred to the tops or feed floors of the roasting furnaces. Having passed through these it is in condition to be fed into the smelting furnaces, which stand upon the next level below. Thence, after smelting, it proceeds in the form of metal, matte or slag, to the dumps near by, but horizontally distant from the furnaces.

Herein we note three horizontal movements and two vertical drops, and the problem before us is to simplify the three former so as to carry them on in the most economical manner. This infers the use of a single means of propulsion wherever possible or practicable. But the conditions forbid such simple applications of force in the terrace plan, for the same apparatus which draws the ore from the bins or beds on the top level can scarcely be brought into use for transferring the roasted material from the calcining furnaces on the second level to the feed doors of the smelting furnaces. To meet this emergency it is customary to provide hand-propelled cars or barrows, or in better or larger establishments electrically propelled

vehicles, by which the material is advanced on the horizontal plane.

In some works it is the custom to draw the ore from the bins into barrows, which run on the charging floor, and by which it is taken to the furnaces after being weighed. In others it is the practice to draw it into cars provided with scales, by which the charge is not only transferred, but also weighed during the passage. The only fault that we as engineers can find with the latter practice is that it involves the use of tracks and rolling stock on a different system from that with which the works in general are provided.

CHIEF OBJECTIONS TO THE TERRACE PLAN

Stated briefly, the principal objection to the terrace system is that it is impossible to adopt any simple and thorough-going system of transport which will answer all purposes throughout the works. The ore may be brought to the furnaces by means of hand cars or barrows; the slag flowing from the smelting furnaces may be carried to the dump by hand pots, horse-drawn pots, or even by steam or electrically propelled vessels; but both operations cannot be carried on by the same means. In the one-level system it is different. The ore may be brought to the bins, from the bins the charges may be brought to the furnaces, and from the furnaces the slag, matte or metal may be transported to the dump or storage house by a single means, the railway.

In the common run of smelting plants the distances by which the furnaces are separated from the bins, and from the slag dumps are so small as in the opinion of the designer to render it not worth while to introduce any extensive, costly or ponderous means of transport. In a few works, of late design, a tendency is manifested to separate these parts of the plant, and to introduce a more adequate means of transport. Temporizing with the necessities, they have generally adopted a half-way method, which while marking something of an advance on ordinary practice, is not accepting in full the lesson taught by the iron-smelting engineers.

There is an inexplicable reluctance among copper and lead smelters to take the bull by the horns and build as the experience of others has shown is best. The present era may be called the transition stage of smelter building, where electric trolleys and undersized ore cars with four wheels are made to perform the work which could be done better and more cheaply by the full-sized broad-gage steam locomotive with its regular equipment of cars, running on rails of standard section. I do not by any means condemn the light apparatus named, for I recognize its advantages when taken in comparison with the older contrivances once in use. The electric trolley is of course an improvement on the horse, as the horse is an improvement on man power; but the steam locomotive is quite as great an advance on all.

DISADVANTAGE OF TRESTLE WORK

The observer will notice in all this a growing tendency to substitute heavier and better apparatus for this part of the smelting work, but he will observe also certain accompanying disadvantages in its use, especially when a certain new fashion is followed. This is where the tracks proceeding from the charging bins to the furnaces are made to pass over long and lofty trestles, to bring the loads quite to the feeding doors, thus necessitating very heavy and expensive constructions, not only of the trestles, but also of the furnace building itself. Such a disposition of parts is most objectionable, because, first, being of wood, the trestles are neither durable nor fire-proof; and, second, because the tracks necessarily cover valuable space about the furnaces which ought to be left free for other apparatus and other operations.

THE SMELTING WORKS OF THE FUTURE

The tendency of modern design shows clearly enough, in spite of present aberrations, what the smelting works of the future will be. The future plant will stand upon a large level space, where the room is ample for all the buildings, tracks, curves, switches, and the extensive paraphernalia of such an establishment. The rails will radiate from a common center, which may be called the focus of the works, and will reach all sources of traffic, the principal points being the furnaces, the sampling mill, the weigh scales, the slag and ore dumps, the storage and feeding bins, and the store-houses.

In order to make the best use of the facilities of transport, the structures will be located with their longer dimension parallel with the tracks, and not the shorter dimension, as in many, if not most, of the present plants. In small plants, which, by the way, are growing less common, there may be two connected tracks through the works, but ample provision must be made for cars to pass each other, so as not to block the way.

The tracks will be laid on a single level, to avoid gradients, and especially to avoid the necessity of employing a locomotive every time a car has to be shifted a few feet. Curves, which cannot be wholly avoided, must be of the greatest permissible radius, never less than 200 ft. The gage, it is hardly necessary to add, must always be that of the connecting lines, and as a matter of the greatest convenience should never be less than standard. Nothing is saved, but much is lost, by installing narrow-gage tracks under the impression of economy, for reasons with which railroad men and some metallurgical designers are familiar. Finally, these tracks, on which so much depends, should be laid out first of all, and before anything else has been so placed as to interfere with their proper location.

The use of the broad-gage railway as

the sole means of transport tends remarkably toward the simplification of the design, construction and operation of the smelting works. Not only are the different units, the engines and cars, of great individual capacity, power and durability, but they are correspondingly few in number. One substantially built switching locomotive, with a train of two 50-ton steel ore cars and an equal number of Weimer cinder pots, is sufficient to do the carrying for a very large plant, and more economically than it can be done by any other means. The simplification of the transporting apparatus involves or permits a corresponding improvement in several other features, obvious to designers and engineers.

IMPROVED METHODS OF CHARGING

Once the reader has grasped the idea of performing all the work of making up the charges and transferring them upon cars to the neighborhood of the furnaces, it will be natural for him to inquire, how are the materials to be raised to the top and charged into the furnaces? The iron-furnace men are our teachers again in this regard. They employ almost invariably a sloping runway upon which travels a skip containing the charge, which upon its arrival at the top, often a hundred feet above ground, is dumped into the hopper and in due time dropped into the furnace, entirely without the intervention of human effort, other than that required to pull levers and touch buttons.

We may imitate them profitably in much of this, but I for one do not follow them in advocating the installation of the skipway, for the conditions in copper and lead smelting occasionally demand that the charges, or a part of them, at times be dropped on the feed floor which is impossible with the skip as ordinarily constructed. It appears to me that a preferable method would be to substitute for the skipway a revolving mechanical crane of suitable radius, which should stand out in front of the furnaces and hoist the charges in a bucket, with provision for dropping them either into the furnace or upon the floor alongside. This method would have considerable advantages over the skipway, first because it leaves the feed floor entirely free from posts, tracks, etc., and, again, because it may be arranged so as to command two furnaces, or more if advisable, which the skipway cannot do. Further, it may revolve over one, two, or perhaps three different tracks laid on the ground below, so as to command a considerable number of the cars on which the charge buckets are brought.

FROM THE MINE DIRECTLY TO THE FURNACE

With this means of transport it scarcely matters where the ore beds or bins are placed, and it happens occasionally that the smelting works may be so located with respect to the mine that the ore for the

charges may be taken directly from the mine dumps to the furnaces without interruption. Such a favorable conjuncture seldom occurs, but I have had the opportunity of designing and building a plant where this plan was feasible. In this case I provided alternative methods, so that when desirable the ore may be passed through bins, but at other times it is dug up from the dump by a locomotive crane working a dredge bucket, which fills the regular charging buckets.

In these designs I have drawn somewhat upon the practice of our skilful brothers, the ironworks engineers, to whom we owe so much and to whom I wish to acknowledge my indebtedness.

SLAG TO REPLACE MINE TIMBERS

I believe, however, that I have in this instance gone somewhat beyond them, in proposing to "timber" the mine with the slag from the works. I propose to cast it in prismatic blocks, and to fill the vacant spaces solidly with this durable, incombustible and cheap material. The lay of the land and the distance from the works are such as to make this proceeding feasible. I will not say that this method of utilizing waste slag is entirely novel, since it appears that in a European coal mine it is the custom, it is said, to shoot the granulated slag from the neighboring furnaces into the worked-out spaces. I believe, however, I can lay claim to the idea of casting the slag in solid blocks, which anyone will recognize as more suitable for such use than granulated material.

Unquestionably, there should be methods of treating furnace slag to fit it for useful purposes. The subject has always seemed to me likely to become fertile in practical results. Thus far, however, it has been studied, so far as I am aware, by only one engineer, Mr. Elbers, who has made himself the authority on the subject of slags, by his articles in this journal. Considerations of this sort will always have their bearing upon the broad subject of this paper.

Soft Iron Ore in Tennessee

BY EDWARD K. JUDD

For a continuous distance of three miles along a range of low hills near Sweetwater, Tenn., a body of soft iron ore has been traced, and has been extensively opened at two points. The origin of this ore has been much of a puzzle to the geologists who have studied it. It is probably associated in time of origin with the fossil ores of the Clinton horizon which are so extensive in this district of the South, but its physical condition is altogether different from that noticed at other localities where the Clinton ore is mined.

The ore is found in a body of indefinite dimensions, in which traces of stratification are slightly perceptible, and suggest

a derivation by disintegration from a hard bedded deposit. The ore has a fine granular texture like moist sand, although streaks and bands of clayey and loamy ore occur. Small nodules of manganese oxide are also found. The surface of the area is strewn with fragments of a fossil limestone, rich in iron, but not sufficiently rich to be valuable.

The body varies from place to place in color, being at some points a brilliant red, which material would be suitable for paint, in others a bluish shade, and at others nearly black. It is a difficult matter to judge of the smelting value of the ore from its color, or from its consistency, whether sandy or clayey.

A determined effort to exploit this ore has been made toward the northern end of the range, not more than 1000 ft. from the railroad, the Bristol & Chattanooga division of the Southern Railway. A siding has been put in here, but up to the present the ore is transported from the mines to the cars by wagons only. The deposit is opened in a simple manner by driving a narrow cut and exposing a face of ore which is then brought down by pick and shovel. The ore is regularly shipped to iron works, notably the Virginia Iron, Coal and Coke Company, the Chattanooga Iron and Coal Company and the La Follette Coal, Iron and Railway Company, who appear to be satisfied with the nature of the ore. Its only drawback is its fine granular texture, but this difficulty will probably be overcome in the same manner as the soft ores of Lake Superior ranges are utilized. Some of the ore approaches bessemer grade, as to phosphorus, while its manganese content is highly prized.

Some analyses of carload shipments of the ore to iron works are given in the following table:

	I.	II.	III.	IV.	V.	VI.
Fe.....	43.20	47.84	48.18	49.30	57.90	59.20
P.....	0.11	0.51	0.42	0.20	0.15	0.22
Mn.....	1.37	2.78	1.64	.....	.....	.....
SiO ₂	21.50	16.22	18.44	16.56	3.24	5.30
Al ₂ O ₃.....	.....	11.41	9.30	.....	.....	.....
H ₂ O.....	22	.....	.....	15.25	.....	.....

I reported by the Virginia Iron, Coal and Coke Co.; II and III by the Chattanooga Iron and Coal Co.; IV, V and VI by the La Follette Coal, Iron and Railway Co.

These ores ought to have a considerable demand since they are situated within easy railway distance (70 miles) of Chattanooga, which is rapidly becoming an important center for the production of pig iron. Proximity to a main line of railroad is another point in their favor. Owing to the intercalation of poor and rich streaks in the ore, it is doubtful if large-scale operations with the steam shovel will be applicable, but the size of the deposit is such as to warrant working on a considerable scale. It is the property of William D. Gilman, of Sweetwater, Tennessee.

The Nordberg Piston Blowing Engine

The Design Provides Unusually Large Valve Seats and Avoids the Drag Due to the Friction of Large Air-cylinder Parts

BY FREDERICK A. HALSEY[†]

In air-compressor and blowing-engine work the valve problem grows rapidly with decrease of pressure, areas of opening which are ample for high pressures being entirely inadmissible with low. This, to many, unknown fact arises from the circumstance that the lost work due to forcing air through the valves becomes a larger and larger percentage of the useful work as the pressure is reduced, a loss becoming entirely inadmissible when considered as a percentage of the work in-

compressing, however, to five pounds the theoretical mean effective pressure would be about 4.5 pounds, and the same suction loss would represent a power loss of

$$\frac{0.5}{4.5} = 11.1 \text{ per cent.},$$

which has a very different look. Obviously the lower pressure requires the larger port opening. The same consideration applies to the loss due to forcing the air through the discharge valves, but to a still greater degree. The loss here, when compressing to high pres-

card, and hence the percentage of lost work increases in a compound manner.

DIFFERENT CONSTRUCTIONS NECESSARY FOR HIGH AND LOW PRESSURES

In the style of compressor having pop-pet valves in the cylinder heads, it has always been the practice to utilize the entire available space for valves, but to give the larger part of it to the inlet valves and, for high pressures, this practice is sound. The first necessity is to get the air into

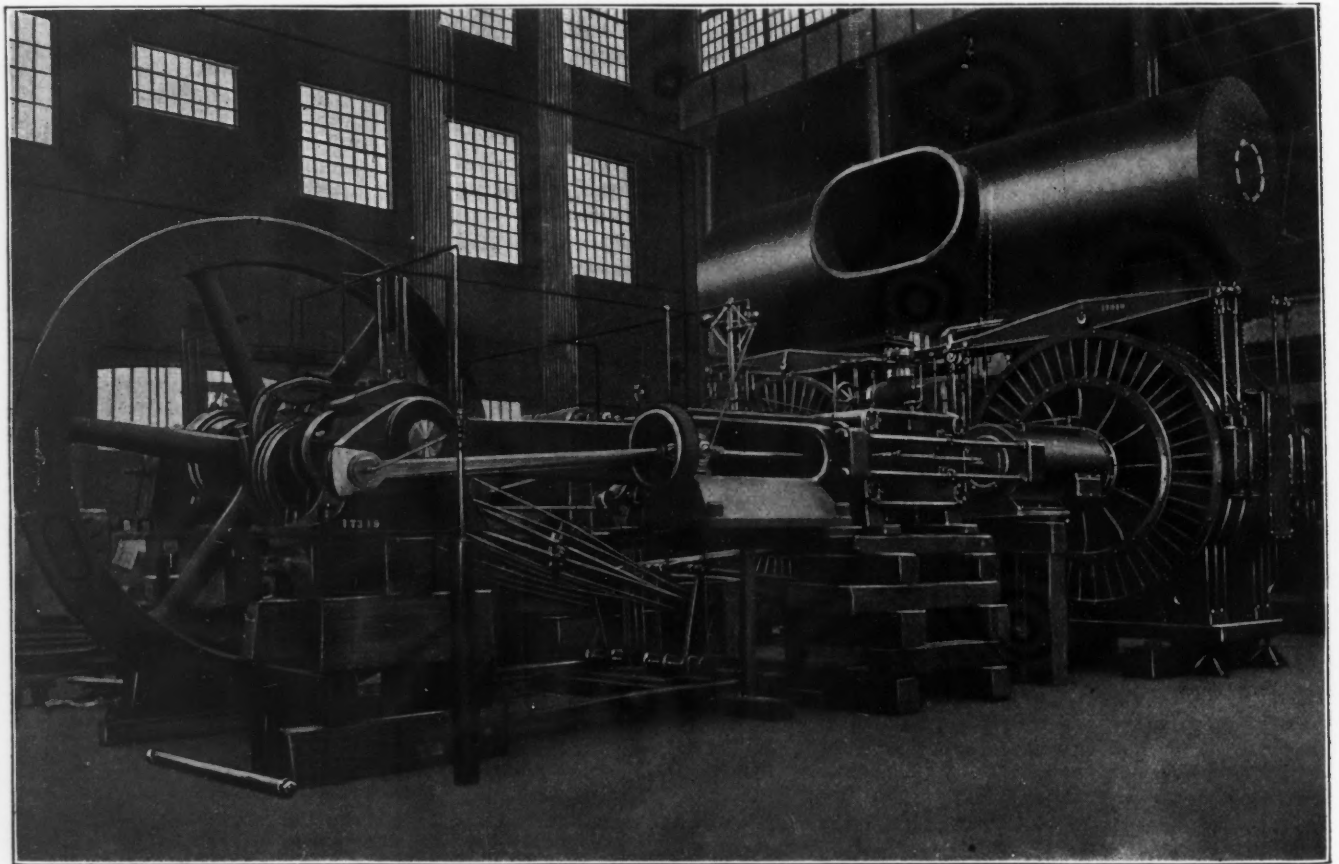


FIG. 1. NORDBERG BLOWING ENGINE

involved in compressing to a low pressure.

LOSSES IN HIGH- AND LOW-PRESSURE MACHINES COMPARED

When compressing air to, say, 80 pounds, the theoretical mean effective pressure is about 35 pounds. A suction loss of, say, $\frac{1}{2}$ pound would represent a power loss of $\frac{0.5}{35} = 1.43$ per cent., which would not be a serious matter. When

Note.—From the *American Machinist*, Feb. 7, 1907.
[†]Editor of the *American Machinist*, 505 Pearl street, New York.

pressures and measured by the pounds by which the pressure within the cylinder exceeds that within the receiver, is much greater than the suction loss; but the length of the surplus area on the indicator card is but a small portion of the length of the card, and hence the area representing lost work is again but an insignificant percentage of the area of the entire card. As the pressure is reduced, not only does the surplus pressure become a larger percentage of the mean effective, but the length of the lost-work area occupies a larger part of the length of the

cylinder, and the effect of the short length of the discharge line is to make admissible an excess of pressure at this point which, considered from the lost-work standpoint only, could not be tolerated if it appeared as a suction loss.

With reduced pressures, however, the lengthening of the discharge line makes additional discharge-valve area imperative; but with the construction now under consideration this is possible only by reducing the inlet-valve area, although, as shown above, an increase is called for by the conditions.

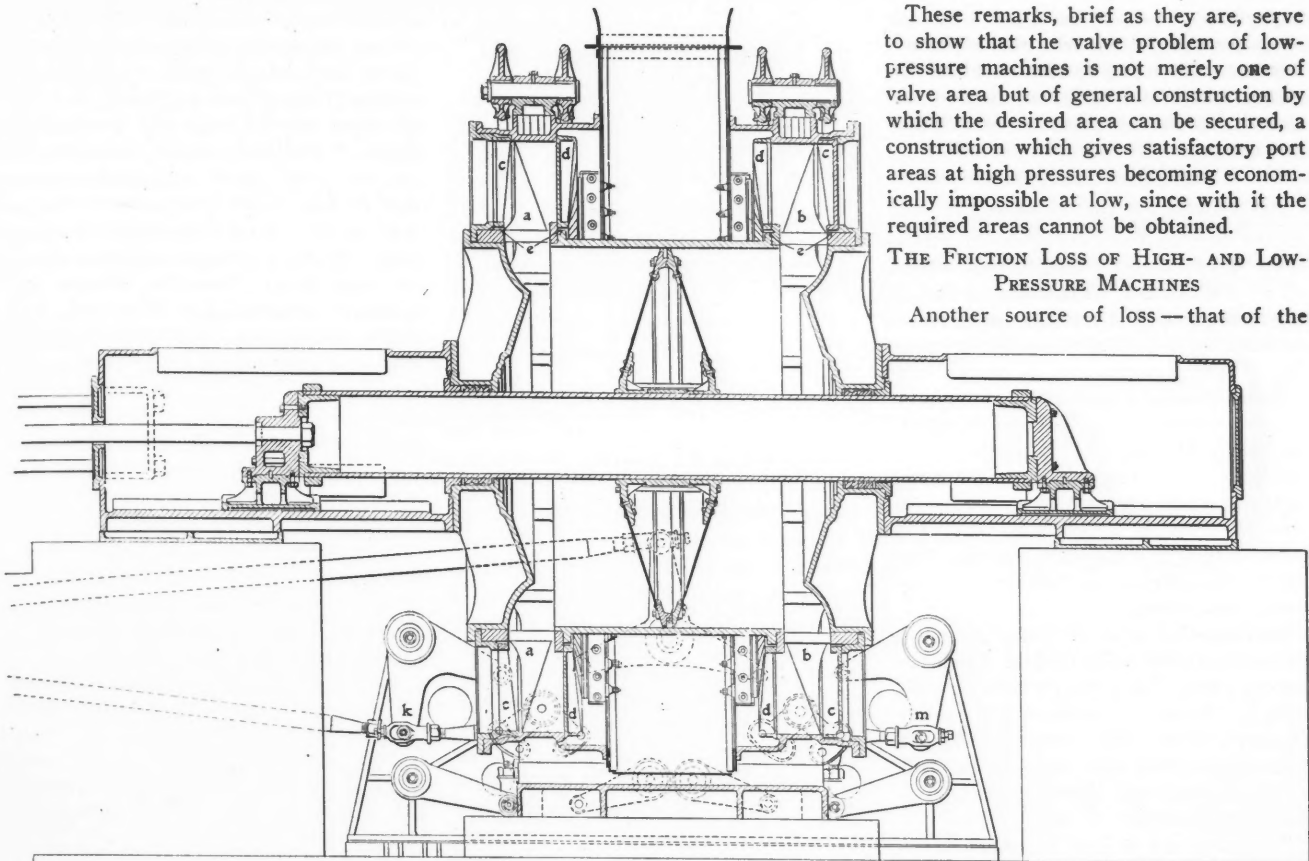


FIG. 2. LONGITUDINAL SECTION OF BLOWING CYLINDER

These remarks, brief as they are, serve to show that the valve problem of low-pressure machines is not merely one of valve area but of general construction by which the desired area can be secured, a construction which gives satisfactory port areas at high pressures becoming economically impossible at low, since with it the required areas cannot be obtained.

THE FRICTION LOSS OF HIGH- AND LOW-PRESSURE MACHINES

Another source of loss—that of the

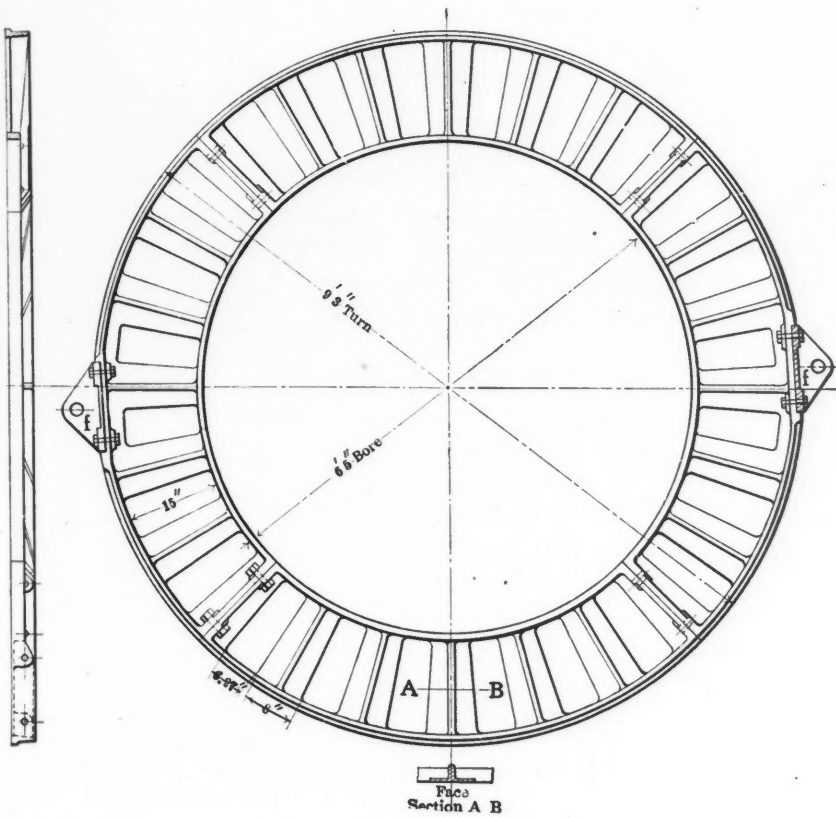


FIG. 3. INLET VALVE

friction involved in driving the machine itself—becomes of increasing importance as the pressure is reduced. Comparing a blowing engine with an air compressor of the same horse-power, we have in the former a large air cylinder attached to a small engine. The air pistons and valves cannot be lightened with the reduced pressure; but, on the contrary, they naturally grow heavier as the cylinder bore is increased. The result is a combination of large, heavy parts doing very light duty and a much larger friction loss than in the case of a compressor of the same horse-power.

A NEW CONSTRUCTION

We illustrate herewith a highly novel and interesting—and, we may add, entirely successful—blowing engine, which was recently supplied to the Tennessee Copper Company by the Nordberg Manufacturing Company, of Milwaukee, Wis. Its design is intended, first, to provide unusually large valve areas, and, second, to avoid the drag due to the friction of large and heavy air-cylinder parts. The machine was designed for an ultimate air pressure of 40 oz. per sq.in., the running pressure at present being, however, but 34 oz. The engine is compounded with Corliss cylinders of 15 and 33 in. bore, the air cylinders having a bore of 70 in. The stroke is 42 in. The blow-

ing-cylinder valves have an opening of 40 per cent. of the area of the piston—this figure belonging to both inlet and discharge valves, and being, we believe, unapproached in any previous machine of this character.

THE PORTS AND VALVES

General views of the machine as it stood on the erecting floor are given in Fig. 1, while Fig. 2 shows a longitudinal section of the air cylinder. Referring to Fig. 4, it will be seen that annular ports *aabb* are built up around each end of the cylinder. These ports involve, of course, considerable clearance space; but, at the pressure for which the machine was designed, the effect of clearance is inappreciable. Clearance loss decreases with the pressure, and at the pressure here used the action more nearly approaches that of a pump, where it disappears entirely, than that of a compressor, as that term is commonly understood.

The opposing sides of these ports are formed into ring gridirons, on which the corresponding ring gridiron valves *ccdd* work, *cc* being the suction and *dd* the discharge valves. Fig. 3 is a detail of one of the inlet valves, with some of the leading dimensions, and Fig. 4 shows a portion of a valve seat.

The valves are in four segments in order to permit placing them in position. In action they oscillate over the port seats, opening and closing them as required. While of light section, they are, of course, in the aggregate heavy, and as they have a wide and free motion, they would, if supported on trunnion bearings of their inside diameter, give a very appreciable

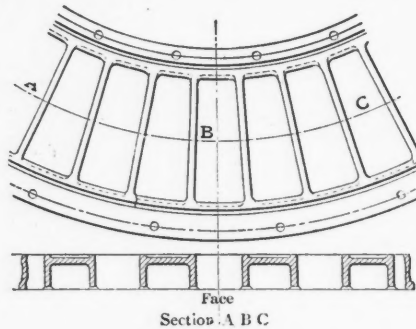


FIG. 4. INLET VALVE SEAT

friction load to the engine as well as be subject to wear. To avoid this, they are bored to a diameter considerably in excess of the outside of the cylinder, clearing it freely, as shown at *e*, Fig. 2. Ears *f*, Fig. 3, are bolted at the ends of the horizontal diameters, and from these ears the valves are hung by swiveled suspension rods, which pass up through stuffing boxes and are attached at their upper ends to walking beams, as shown in the half-tones, and more clearly in the end view, Fig. 5. These beams are supported on trunnions at their centers, the friction of which is all to which the weight of the valves gives rise. The beams are extended inward and are driven by rods *g*, which, at their lower ends, are connected to Corliss wrist-plate mechanisms, by which the valves are positively driven. The suspension rods by which the valves are hung are shown at *h*.

THE WRIST-PLATE MECHANISM

Fig. 6 shows the support of the wrist-plate mechanism and the mechanism by its

center lines. The inlet and discharge valves are driven by separate eccentrics, *i* being the inlet and *j* the discharge-valve eccentric rods. Rod *i* connects at *k* with the inlet, and rod *j* at *l* with the discharge gear. A rod *km* connects the plates for the inlet gears for the two ends, as shown also in Fig. 2, while a common plate at the center serves for both discharge gears. Each wrist-plate motion is double, two such plates intervening between each eccentric rod and the valve rod, both plates passing their idle arcs at the same time. The second plates are centered at *n* and *o*. The effect is to greatly increase the characteristic dwell of the device, extending the range of the idle arc and making it more nearly completely idle than with a single plate. The idle arc is, of course, made use of in order to reduce the movement of the valve after closure, by which two results are secured—first, reduced friction and wear when the valve is closed with the load upon it; and second, a larger aggregate port area than would otherwise be possible. The last result is not obvious at the start, but will appear presently from the description. As a matter of fact, the 40 per cent. port area which these valves give would be impossible without this double wrist-plate mechanism.

THE ACTION OF THE MECHANISM

Fig. 7 shows the action of the mechanism by comparing the movements of the inlet valve with the movements which would take place if the eccentric rod were connected directly to the valve. The full lines show the valve on its seat, and in a succession of positions, such as would be

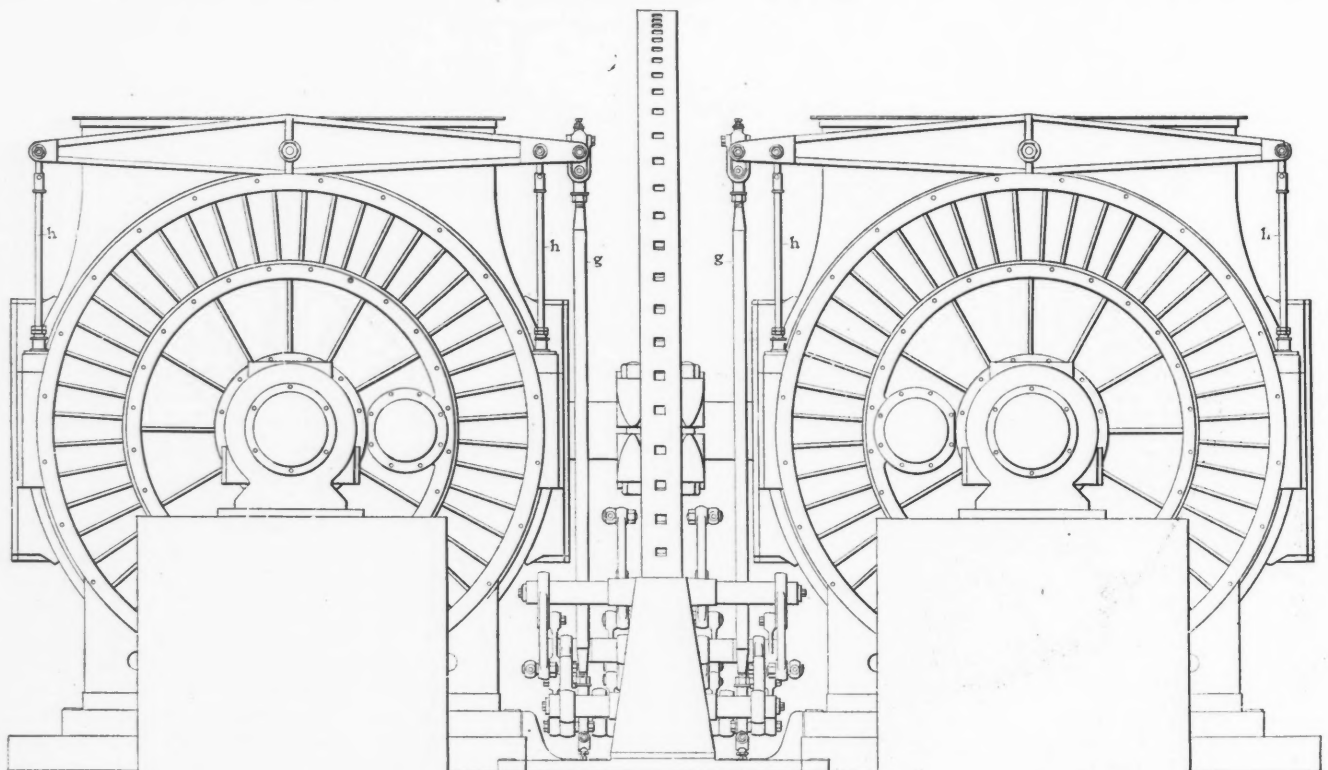


FIG. 5. END VIEW OF BLOWING CYLINDER

given it by a direct connection to the eccentric, while the dotted lines show the corresponding positions actually given it by the plates. Beginning at the top, the valve is fully open in both cases from which point the action is not markedly different until closure at *p*, when a marked change takes place. With the direct connection the valve continues to move until at *q* it covers the port by a width equal to its previous opening, this being characteristic of slide valves having no lap;* but with the actual mechanism the dwell of the wrist plates comes into play as soon as the ports are closed, the result being that the valve covers the port but a small amount, the extreme cover being at *r*, from which it gradually decreases. Were the opening movement to be plotted, it would simply retrace the positions shown in reverse order.

INCREASED PORT AREA

The width of the valve in order to prevent reopening by the rear edge must obviously be determined from the position of extreme cover and, with the direct motion, its value is obviously *q s*. Laying down this width on the top section, we have the point *t* where the edge of the next port must be located in order to prevent that port being covered by the back

*As a matter of fact the valves have a slight lap, but this has been ignored in making the diagrams.

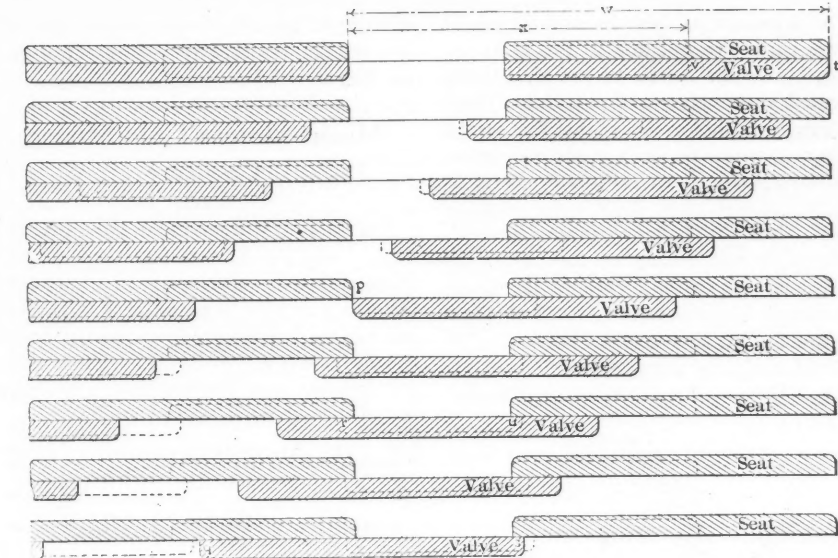


FIG. 7. THE ACTION OF THE WRIST-PLATE MECHANISM ON THE VALVE

edge of the valve in its open position. With the actual motion the width of the valve is reduced to *r u* and, laying down this width on the top section, we have the point *v* for the position of the edge of the next port. Comparing the two constructions, we have the distance *w* for the space occupied by a port and seat with the valve directly driven, and *x* for the corresponding space when the wrist plates are used, the width of the port being the same in

both cases. The total circumference of the valve divided by *w* and *x* obviously gives the number of ports which can be got into the circumference by the two arrangements. The total port area being proportional to the number of ports, the ratio of the reciprocals of *w* to *x* obviously gives the increased port area which is made possible by the wrist-plate mechanism.

THE CONSTRUCTION OF THE AIR PISTONS

The light duty added to the large diameter of the air pistons has led to the special construction, shown in Fig. 8. The pistons are made of 3/8-in. boiler plate, each side in one piece and dished to the form shown. Lateral stiffness is provided by riveting the plates at the outer diameter to a ring spider in halves, the piston-ring groove being between the halves. The piston is turned 2 3/8 in. smaller than the bore of the cylinder and the ring does not bottom in its groove. The piston is thus a floating piston, and its weight cannot be carried by the cylinder, but is carried by the piston rod. This rod, as befits its duty, and as shown in Fig. 3, is extremely light. It is made of steel pipe and its diameter provides ample stiffness. Each end carries a shoe for supporting the weight of the piston, the shoes and their guides being shown in Fig. 2.

INDICATOR DIAGRAMS

Fig. 9 shows a pair of indicator cards (reduced in size) from the blowing cylinder, the speed and pressure being noted thereon. The discharge lines will be seen to contain the usual undulations, but in estimating their size the scale of the spring must be kept in mind. In the original cards the scale is two lb. per in. and, scaling them, the extreme rise above the receiver pressure line scarcely exceeds 1/2 lb. Such a rise on a card taken with the usual spring would hardly be noticeable, and the card would be passed as, in this respect, perfect.

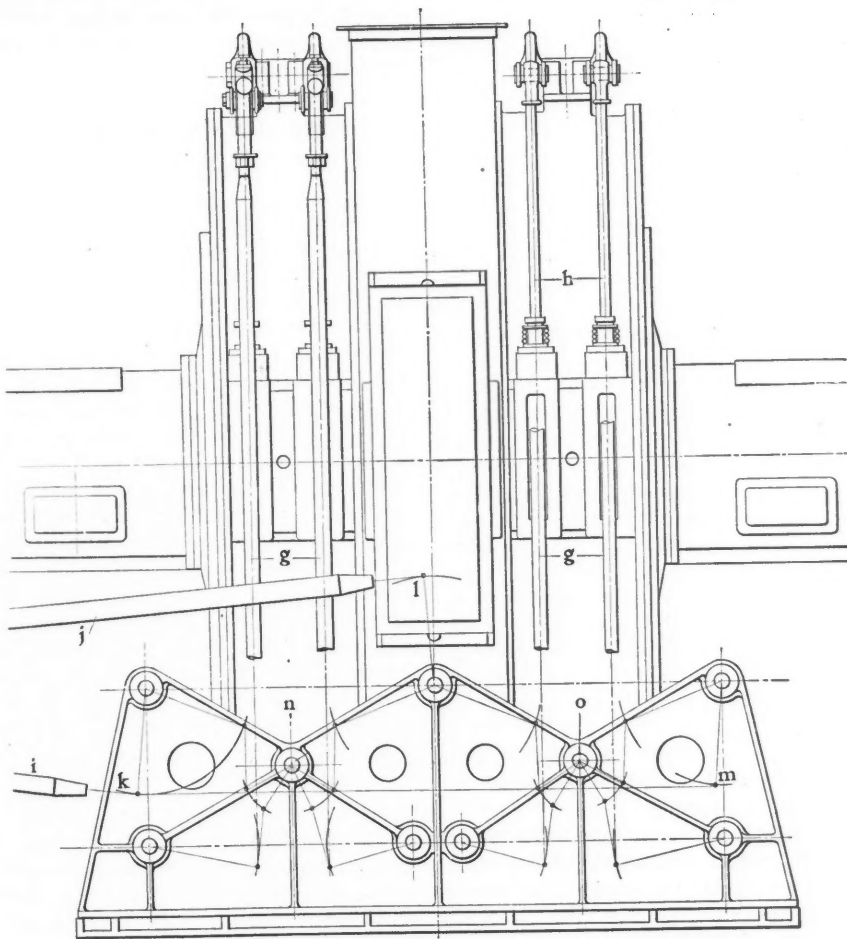


FIG. 6. WRIST-PLATE MECHANISM AND SUPPORT

As a matter of fact the undulations in these cards are not due to the valve action, but to the inertia of the air surging through the receiver and pipe line. There is plenty of other evidence that this inertia is very appreciable, both in air and steam. Indicator cards from the steam chests of cut-off engines often show a rise in pressure above the boiler pressure immediately after the closing of the valve, the rise being due to the inertia of the steam developed by its surging forward after stoppage of its flow to the cylinder. The present cards also give evidence of the inertia action in the dropping of the dis-

charge lines below the receiver pressure line. Were the rise in pressure above the receiver pressure line due to the forcing of the air through the ports, the pressure would necessarily lie entirely above the receiver pressure line.

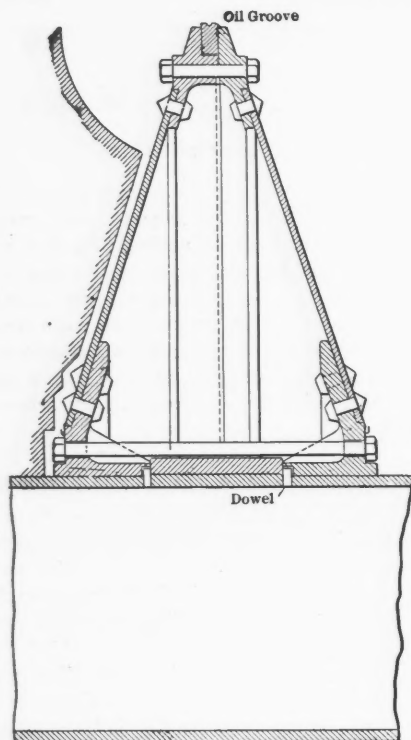


FIG. 8. AIR-PISTON CONSTRUCTION

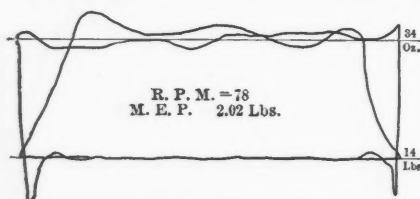


FIG. 9. INDICATOR CARDS FROM BLOWING CYLINDER

charge lines below the receiver pressure line. Were the rise in pressure above the receiver pressure line due to the forcing of the air through the ports, the pressure would necessarily lie entirely above the receiver pressure line.

It will be observed that the removal of the two rows of bolts which hold the two sides of the piston together permits the sliding back of one of them on the piston rod, thus giving access to the packing ring.

The suction line will be seen to be remarkable. Remembering the scale of the spring, a single ounce of suction loss would show in the original cards by a drop

Mount Morgan Gold Mining Company

The Mount Morgan Gold Mining Company owns, in Queensland, one of the most valuable properties in Australia. Originally a gold mine only, it is becoming a large copper producer, as the depth of the workings increases. The report for the half-year ending Nov. 30, 1906, shows income as follows:

Gold, copper, etc., produced.....	£ 446,815
Miscellaneous.....	1,323
Total earnings.....	£ 448,138
Working expenses at mine.....	£ 253,581
Freight, taxes, royalties, etc.....	21,102
Total expenses.....	£ 274,683
Net earnings.....	£ 173,455
Balance from previous half-year.....	4,922
Total.....	£ 178,377

Appropriations were £24,699 for depreciation, and £75,000 for dividends; leaving a balance of £78,678 forward.

The mine report shows the quantity of material handled and delivered to works as follows, in tons:

	Open Cut.	Undergr'd.	Total.
Oxidized ore.....	60,445	.....	60,445
Sulphide ore.....	5,060	54,151	59,211
Converter linings.....	1,708	.....	1,708
Copper-gold ore.....	.....	33,022	33,022
Pyritic flux.....	.....	13,916	13,916
Pyrite for acid.....	.....	519	519
Waste & overbur'n.....	134,371	7,214	141,785
Total.....	201,784	108,822	310,606

The deliveries of gold ore to the old works were: West works, 60,445 tons oxidized ore; Mundic works, 59,211 tons sulphide ore; Lower works, 10,183 tons tailings; total, 129,839 tons. The fine gold recovered was: Oxidized ore, 19,440 oz., or 0.32 oz. per ton; sulphide ore, 31,199 oz., or 0.52 oz. per ton; tailings, 1240 oz., or 0.12 oz. per ton. The total was 51,879 oz., giving an average of 0.40 oz. per ton for all gold ore treated.

The smelting works treated 62,539 tons of material, including 46,665 tons ore, 14,889 tons pyritic flux, and 985 tons old matte, etc. They were used in smelting 21,957 tons of limestone and 959 tons of ore as flux, with 6668 tons coke. The matte made was treated in the converters, yielding 1767 tons of blister copper, containing 1751 tons of fine copper and 20,838 oz. gold. The blister copper is sent to the DeLamar works, in New Jersey, to be refined. On the basis of ore treated, this shows 0.44 oz. gold per ton and 3.75 per cent. copper.

The total yield for the half-year, from all ore treated, was 72,717 oz. gold and 1751 tons fine copper.

The directors' report says: "Temporary advance, which at the date of last report stood at £75,000, has been repaid, leaving the company entirely free from debt. The payment of dividends quarterly in place of monthly has been sanctioned by the

board, the first of such quarterly dividends being at the rate of 9d. per share, paid Jan. 2. Owing to additional works authorized and contemplated, and to the necessity of creating a reserve fund, the board is unable to increase the rate of dividend now being paid.

"The ore treated at the Mundic works has maintained the value obtained last half-year, but the oxidized ore treated at the West works shows a falling-off in value of 5s. 9d. per ton. This was expected. The copper reduction works have produced 1751 tons of copper, containing 20,838 oz. gold, which have been shipped to America under advance in terms of contract entered into with the DeLamar Copper Refining Company. The board has authorized the erection of an additional blast furnace, extensions to the converter plant and power house and other expenditure, estimated to cost approximately £125,000. The board is now considering the advisability of erecting an electrolytic copper refinery.

"With a view to insuring an abundant supply of suitable ironstone flux, several leases have been acquired, and are being opened up. An option has also been secured over a property known as the Many Peaks copper mine, which contains an extensive lode of pyritic ore. Owing to the increased consumption of water, provision is being made for the additional storage of about 56,000,000 gal. by raising the wall of No. 7 dam. When the work is finished the total capacity of all dams will be 376,000,000 gallons."

Future of the British Cement Industry

Bertram Blount predicts that both the distribution of the industry and demand for cement will increase, and that eventually it must become the standard building agent. He adds that it is more than likely there will be great development of the use of armored concrete, especially in massive, permanent and fire-proof structures, and says that the commercial preparation of portland cement by fusing the raw materials together is the task now before the manufacturer. In conclusion Mr. Blount says there is no cause for discontent over the progress made. The very appearance of a modern works, with machinery, kilns, etc., almost like engines, and engines kept like a gun, is sufficient contrast with the wonderful old collections of tumble-down sheds full of discarded millstones and toothless harrows, and with nearly as much cement on the floor and in the air as in the warehouse.

The Brazilian Government is about to levy a heavy export tax upon monazite sand, says the *London Engineer*, which is bound to have a very serious effect upon the use of thorium in the manufacture of incandescent gas mantles.

The Oriental Consolidated Mining Company, Korea

The report of this New York company which is operating gold mines in the Wunsan district, in Korea, deals with the operations in the year ended June 30, 1906. Although the Russo-Japanese war ended in October, 1905, a large amount of trouble was experienced at the mines through scarcity of competent labor and lack of transportation facilities. This resulted in a reduction in tonnage crushed in the mills of 21,230 tons as compared with the returns for the previous fiscal year. The total amount of ore mined in the company's properties was 233,157 tons valued at \$1,177,487, or an average of \$5 per ton. In addition to the above the mines operated on tribute, or lease agreements, produced 3260 tons of ore valued at \$20,150. The average mining cost, including all underground development work done during the year, was \$1.14 per ton. The operating profit was \$367,882, and of this amount a sum of \$140,637 was expended in new construction, leaving a net balance of \$227,245. Six of the company's mines were operated during the year, and their returns were as follows: Chittabalie produced 8946 tons of ore valued at \$26,753; Tabowie produced 43,473 tons valued at \$213,367; Taracol produced 91,936 tons valued at \$497,954; Kuk San Dong North produced 28,146 tons valued at \$142,964. Kuk San Dong South produced 23,065 tons valued at \$93,660; and the Charabowie produced 37,591 tons valued at \$202,788. Milling costs varied from 0.45c. per ton in the Kuk San Dong ore, to 0.80c. for the Chittabalie. The combined operations of the Tabowie and Taracol cyanide plants resulted in the treatment of 31,611 tons valued at \$395,271. The bullion return was valued at \$255,518, and the percentage extraction 64.6. In order to improve the extraction a small plant was built at the Taracol mill consisting of a tube mill 24 in. in diameter by 12 ft. in length, fitted with two agitators, gold tanks, zinc boxes and sump tanks. The results of experimental runs of 6-ton lots, lasting 30 hr., approximated a theoretical extraction of 93 per cent. The average extraction at the Kuk San Dong mill was 80 per cent., and a net profit of \$7795 was obtained by retreating 12,529 tons taken from the old Taracol cyanide dump. The results of the experiments carried out in the various cyanide plants during the year clearly demonstrate that it is essential to re-grind all the material going to the vats in order to raise the percentage of cyanide extraction.

Development in the various mines was vigorously carried out during the year. It was estimated in 1905 that the Chittabalie mine, which, with the Charabowie, is situated on a distinct line of reef from the other mines, and lies toward the southern portions of the concession, had

an ore reserve of 7600 tons, valued at \$22,375, and during the period under review an additional tonnage of 1346 tons was opened up. All of this ore has now been mined, and it is intended to continue to develop the reef by sinking the main shaft deeper. The ore reserves in the Tabowie mine are estimated at 465,136 tons, valued at \$2,739,327. The prospects in this mine are so favorable that it has been arranged to enlarge considerably the Tabowie mill. In the Taracol mine the reserves amount to 308,758 tons, valued at \$1,765,452. The vein is 16 ft. wide, and averages \$10 per ton in value about 700 ft. out from the shaft on No. 2 level west. Above the No. 3 level west the ore averages \$4 per ton. The main shaft has been sunk to a depth of 629 ft., and No. 5 level having been run out, it is proposed to continue sinking another 100 ft. during the present year, and developing Nos. 6 and 7 levels.

The development work in the Kuk San Dong North mine was most satisfactory and resulted in opening up by rises and cross cuts above and to the east of No. 7 tunnel over 37,000 tons of ore of an average value of \$5 per ton. The ore reserves in the Chintui mine amount to 20,000 tons valued at \$100,000.

During the year the company's placer ground was prospected with a Keystone traction drill. Frozen ground stopped the work in December, after 17 holes had been drilled; but work was resumed in April, 1906, and up to the end of June over 50 holes were put down. The average value of the ground thus prospected was found to be 6c. (U. S. gold) per cu.yd. About 40 of the holes were sunk near the electric power house, 5 miles south of the Tabowie camp. It does not appear that any of that ground is rich enough to yield a working profit. Beginning at the power house and extending down the valley in a southeasterly direction a distance of 4000 ft., there is a narrow channel, the width of which has not yet been determined, averaging 12c. per cu.yd. in value. At a point 5 miles lower down the river there is another channel a mile in length, which was found to average between 10 and 12c. per cu.yd. The depth of the deposit runs from 9 to 23 ft., with an average depth of 16 ft. The gold is mostly found close to the bed-rock. The bed-rock is fairly soft, and the gravel is fine and free from clay, and it is possible that it would be suitable for dredging. The gravel deposits in the concession similar to the above, but which have not been prospected yet, consist of some 40 or 50 miles of river valleys varying in width from a few hundred feet to a mile. Although the early prospects are not very encouraging, the superintendent proposes to continue prospecting the gravel deposits with the drill during the present year.

The Chorrie dam, which supplies the mines and mills with water and water

power, was repaired, and the dam now holds over 120,000,000 cu.ft. of water. The Taracol and Tabowie camps are furnished with electrical equipments, the power for which is furnished by hydraulic turbines.

General Manager H. F. Meserve reports that local conditions due to the Russo-Japanese war, which disturbed the supplies of labor, cordwood and mining timber, and made transportation difficult, are slowly improving, and it is expected that he will be able to keep the Taracol, Tabowie and Kuk San Dong mills running steadily throughout the present year. He estimates the ore reserves at present developed in the company's properties at over 1,000,000 tons, or \$5,300,000 in value.

Determination of Tin and Tungsten

E. Donath (*Zeit. f. angew. Chem.*, 1906, XIX, 473-474) gives the following method for the analytical separation of tungsten and tin: The mixed tungstic and stannic oxides are heated in a covered porcelain crucible with zinc dust or zinc filings, for a quarter of an hour, and after cooling, the mass is heated with 1:2 hydrochloric acid till no more hydrogen is evolved, and all the metallic tin is, therefore, dissolved. To the cooled liquid, potassium chlorate is cautiously added till the blue color has entirely disappeared, and the tungsten is entirely in the form of dioxide. The liquid is now diluted with at least 1.5 times its volume of water, and allowed to stand for 24 hours, when the whole of the tungstic oxide is deposited. It is filtered off, washed first with water containing nitric acid, and finally with a hot dilute solution of ammonium nitrate, dried, ignited, and weighed. In the filtrate the tin is precipitated as sulphide.

Japanese Mineral Output

The *Chugai Shogyo Shimpo*, a Japanese paper, states that the mining output generally showed more or less increase in 1906. The production of coal amounted to about 13,000,000 tons, an increase of 1,500,000 tons; the output of petroleum to 1,510,000 koku (koku = 40 gal.), an increase of about 200,000 koku; the gold produced up to the end of November was 720 kwamme, equal to about 5976 lb.; silver, 19,000 kwamme, or about 157,700 lb., both showing a slight decrease. The output of iron ore was 17,000,000 kwamme, or 70,550 tons, an increase of about 6,000,000 kwamme, and of sulphur 50,000,000 kin (kin = 1½ lb.), also showing some increase. The exports of refined copper from Japan during 1906 up to November were valued at \$10,729,000, as against exports of \$8,000,000 and \$6,380,000 during the same periods of 1905 and 1904.

The Bauxite Industry of the South

Ore-bodies are Easily Found, Quickly Developed and often Speedily Exhausted. Number of Producing Mines Varies with Market

BY EDWARD K. JUDD*

The Georgia-Alabama bauxite district, extending along the Coosa valley from Adairsville, Ga., to Jacksonville, Ala., while second to the Arkansas district in point of output, yet yields an ore so pure that it has altogether outdistanced the other producing territory in its supply of aluminous material suited to the chemical trade. Arkansas, on the other hand, has been the mainstay of the aluminum reduction plants, but, just at present, the Southern area too is being called upon to furnish aluminum ore.

OCCURRENCE OF THE ORE

Unlike the Arkansas bauxites, which were plainly derived by the decomposition, in place, of highly aluminous igneous rocks, the Southern bauxites offer no unmistakable clue as to their origin. The ore-bodies are found in the shape of irregular funnels, tapering from a diameter of 200 to 500 ft. at surface to less than 100 ft. at a depth of, say, 75 ft., which is as far as any mine has yet been operated. The inclosing walls of these bodies consist entirely of boulders and gravel, while an exceedingly fine and unctuous clay, beautifully colored in red and blue, accompanies the bauxite, forming streaks throughout its mass, and often extending into the surrounding gravel. The ore itself is markedly pisolitic, the spherules varying from a minute size to that of marbles. Occasionally the globular concretions themselves constitute almost the entire substance of the ore, but more often they are imbedded in a much larger proportion of fine and granular matter.

DISTRIBUTION OF THE INDUSTRY

At the present moment active bauxite mining in this district is confined to three centers—in the vicinity of Hermitage, Ga., Cave Spring, Ga., and Rock Run, Ala.

Around Hermitage only four mines are now active. The Julia, five miles east, and the Ward mine, two miles south of Hermitage, are worked by the Republic Mining and Milling Company, of Philadelphia. The Pittsburgh Reduction Company is taking ore from the South Watters, one of a group of several mines three miles south of Hermitage, which it recently acquired from the General Bauxite Company; and J. H. Hawkins, of Rome, Ga., maintains a steady production from his mine, two miles south of the Julia. The Republic company operates a drier at the Julia mine and another at

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Hermitage, hauling crude ore to the latter from the Ward and one or two other mines whose stocks of mined ore are not yet depleted. Mr. Hawkins also has a drier at his mine.

At Cave Spring, Ga., the National Bauxite Company, which has lately been organized by the leading interests in the former General Bauxite Company, is operating the Hampton mine and ships its ore for drying to its excellent plant at Rome. This same company is also developing mines at East Lake and Sherman Heights, near Chattanooga. Both the Pittsburgh and the Republic companies own other ore-bearing land at Cave Spring, but neither is mining extensively. The Pittsburgh company has a drier at this place.

At Rock Run, Ala., the Republic Mining and Milling Company owns a group of four mines, of which only one, the Dykes, is now productive; the others, however, are not all exhausted. The same owner has a drier in the vicinity.

Another small mine now operating is the Bigelow, 12 miles south of Rome, owned by Harrison Bros. & Co., of Philadelphia.

This list accounts for all driers and all the now active mines in the South, but the catalog of the district's bauxite resources does not end here. Exploration for new deposits is constantly in progress and as the ore-bodies are easily found, quickly developed and often speedily exhausted, the number and location of producing mines is variable and is influenced mainly by the market demand for bauxite. It may safely be stated that in no case has one of the ore-bodies been completely exhausted; for, owing to the system of mining, hereafter described, the mines reach their economical limit long before all ore, even that of shipping grade, is removed. Then there are numerous instances of mines with abundant reserves abandoned for reasons not apparent to an outside observer.

BAUXITE MINING

The customary method of winning bauxite, as exemplified in the South Watters and the Julia mines, may be briefly described. The South Watters is singularly fortunate in being opened on a hill top and is, in fact, the only important mine in the whole district so situated. A narrow cut was dug into the hillside, 30 ft. below the top of the orebody, a trestle extended outwardly from it to facilitate the handling of both waste and ore, and the breaking down of the ore-

body began. Pick and shovel were the only tools employed; blasting, although it would have greatly assisted in loosening the ground, was out of the question on account of the intimate association of bauxite, clay, gravel and soil.

The pit now presents a series of benches, the bottom being a level floor over which movable tracks radiate to the various points on the wall at which bauxite predominates over clay. Everything taken down, ore, clay, gravel, and even overburden, is loaded into the same wooden cars and pushed out over the trestle. Ore is deposited at a point convenient for wagons, but the rest is conveyed as far as practicable. The chief difficulty in bauxite mining is to keep the ore uncontaminated with worthless material. It is usually accomplished by removing waste alone until a good face of bauxite is uncovered, which is then attacked. This process occasionally renders it permissible in a richer mine to employ a blast in the bauxite, thus reducing the expenditure of pick labor. In this mine it is found necessary to move about six tons of material to recover one ton of bauxite. Some analyses of ore shipped from this mine show the following compositions:

	Al ₂ O ₃	Fe ₂ O ₃	SiO ₂
I.....	36.95	3.90	30.60
II.....	54.70	0.66	15.70
III.....	56.77	1.43	11.15
IV.....	53.10	0.46	17.84

This ore is usually sold on guarantee of 52 per cent. alumina, and not more than 2 per cent. ferric oxide, nor over 5 per cent. silica.

The adjoining North Watters mine, now nearly exhausted, was not amenable to this same treatment, since it was some distance from a convenient hillside. A tunnel was therefore driven to tap the orebody at a depth of 65 ft., and through this opening, besides securing drainage, all the ore was extracted by the glory-hole method. This body presented an unusually clean mass of ore, so that this process, whose principal drawback is the impossibility of keeping things separate, could be applied. In this mine, six tons of material moved were found to yield about five tons of ore.

The Julia mine more truly displays the usual adverse conditions of bauxite mining in the district. The ground is low and level so that not only are natural drainage and level car tracks not obtainable, but the cavity made by taking out ore acts as a collector for all the surface water within reach. At the Julia an inclined track

extends with a 30-deg. slope to the level bottom of the pit, and there branches. A steam hoist at the top pulls the cars from the bottom and they then proceed by trestle to the drier. A small plunger steam pump at the bottom is required to run nearly constantly to keep pace with the water. In the hope of restricting the inflow of water, a trench was once dug around the entire circumference of the pit, draining at the lowest point, but the results were not the ones anticipated, for some of the water, taking an underground course to the bottom of the excavation, made a slippery plane down which most of the adjacent earth slid into the pit. The most successful method for retaining the loose banks is to leave a skin of bauxite, wherever this can be done, but even then so large a part of the circumference is devoid of ore, and composed entirely of clay and gravel, that a heavy rain will wash in enough mud to retard mining for several days.

BAUXITE DRYING

As the mine output has, in nearly all cases, to be hauled several miles to railroad, and as a long train haul is then required to get the ore to market, it becomes a matter of economy to remove as much water as possible before shipping the bauxite. The Julia drier may be described as typical of the plants commonly employed. Some of the Julia ore is obtained in hard lumps; these are shipped, with no preliminary treatment, to Niagara Falls to be used in the manufacture of alundum, an artificial abrasive analogous to the natural corundum.

As the crude ore arrives at the drying plant, some of that which is most contaminated by clay is first put through an inclined double-log washer. The ore is fed into the low end of the trough, and a copious stream of water falls into the high end. The logs work the bauxite up the incline, and discharge it, cleaned, at the upper end, while the clay goes off at the bottom, through a launder. A number of shallow settling boxes are provided at points along this launder, and a considerable saving of fine bauxite is effected in them.

This washed ore, together with the higher-grade crude, is then put through the drier. This apparatus is a simple sheet-iron cylinder, of 3-ft. diameter and 26 ft. long, inclined at about 10 deg. from horizontal, and rotated slowly by a sprocket chain. At the low end are a fire-box, and a bucket elevator for raising the dried ore to the shipping bin; the damp ore is shoveled into the upper end, whence the smoke and steam pass up the chimney. The interior of the cylinder is not lined, but is provided with three rows of buckets precisely like those on a bucket elevator. The rows are set staggering, so that a forward and downward motion is given to the ore as the buckets raise it and then let it fall through the current of hot air.

The drier has a capacity of 25 to 30 tons in 12 hours. Wood is the most satisfactory fuel for bauxite drying, not because it is cheap, but because the smoke from soft coal blackens the ore. With the present inadequate supply of labor for obtaining firewood, this plant has actually had to haul in coke to burn in its drier. The fireman maintains a thick bed of burning coke and occasionally throws in a heavy chunk of wood to provide a flame.

This mine is now shipping one carload of ore per day, mainly to chemical manufacturers, with some to basic open-hearth steel plants, and to Niagara Falls, as noted. The highest-grade, or so-called "Alum," ore ranges between 56 and 58 per cent. Al_2O_3 and around 8 per cent. SiO_2 . The No. 2 ore averages 50 per cent. Al_2O_3 and 12 per cent. SiO_2 . All the ore from this mine carries less than 1 per cent. iron, and some of the hard lump ore is said not to exceed 2 per cent. of silica.

The mine is 5 miles from the nearest railroad point, Halls, on the Western & Atlantic Railroad, and the ore is hauled out in wagons, eight of them making two trips each, per day, over exceedingly difficult roads. The necessity for this kind of transport seems inherent in, and must be a heavy burden on the bauxite industry. The difficulty has been solved at Hermitage, in particularly favorable circumstances, by building a narrow-gage track, down which a couple of loaded cars run by gravity $1\frac{1}{2}$ miles to Shannon, on the Southern Railway, whence the empties are hauled back by mule. As a rule, however, the mines are too widely scattered, too remote from the railroads, and of too doubtful endurance to warrant any elaborate arrangement for transporting the bauxite.

Rock Drill Lubrication

The Chicago Pneumatic Tool Company, Chicago, Ill., is supplying an independent rock-drill oiler which may be attached to the hose connection by using a standard nipple and tee joint.

The upper part of the oiler body is made to form a reservoir for the oil, and

is of sufficient capacity to hold from 50 to 60 oilings, which are measured out to the drill by turning a star wheel. One filling of the reservoir chamber will last a day's run.

The device is constructed so that at each quarter turn of the star wheel a definite quantity of oil is delivered and passes into the drill with the operating fluid.

The positions of the arms on the star wheel and the measuring pockets in oiler coincide and provision is made for automatically latching at each quarter turn of the star wheel.

A strainer in the mouth of the filling chamber prevents dust and grit from being introduced with the oil. This strainer is easily removed for cleaning.

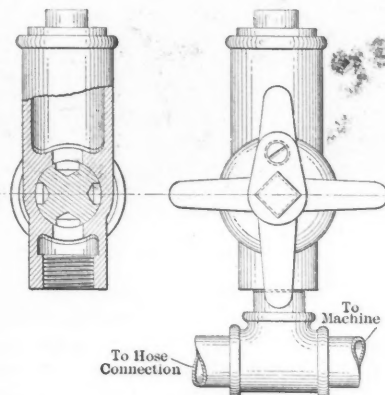
The addition of one teaspoonful of flake graphite to each pint of oil will be found to be very beneficial. The graphite and oil should be mixed as thoroughly as possible before placing in the oiler.

Roasting at the Washoe Smelting Works

At the Washoe smelting plant, described in a pamphlet issued by the Anaconda Copper Mining Company, there are 64 McDougal calcining furnaces of the Evans-Klepetchko type. These furnaces have six hearths, 16 ft. in diameter, and are 18 ft. high; they have revolving water-cooled shafts and arms, driven by suitable gearing from the top. The rables are so set as to move the material from circumference to center, and *vice versa*, on alternate hearths until it finally drops into the calcine hoppers immediately over tracks for transportation to the charge floor of the reverberatory building.

No fuel is used other than the sulphur in the concentrates, the burning of which furnishes sufficient heat to do the calcining, except on occasions when the furnace is not hot enough to ignite the sulphur, at which times fine coal is fed. The gases are taken through brick flues into large brick and steel dust chambers, where a large proportion of the flue dust is settled. This dust chamber is so arranged that the bottom is a series of hoppers, so that the entire contents of the dust chamber can be drawn into the flue-dust cars and sent directly to the reverberatory furnaces for smelting.

The material which sticks to the rabble arms, center shaft, etc., called "barrings," is barred off and sent to the blast furnaces. Fine limerock and the screenings from first-class ore in sufficient quantities to produce the slag desired in the reverberatories are charged with the fine concentrates through the feed hoppers of the roaster for the purpose of getting an intimate mixture. Each furnace is capable of handling 45 tons of material in 24 hours.



LUBRICATOR FOR AIR DRILL

Coal-storage under Water at Hawthorne, Ill.

About 1902 the Western Electric Company, at Chicago, Ill., after carefully in-

one on each side outside the pit, running the entire length, so that coal cars may be emptied into or loaded from the storage pits while on any one of five railroad tracks.

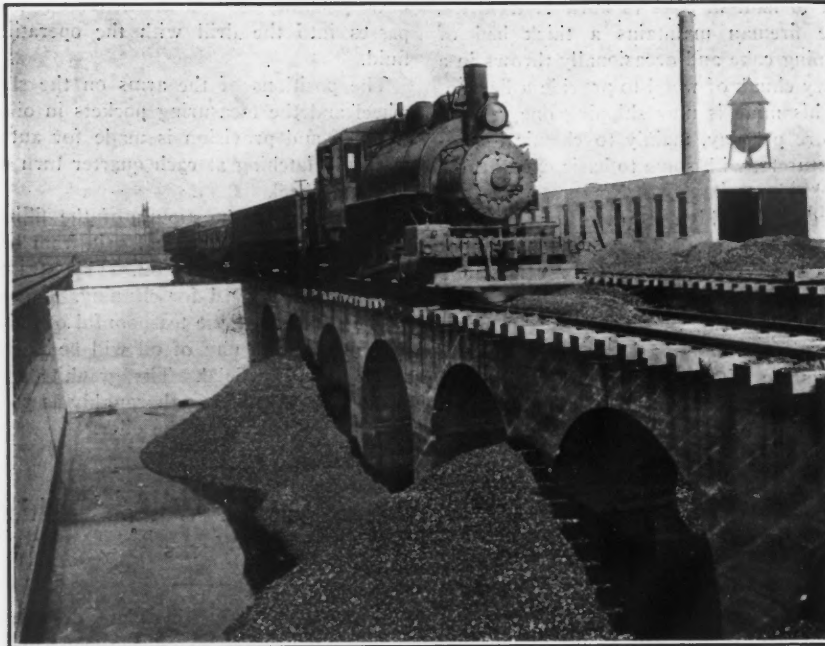
A locomotive crane, fitted with a grab

practical purposes by the time it reaches the boilers.

LOSS OF HEATING VALUE DUE TO EXPOSURE

In *The Engineer*, London, for Sept. 4, 1903, commenting on a report that Lord Charles Beresford had stated that possibly 50 per cent. of the heating value of coal is lost when the coal is stored for a considerable length of time in piles exposed to the open air, the statement is made that the loss in calorific value will probably be found in practice to be between 10 and 15 per cent., with a possible maximum of 20 per cent. In the same paper for Sept. 18, 1903, Lieut. Carlyon Bellairs, R. N., in a communication to the editor, states that from second-hand evidence he believes that the coal stored at Hong Kong loses from 20 to 30 per cent. of its calorific value with a probable average of about 25 per cent.

John Macaulay, general manager of the Alexandre Docks and Railway, of Newport, Monmouthshire, Wales, contributed an article on the same subject, in which he stated that as a result of his experiments and observations he believed that coal submerged to a considerable depth in water, so that the coal would be stored under pressure, would not lose more than 3 per cent. of its calorific value after being stored for twelve months, whereas if



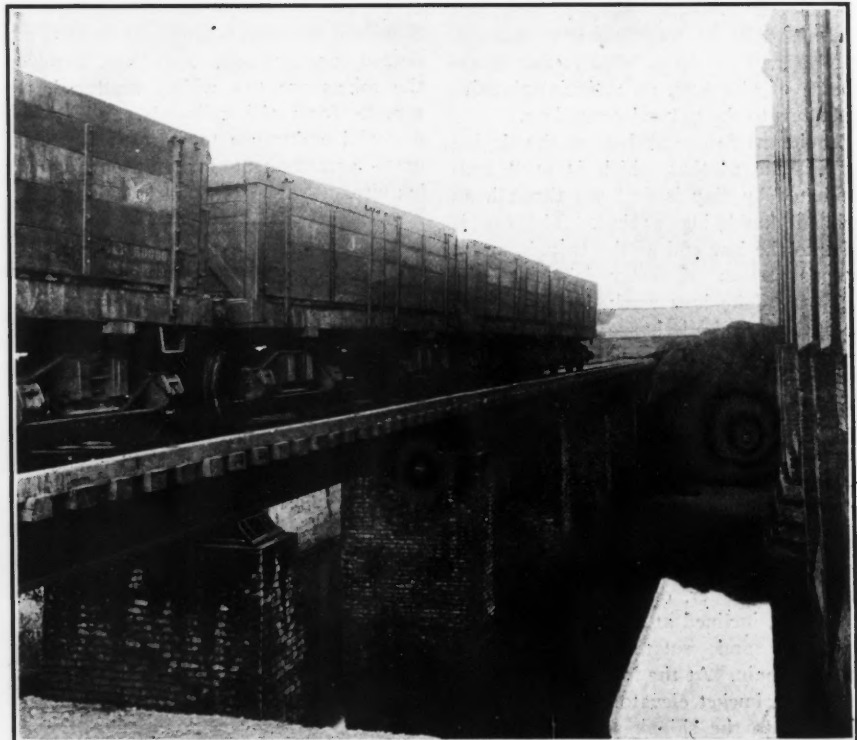
COAL-STORAGE PITS BEFORE MILLING WITH WATER

investigating the question of uncertainty of coal supply due to strikes and other conditions beyond its control, decided to provide for the storage of a considerable amount of this fuel. As experience with coal bunkers at one plant showed very clearly that the Illinois coals, which the Western Electric Company makes use of, when stored in ordinary bins exposed to the air, suffered materially from spontaneous combustion, it was decided to dig a hole in the ground at the Polk street plant, and store a large quantity of coal under water. This was carried out with satisfactory results inasmuch as no trouble has ever been experienced there from spontaneous combustion.

CONCRETE PITS

When it was decided to provide for a large storage of coal at the new plant at Hawthorne, Ill., the same scheme was followed, and a storage pit, built of concrete, divided up into three sections and covering a ground area of about 310x114 ft., was decided upon. It is arranged for filling with water so as to entirely cover all the coal that may be placed in it. As constructed, each section is approximately 15 ft. in depth, and the whole pit has a capacity of about 10,000 tons, which reserve is kept exclusively for emergencies.

Three railroad tracks are carried on concrete piers and arches running the entire length of the pit, thus dividing each of the three sections into four equal divisions. There are also two railroad tracks,



LOADED CARS IN POSITION FOR DUMPING INTO STORAGE PIT

bucket, is provided for taking the coal out of the storage pit and loading it into the coal cars. No provision is made for drying the coal before use as it is believed that the handling of the coal will result in its being dry enough for all

the same coal were stored in the open air in England, at least 12 per cent. would be lost and in a hotter climate 18 to 24 per cent.

These opinions apparently all refer to bituminous coals running probably 30 to

35 per cent. volatile combustible matter similar to the Illinois coals which the Western Electric Company makes use of. The company has never made any careful tests to verify the opinions expressed above, but there is very little doubt that these opinions are amply borne out by practical experience.

Mr. Macaulay, referred to above, found that coal submerged in salt water showed an apparent increase in heating value which may or may not have been caused by the salt in the water, but the Western Electric Company has not thought it worth while to go to the expense of throwing salt into its storage pits with the idea of enriching the coal.

Cost of Producing and Distributing Oil

A report of the chairman of the Interstate Commerce Commission gives a concrete illustration showing the cost of producing and distributing petroleum products.

The Standard Oil Company erected, in 1904, a refinery at Sugar Creek, Mo., which is within the switching limits of Kansas City, Mo., and the superintendent of this refinery testified at some length upon the hearing at Kansas City. From his testimony, together with other testimony taken upon the same hearing, the following facts appeared:

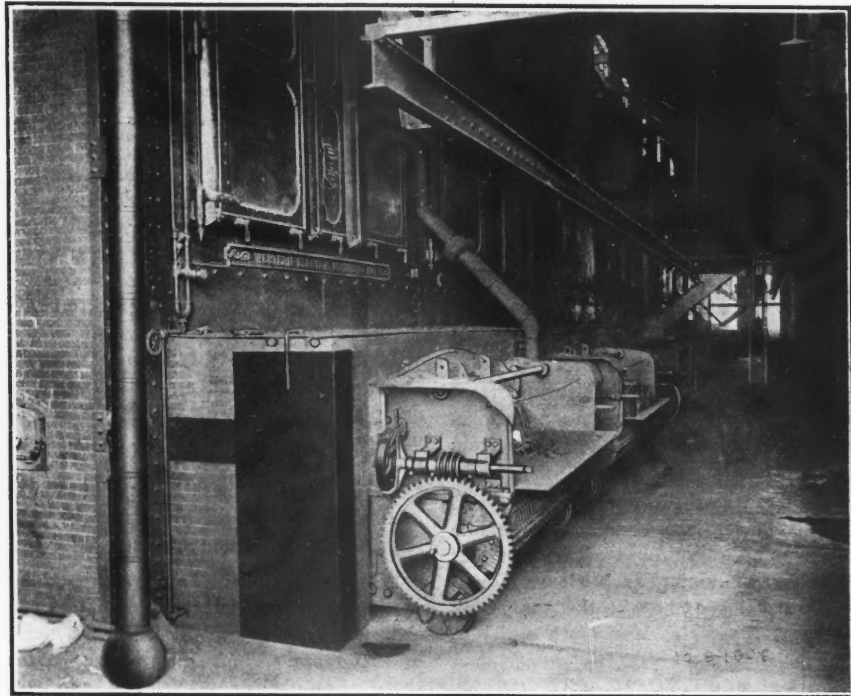
This plant refines 9000 bbl. of crude

What is known as fuel oil is also further treated to produce gas oil and gas coke, but it may all be considered as though disposed of as fuel oil.

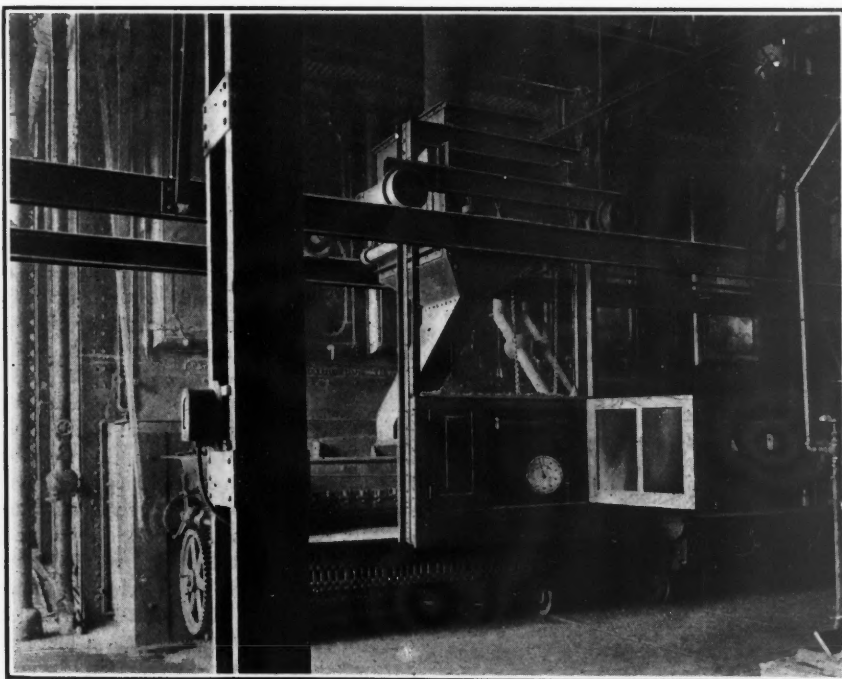
The crude petroleum refined at Sugar Creek comes from the Kansas and Indian

to the refinery. The entire cost of crude at the refinery, when this hearing occurred, in March, 1906, was not far from 55c. per barrel.

The fuel oil was largely disposed of in Kansas City for the making of steam in



AUTOMATIC STOKER



AUTOMATIC SCALE SHOWING AMOUNT OF COAL USED

petroleum daily, and its superintendent stated that the cost of refining a barrel of 42 gal. was from 15 to 20c. Crude oil of the kind refined here produces about 10 per cent. gasolene, 25 per cent. refined oil or kerosene, and 65 per cent. fuel oil.

Territory fields, and at the time of this hearing was worth to the producer about 50c. a bbl. The Sugar Creek refinery is connected by pipe line with these fields and the crude oil is pumped at an expense not exceeding 5c. per bbl. from the fields

competition with coal, and was bringing at that time from 67 to 80c. per bbl. Much of this fuel oil, as already indicated, was further treated, and sold for other purposes, but when so treated its value to the Standard Oil Company was no less, and probably somewhat more, than when sold for fuel oil. It is conservative to say that at Sugar Creek in the process of refining no loss occurs in the production and sale of that part of the product known as fuel oil over the cost of the crude and the cost of refining; in other words, that the residuum takes care of itself.

The cost of refining the gasolene and kerosene would be approximately 1/2c. per gal., and the original cost not far from 1 1/2c. per gal., so that the Standard Oil Company was producing at this refinery 900 bbl. of gasolene and 2250 bbl. of kerosene daily at a cost to that company of about 2c. per gallon.

The price realized by the Standard company from the sale of the products of this refinery varied according to the locality in which they were sold. Competition in the sale of the products of petroleum in Kansas City was acute, and the price there was from 8 to 9c. per gal. to the retail dealer. The cost of taking it from the refinery and delivering it to the retailer in Kansas City would be from 1 to 2c. per gal., leaving a net profit to the Standard Oil Company upon this oil of 5c. per gallon.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

A large deposit of anthracite coal has recently been discovered in Russia. The coal beds are 60 miles broad, but the length and thickness have not yet been determined.

In prospecting for coal with a diamond drill, it is well to remember that any bit smaller than 2 in. in diameter is likely to grind and break the coal, producing an imperfect core, especially in soft coal.

In the satisfactory operation of a coal washery, it is necessary to feed the jigs slowly and regularly. It is also important to have the material jigged to a uniform size, if the separation of the refuse from the coal is to be complete.

In mines where the water is gritty and acid, it is generally best to use an outside packed pump, on account of the fact that the water containing such elements will cut the packing and make the pump leak in a short time; also it is much easier to repair a pump packed on the outside than one packed on the inside.

Experience has shown that in breaking coal through rolls, the waste may be increased as much as 5 per cent. by over-feeding. It has also been proved that the amount of waste is less when the coal is not broken at once into small sizes, but is passed through two sets of rolls, the second set being closer together than the first.

In fighting a mine fire or going into old workings where an accumulation of carbon dioxide is suspected, the use of patent electric pocket lamps is not advisable, as they emit light in carbon dioxide as well as in air; whereas, an ordinary safety lamp will go out when this gas is present in quantity, thus warning the men to retreat.

In laying tracks on a slope or plane (at head and foot wherever necessary), the knuckles should be provided with vertical curves, the radii of which are determined by the car base, so that while the cars are running over the knuckles, both the front and back wheels of the car rest on the rails. If the curve has too short a radius the cars will leave the track when they pass over the knuckle.

On a gravity slope, rollers must be provided for the rope so that no part of the latter will slide on the ties. The distance between rollers should not be more than 12 to 15 ft. near the foot of the plane, which gradually flattens off. Rollers on level tracks should not exceed 20 ft. Having tracks in good condition, and the average distance between rollers from 12 to 15 feet, the friction due to the rope for

slopes having grades from $4\frac{1}{2}$ in. to $7\frac{1}{2}$ in. in 10 ft., varied in one case from 6 to 16 per cent. of the weight of the ropes used.

It has been found after many careful observations, that the size of a flame in a safety lamp is governed by the proportion of oxygen present in the air in which it burns. If the proportion of oxygen be increased the flame is shortened, while a decrease in oxygen lengthens the flame. It is therefore true that a lengthening of the lamp flame in an air containing fire-damp is due to less oxygen in the atmosphere than in the normal air. This causes the combustible gas to seek food in the form of oxygen, and the less the supply of oxygen present, the greater is the need for an extended flame surface.

West Virginia will have a coal exhibit at the Jamestown Exposition that will eclipse any display of the kind ever made by that State. The exhibit will be in the shape of an obelisk, 125 ft. high, and built of soft coal from the many producing counties of the State. The base will be 40x40 ft., and the coal will be placed in horizontal strata, one layer for each producing county. The structure will be brilliantly illuminated at night, and as it is to be located on the water front, it will serve as a landmark both by night and by day. This obelisk will be an addition to the regular State exhibits of West Virginia.

In estimating an anthracite coal measure, it is the practice to look first for the percentage yield of prepared sizes per foot acre. This ratio varies from 50 per cent. to 77 per cent. of all the coal produced, depending upon the manner in which the coal is mined, handled and prepared in the breaker. The production varies from 70 to 85 per cent. of all coal in the area worked. One-foot acre of coal land contains 1825 tons; of this amount from 640 to 1200 tons of prepared sizes is obtained. However, if it is necessary to leave 40 to 50 per cent. of the coal as pillars to support the roof and surface, only from 320 to 720 tons per foot-acre will be won.

Sulphuretted hydrogen, which is sometimes called "stink-damp" by miners, is colorless and has distinctly poisonous properties when inhaled in its pure state. In certain proportions it forms an explosive mixture with air. The production of this gas in a coal mine is usually a forerunner of gob-fires, and also an indication of coal heating spontaneously. Furthermore, it is a valuable indication to the miner that he

should be on the lookout for the deadly white-damp, which together with black-damp is always given off from gob-fires. Stink-damp may be easily detected by its effect upon metallic silver, such as a watch-case or silver ring, which becomes covered by bluish-black deposits after being exposed to the air for a while. This is due to the union of the silver with sulphur, forming silver sulphide.

In conjunction with the United States Forestry Department, the Reading Coal and Iron Company is meeting with much success in its experiments dealing with the preservation and economical use of mine timbers. During the past decade, the proportionate increase in the consumption of lumber has been 50 per cent. greater than the increase in our country's population. In 1890, we consumed 27,000,000 ft., while at the present time we are annually using upward of 40,000,000 ft. In re-foresting our timber lands, the most careful management will not insure an average growth of more than 50 cu.ft. of wood per acre each year; at this maximum figure, our forests would not furnish by annual growth the amount of wood we now use. As to the waste in manufacture, it may be stated that present practice secures only about 30 per cent. of the cubic contents of a tree, the remaining 70 per cent. being almost wholly wasted. For fuel purposes, our available statistics show that we consume about 115,000,000 cords of wood annually.

Sawdust in cake form was recently used in Germany, with promising results. The briquets weighed about one-half pound each. In the district surrounding the factory where the briquets were made, the schools were heated with this fuel, the combustion leaving very little ash and proceeding without a large flame. No binding material was used, the sawdust being dried and pressed into the desired shape, and owing to the absence of tarry matters there was no smoke in burning. The weight of such a briquet indicates the heavy pressure under which it takes its shape, and the edges look like polished oak; in fact, it is heavier than a piece of hardwood of the same size. The demand created by the popularity of the fuel exceeded the supply of sawdust obtainable in the vicinity of the factory, and shiploads were, therefore, procured from Sweden and carloads from distant manufacturing factories. Sawdust, which previously could be had for the asking, soon commanded a market price. Unfortunately, the factory was destroyed by fire, and operations have temporarily been suspended.

The United States Steel Corporation

The annual report of this company for the year 1905, which has just been issued, covers fully the operations, as usual. The important portions of the report are summarized here, and form a valuable indication of the course of the iron trade during the year.

The capital account shows that on Dec. 31 there was outstanding \$508,302,500 common stock and \$360,281,100 preferred stock. The total bonded debt was \$564,670,876, a reduction of \$5,801,389 during the year.

EARNINGS AND INCOME

The general statement of earnings and expenses may be summarized as follows:

	1905.	1906.
Gross receipts.....	\$585,331,736	\$696,756,926
Operating expenses.....	\$440,013,432	\$517,083,955
General expenses.....	18,570,374	22,907,679
Total.....	\$458,583,806	\$539,991,634
Net earnings.....	\$126,747,930	\$156,765,292
Interest on investm'ts, etc.	6,057,134	9,159,864
Total.....	\$132,805,064	\$165,925,156
Account, subsidiary cos..	13,017,406	9,300,883
Final net earnings.....	\$119,787,658	\$156,624,273

The increase in gross receipts last year was \$111,425,190, or 19 per cent.; in net earnings, \$30,017,362, or 23.7 per cent.; in final net earnings, \$36,836,615, or 30.8 per cent.

The disposition of the net earnings for 1906 is reported as follows:

Net earnings, as above.....	\$156,624,273
Depreciation and replacement funds..	\$30,657,335
Interest and sinking fund.....	27,747,850
Adjustment of sundry accounts.....	90,501
Dividends, preferred stock, 7%.....	25,219,677
Dividends, common stock, 2%.....	10,166,050
Special appropriations, new work.....	50,000,000
Total.....	\$143,881,413
Surplus for the year.....	\$ 12,742,860

The total undivided surplus, as of Dec. 31, 1906, amounted to \$97,720,714, which represents the working capital of the company.

The expenditures for new property and construction during the year were: Gary plant, \$4,720,159; other manufacturing properties, \$12,895,066; coal and coke properties, \$1,089,379; iron-ore properties, \$3,878,295; transportation properties, \$9,227,466; miscellaneous, \$344,781; total, \$32,155,146. The total expenditures under these heads from the organization of the company, April 1, 1901, to the end of 1906 were \$208,231,164.

PRODUCTION

The report of production from the various properties of the company is as follows, in long tons, except cement, which is in barrels:

	1905.	1906.
Iron ore mined.....	18,486,556	20,645,148
Coke manufactured.....	12,242,909	13,295,075
Coal mined, not including that used in making coke.....	2,204,950	1,912,144
Limestone quarried.....	1,967,355	2,227,436

BLAST-FURNACE PRODUCTS.		
	1905	1906
Pig iron.....	9,940,799	11,058,526
Spiegel.....	158,071	150,044
Ferro-manganese and silicon	73,278	58,807
Total.....	10,172,148	11,267,377
STEEL-INGOT PRODUCTION.		
Bessemer ingots.....	7,379,188	8,072,655
Open-hearth ingots.....	4,616,051	5,438,494
Total.....	11,995,239	13,511,149
ROLLED AND OTHER FINISHED PRODUCTS.		
Steel rails.....	1,727,055	1,982,042
Blooms, billets, slabs, sheet and tin-plate bars.....	1,253,682	1,096,727
Plates.....	780,717	836,399
Heavy structural shapes.....	484,048	620,823
Merchant steel, skelp, hoops, bands and cotton ties.....	982,782	1,240,548
Tubing and pipe.....	911,346	1,025,913
Rods.....	84,049	111,488
Wire and products of wire.....	1,283,943	1,399,717
Sheets—black, galvanized and tin plate.....	924,439	1,112,542
Finished structural work....	404,732	643,622
Angle and splice bars and joints.....	150,265	176,730
Spikes, bolts, nuts and rivets	61,496	70,233
Axles.....	149,596	181,913
Sundry iron and steel products.....	28,236	79,736
Total.....	9,226,386	10,578,433
Spelter.....	29,781	28,884
Copperas (sulphate of iron)...	20,040	21,933
Universal portland cem't, bbl.	1,735,343	2,076,000

The iron ore mined in 1906 was from the following sources: Marquette ranges 1,442,290; Menominee, 1,874,680; Gogebic, 1,465,375; Vermillion, 1,794,186; Mesabi, 14,068,617 tons.

EMPLOYEES

The average number of employees in the service of all companies during 1906, in comparison with 1905, was as follows:

	1905.	1906.
Manufacturing properties.....	130,614	147,048
Coal and coke properties..	20,883	21,929
Iron-ore mining properties	12,068	14,393
Transportation properties.	14,524	16,638
Miscellaneous properties..	2,069	2,449
Total.....	180,158	202,457
Total annual salaries and wages.....	\$128,052,955	\$147,765,540

The offer to the employees to subscribe for the preferred stock of the United States Steel Corporation was again renewed at the end of the year 1906 on substantially the same conditions as offered in previous years, except the price was fixed at \$102 per share. Under the offer subscriptions were received from 14,169 employees for a total of 27,032 shares. At Dec. 31, 1906, there were 15,568 employees who had purchased preferred stock under offers made by the corporation, and who on that date either held the certificates for the stock or were making monthly payments on account of the purchase price thereof.

An increase was made on Jan. 1, 1907 (on March 1, 1907, in case of the coke companies), in the wages and salaries of approximately 131,000 employees, or 65 per cent. of the total employees of all companies. The advance applied to practically all employees who are paid on basis of day rates, and to a considerable number of those paid on basis of a monthly salary. The average rate of increase in wages and salaries of the employees affected equaled 6.6 per cent. The amount of increase in the total pay-roll attributable to above advance will be approximately \$6,000,000 per annum. The average

rate of pay received by all employees is now the highest paid at any time since the organization of the corporation.

Following the practice heretofore adopted, a substantial amount was distributed as a bonus for the year 1906 to a large number of employees who merited the same. Included in the distribution were about 21,000 shares of common stock which were previously purchased in the market for that purpose, and which will not be delivered until the expiration of three years and the compliance with various conditions named for the protection of the companies. From the bonus fund to be ascertained at the end of 1907 in the usual way it is proposed to establish a separate fund to be known as the pension fund and to be used for pension purposes.

GENERAL

In common with practically all lines of industry throughout the United States, the business of the subsidiary companies during the year 1906 reached a new high level. The average prices received during the year for all steel products shipped to the domestic trade exceeded by 5.3 per cent. the average received in 1905, and were about 8 per cent. lower than the prices which prevailed in 1902. The condition of the trade has been such that prices of many of the commodities produced could have been advanced; and as wages have been largely increased and freight rates raised, it has been argued by some of the manufacturers of steel that prices of their manufactured commodities should be correspondingly advanced; but it has been decided by the management of this corporation and of its subsidiary companies to make no changes in prices at this time.

The orders for steel products of all kinds, both for immediate and for future shipments, were received in large volume up to the close of the year. Since Jan. 1, 1907, the orders received have been somewhat less than they were during the months immediately preceding that date, but they are larger than they were during the same months in 1906, and have about equaled the productive capacity of the mills, notwithstanding the tonnage of unfilled orders on the books at close of the year equaled 8,489,718 tons of all kinds of manufactured steel and iron products, in comparison with 7,605,086 tons at the close of 1905.

The export business of the subsidiary companies continues to show material improvement. Export shipments during the year amounted to 1,079,319 tons of various products, an increase of 13 per cent. over the tonnage shipped in the previous year, while the gross receipts exceeded those of 1905 by 28 per cent. Since the export business of all the subsidiary companies was concentrated, late in 1903, in the hands of a single selling organization, there has been steady and systematic development in all foreign markets.

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To Our Canadian Subscribers

The present postal treaty between Canada and the United States expires on May 7 next. The Canadian Government has before it a proposition to increase the rate of postage on periodicals from the United States to such an extent as will make it necessary for us to about double our subscription rate to Canada.

If Canadian friends of this paper object to such a raise it would be well if they wrote their postal authorities protesting against such action.

Pennsylvania Mine Inspectors

We learn that our recent editorial on the proposed legislation dealing with the election of mine inspectors in Pennsylvania is stimulating thoughtful discussion in the anthracite districts. This is as it should be. There are few public positions where the lives of so many men depend upon a conscientious, fearless performance of duty as that of mine inspector, and it would be surely ill-advised to make that office merely a place to be given as a political reward, instead of keeping it for the efficient regulation of an industry attended by many hardships and dangers.

The advocates of the present proposed measure have so far advanced no plausible reason that would justify lowering the standard of qualification for the post of mine inspector. The assertion that the miners would be better represented if all those holding mine-foremen's certificates were eligible as mine inspectors is in error, as the majority of the present inspectors have risen from the ranks of the more intelligent mine foremen, and they are no more likely to be influenced by unscrupulous mine operators than any of the present mine foremen would be.

Anyone who reads the questions that were recently asked of the candidates for a mine-foreman's certificate and compares them with the examination for mine inspectors will see how much more elementary and narrow is the former. Yet the present requirements do not render it impossible for any ambitious miner or mine foreman to attain to the position of mine inspector, providing a sufficient amount of conscientious effort is expended in preparing for the duties.

Many of the present mine inspectors have been attracted to the position by reason of the standard of the qualifications

established. They have felt, and properly so, that to win the office in this way gives them a certain rating among their associates in matters pertaining to mining that is honorable and in other respects worth while. For this reason, among others, any lowering of the standard would be an injustice to all who have honestly worked to become eligible for the position. However, the prime reason against any change in the present law for the worse is that it would be directly contrary to the most solemn interests of the miners themselves.

A fact important to remember is that there are upward of 1000 mine-foremen's certificates that have been issued to men who have abandoned mining for other pursuits in life, and each of these holders, regardless of present inexperience or occupation, would be eligible for the office in question under the proposed legislation. Popularity, rather than ability and fitness, is generally the magic virtue that leads to success in the political field, and this same condition is unfortunately true with respect to the office of mine inspector, and will be as long as the position is controlled by political parties.

We do not pretend to be satisfied with present conditions nor content with the position as it is now administered, and we would heartily indorse any reform that might give greater independence and higher efficiency to the mine inspectors; however, all mining men, including both operators and the thousands who work with their hands underground, should strongly oppose any measure that will tend to lower the standard of qualifications for a position that should be characterized by dignity, prestige and ability.

The Location of Smelting Works

In an interesting and valuable article, published elsewhere in this issue, Herbert Lang raises again the old dispute among metallurgical engineers as to the relative advantages of flat sites or hill-sides for the location of smelting works. As he remarks in his introductory paragraph, little of a really conclusive nature was said in the former discussions, and it is scarcely probable that any converts were made to one side or the other. Mr. Lang has excellent reason for re-opening this discussion, at the present time, because the increasing magnitude of metallurgical plants constructed during the last few years has introduced new con-

ditions, appreciation of which must necessarily have affected views on the subject.

It would be ridiculous, for example, to contemplate the location of a plant of the magnificent distances of the Copper Queen works, at Douglas, Arizona, on a hillside with the idea of securing some advantage, real or fancied, from gravity. However, the change in conditions in such respects, which is especially the theme of Mr. Lang's present article, has not by any means led yet to unanimity in opinion. We have seen recently a large metallurgical works in course of construction—not so large as that at Douglas but large enough to warrant classification among the great metallurgical plants of the country, comprising many buildings and interdependent departments—for which the builders have selected a steep hillside.

Probably a conclusive answer to the relative merits of flat and sloping locations can be given only by designing a works of the same type and capacity for either kind of location, and carefully estimating the cost of construction and the probable cost of operation in each case. However, that would involve practically the engineering of two plants, which would be an expensive matter, and is doubtless the reason why no one has yet contributed to the discussion on that basis. The same difficulty will hold true at the present time, but nevertheless a general discussion of the subject on the new phases which have been presented by Mr. Lang, will be distinctly useful. We hope that our metallurgical readers will take up the matter and contribute their criticisms upon the points which Mr. Lang invites.

Mine Explosions and Atmospheric Pressure

We note with gratification the interest that is being evinced by colliery operators in the principle we are advancing (we make no claim to originality in its formulation) with reference to the relationship of barometric pressure and outflow of gas into a mine. Our Scranton correspondent in his letter this week reports that: "The recent editorial in the JOURNAL calling attention to two nearly simultaneous gas explosions in the anthracite region, and their connection with atmospheric conditions, has attracted general attention, and was copied by several daily papers. The

editorial was indorsed everywhere, and caused increased watchfulness among the officials at the various collieries. It is interesting to note that a few days afterward, work was suspended at the Dorrance colliery, of the Lehigh Valley Coal Company, owing to the excessive amount of gas found in the workings. The workmen were not allowed to enter the mine, and the officials stated that there was no doubt that the atmospheric conditions were responsible for the accumulation."

During the last few weeks we have been assured by many practical mining men of their positive belief in the statements we have made concerning this matter; however, it is our opinion that few mine managers fully realize what actual good may result from a better understanding and more careful observance of the problems involved. It is only from a widespread understanding that the greatest benefit will be derived, and we therefore urge all mine inspectors, engineers and managers to write us their experiences and ideas concerning the subject, so that the resulting discussions will bring forth the technicalities, and cause a better solution of the questions included.

The Steel Corporation Report

The report of the United States Steel Corporation, an abstract of which is given on another page, excites attention if only by the magnitude of its figures. The gross earnings last year were close to \$700,000,000, and showed a gain of more than \$111,000,000 over the previous year, while its working capital is over \$100,000,000. Moreover the report is of value as indicating the general course of the iron trade, of which the corporation controls over 60 per cent. In this sense there is every indication of remarkable growth. The business of the company increased last year sufficiently to require increased outputs of 1,095,229 tons of pig iron, 1,915,910 tons of steel ingots and 1,352,047 tons of finished iron and steel. To supply its furnaces and mills the production of coke was increased by 1,052,166 tons, and that of iron ore by 2,158,589 tons.

The report is, as in former years, to be commended for giving a full and fair exposition of the company's work and finances, its expenses and profits. There is no concealment, and the actual condition of its affairs can readily be ascertained.

The corporation is still comparatively weak on the pig-iron side, though some progress has been made toward the correction of this condition. On the other hand, it has done much to strengthen its iron-ore position, as has been heretofore recorded. In steel and finished material there was little change during the year, though preparations were made for a great increase in both.

Pig-iron Production of the World

We have now the reports of the three great iron-producing nations for the year 1906, giving their output of pig iron for the year. The figures are as follows, reduced to metric tons, for purposes of comparison:

	1905.	1906.	Changes.
United States.....	23,340,258	25,712,106	I. 2,371,848
Germany.....	10,987,623	12,478,267	I. 1,490,644
Great Britain.....	9,746,221	10,311,778	I. 565,557
Total	44,074,102	48,502,151	I. 4,428,049

Germany showed last year the largest proportional gain, 13.6 per cent. The increase in the United States was 10.1 per cent., and that in Great Britain 5.8 per cent.; the total gain for the three countries being 10 per cent. The United States production last year exceeded that of the other two countries combined by 2,922,061 metric tons.

In 1905 the three countries named furnished 81.6 per cent. of the world's supply of pig iron. Assuming that the same ratio held in 1906—and there was probably little change—the total output of pig iron last year was approximately 59,400,000 tons. To make this iron it was necessary to mine some 120,000,000 tons of iron ore and to assemble at the blast furnaces over 200,000,000 tons of ore, flux and fuel.

THE NEW BUILDING of the engineering societies, at New York, will be dedicated April 16. On April 17 there will be addresses by representatives of the founder societies, greetings from sister societies, and presentation of medals. On April 18 the American Institute of Mining Engineers and the American Society of Mechanical Engineers will open their spring meetings. The union of the mining, mechanical and electrical engineers in this magnificent building, received through the munificence of Mr. Carnegie, is a noteworthy event in our professional history and the formal inauguration of their joint occupancy of it will be a red-letter occasion.

Calumet & Hecla, Osceola, and United Metals Selling Company

The recent contest between the Bigelow party in the Osceola and the Calumet & Hecla management has brought out some interesting statements. In a meeting of business men at Detroit to protest to the Governor of Michigan against the Gordon-Fuller amendment to the mining laws of that State (since recalled), Vice-president Livermore, of the Calumet & Hecla, spoke vigorously in denunciation of the methods which had been employed to pass the bill, riddled the arguments which had been made in favor of its passage, and asserted that the bill, if it became a law, meant confiscation of property which had been clearly conveyed to the Calumet & Hecla Company, strictly in conformity with the previously existing laws.

In reply to the charge that the Calumet & Hecla was seeking control of the entire copper industry of the State, it was pointed out that the real copper trust was the United Metals Selling Company which stood in danger of losing the sale of Osceola copper. Of the total copper production in this country today of 1,100,000,000 lb. per annum, the United Metals Selling Company has the disposal of 600,000,000 and it has made, during the last eight years, repeated but unsuccessful attempts to secure the sale of Calumet & Hecla copper. The commission of 1½ per cent, on the sale of 600,000,000 lb. of copper per annum at 19c. per lb. means \$1,710,000 to the United Metals Selling Company. In this company President Bigelow and G. M. Hyams, of the Osceola, are stockholders.

In this connection it may be remarked that the directors of the United States Metals Selling Company last week declared a quarterly dividend of \$7.50 per share, placing the stock on a \$30 per share basis. Hitherto the company has declared an annual dividend in December, and for the last few years this has been \$20 per share on a capital of \$5,000,000, calling for the annual distribution of \$1,000,000. However, besides profit from the sale of copper, the company derives profits from the electrolytic refining of part of the product which it sells. It owns the Raritan works at Perth Amboy, which has a capacity for treating 300,000,000 lb. of copper per annum.

Since the Gordon-Fuller amendment was recalled, the Bigelow interests have secured an injunction preventing the Calumet & Hecla from voting its Osceola stock. The bill of complaint, filed in the United States Circuit Court for the western district of Michigan, states that Albert S. Bigelow is the owner of 1000 shares of Osceola stock and that Calumet & Hecla is now the owner of record of

20,000 shares, and on information and belief Mr. Bigelow charges that Calumet & Hecla is the owner of a large number of shares which have not yet been transferred on the books of the company.

The bill states that Calumet & Hecla has acquired a majority of the stock of the Centennial and Allouez companies and charges that it is seeking to acquire further controlling holdings in Tamarack, Isle Royale and Ahmeek.

The bill further alleges that Lake copper is sold at a higher price, and is used exclusively in certain important industries demanding the use of copper of a superior tensile strength and ductility, "and that the control of the copper output of the mines of Michigan would establish an absolute and complete monopoly in the production of copper of a certain high standard, independent of any ownership of any mines now in operation within the United States or elsewhere. . . . The control of Osceola and Tamarack by one corporation will create a practical monopoly in the supply of, such copper, and would eliminate all competitive bidding as between said two companies." The bill further alleges that the annual production and sales of Calumet & Hecla are 90,000,000 lb. of copper, of Osceola, 19,000,000 and of Tamarack, 15,000,000 to 18,000,000, and that Tamarack and Osceola are in active competition with Calumet & Hecla in the production and sale of Lake copper throughout the United States and in foreign countries.

Winona Copper Company

The Winona Copper Company is opening up a large mine in the Lake Superior copper district. The report is for the year ended Dec. 31, 1906. The rock stamped during the year was 19,399 tons, from which 457,775 lb. mineral was saved; the final result being 278,182 lb. refined copper. The average yield was 23.59 lb. mineral, or 14.34 lb. refined copper per ton stamped. The average price obtained for the copper was 22.664c. per pound.

The income account is as follows:

Copper sold.....	\$63,326
Interest	1,175
Calls on stock.....	294,871
Total receipts.....	\$359,372
Mine expenses and construction.....	292,991

Balance

Adding \$12,828 brought forward from 1905 made a total surplus of \$79,209 carried over to current year.

President Stanwood says: "Our plans for 1907 call for improvements at an approximate cost of \$100,000, which will be provided from our present resources and from the profits of the mine. No. 4 shaft was started May 7, 1906, on land formerly belonging to the King Philip Copper Company, whose territory adjoins on the south. The old boundary line between the two properties ran diagonally across

the Winona lode. By an arrangement providing for an exchange of about five acres of mineral land, the boundary line has been made to run at right angles with the outcrop of the lode, so that each company can mine out more economically its ground lying between No. 4 Winona shaft and No. 1 King Philip shaft. Our No. 4 shaft commands all the territory to the south of it, so that no more shafts will be required.

"At present we are sending daily 360 tons of rock to the stamp mill and we expect to increase our shipments from time to time, so that with the beginning of 1908 they should reach 800 tons daily. The mine has improved greatly in appearance during the year, and there are indications that there will be further improvement as the shafts attain greater depth. A statement of the actual cost of production from the beginning in October to the close of the year would be misleading, as some time was required to get things running smoothly. In December, which may be taken as a representative month on the present basis of production, the cost was 17.15c. per pound, including all expenses except construction. This cost will diminish materially as the tonnage of rock is increased."

The Gordon Drill

SPECIAL CORRESPONDENCE

Much is being made of the success of a stoping drill, the Gordon drill, which has been brought out by local people, to work in narrow stopes. On the Rand many of the stopes must be carried 30 in. or under. The drills commonly in use are unsatisfactory in such narrow stopes. Hence the Gordon drill. On the Robinson mine where this drill has been tried, satisfactory results have been obtained. It is claimed that the average stoping width is as low, if not lower, than with hand labor, and that with these machines one white man and five Kafirs can break as much rock as one white man superintending 30 Kafirs. It is also claimed that the Gordon drill will make for better health among the miners, because of the use of a water jet which lays all dust.

This drill has not been tried on a scale extensive enough to prove whether it will accomplish all that its advocates claim for it. If it is really a success, the mines can work with fewer unskilled laborers than at present, and it will do much to solve the labor problem. The Gordon drill has been floated in a company. A large order has been placed for these drills by two of the leading groups.

Basic lead sulphate, 2PbSO_4 , $\text{Pb}(\text{OH})_2$, is produced by adding the calculated quantity of sulphuric acid to lead oxide with continuous stirring.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Copper in North Carolina

Having had numerous inquiries of late from all parts of the country regarding copper in this State, I take this opportunity of giving my ideas based on some 30 years' experience in the State.

Within a radius of 100 miles, Salisbury being the center of the mineral belt, I have examined more than 200 localities showing copper ore. For most part the veins are quartz incased in stratified country—Huronian slates with dikes of diabase, altered slates, brecciated porphyry, cherts, etc.; the general trend being northeast and southwest. The ore is pyrite with the resulting carbonates and silicates, always terminating in shallow depth to the first named. Native copper has been found in a few localities as the result of precipitation. These copper ores are, as a rule, accompanied by gold and silver, which is contained generally in the iron pyrites; this always furnishes a part of the vein filling. As a deduction and considering the deposits of this belt in their entirety, they would be classed as veins of auriferous iron and copper pyrites, and as such must be treated. To convey the idea in a simple form, the gold, silver and copper must be recovered at one operation, and on a large scale in order to insure permanent and commercial results. This would require the establishment of a metallurgical plant whereby the by-products could be utilized, copper converted direct from the ore into sulphate; sulphur recovered as sulphuric acid, and used in the manufacture of fertilizers and other acids and chemicals.

Every by-product, even to the sand, is in great and increasing demand in this section, yet strange to say, thousands of tons of Virginia pyrites are shipped in for the manufacture of sulphuric acid in connection with the fertilizer industry.

The Union copper mine, in Rowan county, has shipped to smelters in the past two years not less than 14,000 tons of crude ore, on which the freight and smelter charge has been approximately \$10 or \$12. This is cited as an instance of the cost, and what can be done with low-grade ore under able management. The probable average of the ore has been 4 per cent. copper, \$2 gold and silver. This rate of shipment is being kept up at the present time with much better results on account of the advanced price in copper.

The Gold Hill copper mines have struck, on the 800-ft. level, a new vein of auriferous pyrites, which at present is

producing paying results in gold, while the concentrates are accumulated for shipment to smelter. In these mines are thousands of tons of low-grade copper-gold ore blocked out for future treatment.

The Ashboro copper mine shipped some 200 tons of ore which ran 8 per cent. copper and \$4 in gold and silver. They have a quantity of low-grade exposed, and are preparing to develop in a businesslike manner. They have a strong vein fully 8 ft. in width, with mineralized country rock. Near this mine is a large belt of copper-bearing strata worthy of attention.

Ore Knob, in Ashe county, has a record of several thousand tons of 6 per cent. ore, which was smelted at the mines with a profit that paid dividends for some time. Here, too, there is a large reserve of low-grade pyrites. Several other localities in the same county have produced ore worthy of development. The Copper Knob mine made one shipment of picked ore that ran 25 per cent. copper with \$150 per ton in gold and silver. The Hercules Gold and Copper Company had on the dumps in 1903 some 6000 tons estimated at 5 per cent. copper and \$2 in gold. This company are still mining and blocking out ore. The Conrad Hill, in Davidson county, is a large developed family of veins of low-grade gold-copper ore, which they are preparing to put in operation at an early day. The Salisbury copper mine, in Rowan county, is a remarkable deposit of rich ore on the surface; chalcopyrite running 30 per cent. copper and \$5 in gold and silver. The development is limited to two prospects. The property is under option to New York capitalists. The Virgilina district of North Carolina and Virginia has some 20 localities that have produced high-grade shipping ore.

Many localities in Rowan, Mecklenburg, Cabarrus, and adjoining counties, have prospects showing copper ore with gold and silver, all of which require development that will justify the erection of concentrating plants. Many instances are cited in this district where good copper ore has been worked for a small gold result, allowing the copper pyrites to pass off in the tailings. A systematic development would result in exposing a large quantity of these ores, which in turn would justify the erection of works for their treatment here in this State.

Respectfully,

RICHARD EAMES, JR.

Salisbury, N. C., March 7, 1907.

Shear Zones in Sonora

In a recent contribution in the JOURNAL on "Heretical Veins in Sonora" I called attention to the prevalence in this Mexican State of impregnated shear zones as important ore deposits. Since that communication was written some further facts have come to my notice which seem worth putting on record. In the camp of Minas Prietas it appears that the ore deposits of the Grand Central and Creston-Colorado properties are of this type.

The practical point about the impregnated shear zone type of ore deposit is that the ore is country rock in various stages of alteration or decay, saturated with metal and without foreign vein stone, as is usually the case with the so-called true-fissure vein. The impregnated shear zone is usually without distinct walls, though sometimes a more clearly defined fault surface, which may be slickensided, serves as a lateral boundary or wall to the field of impregnation. Further, where the shear zone is wide, the impregnation may not occur throughout its whole extent.

Again, the zone of impregnation or orebody may meander in its vertical or oblique course, through the zone of faulted and shattered rock. In other words, the limits of the orebody may not always be parallel to the surfaces of faulting.

As Sonora is so new a field that many of its mines are still in the zone of oxidation and little is accurately known of its ore deposits in the zone of primary mineralization, the aid of trained observers is solicited in placing on record full details of the orebodies and their characteristics.

F. J. H. MERRILL.

Mina Las Animas, Sonora, Mex., March 9, 1907.

Economy in Abundant Supplies

There is nothing that adds so much to the expense of mining as a shortage of supplies. I once worked where the shift-boss gave out nails only upon request. Nails are cheap; it is better generally to even waste a pound of nails than to have a miner lose a quarter of an hour "chasing up" nails. It is far cheaper to have too many blacksmiths than to have the miners have too many pieces of dull steel. Especially in machine drilling is it necessary to have the miners supplied with an abundance of steel.

C. T. RICE.

Bisbee, Ariz., March 10.

New Publications

"Manual of Topographic Methods." By Henry Gannett. Pp. 88; illustrated. 6x9 in.; paper. Washington, 1906: Government Printing Office.

"The Assay of Tin and Antimony." Second Edition. By L. Parry. Pp. 49. 5½x8½ in.; cloth, 3s. 6d. London, 1906: Mining Journal Office.

"Mining Law in Practice." By G. W. Miller. Pp. 292; illustrated. 4x5½ in.; leather, \$2. Denver, 1907; Ores and Metals Publishing Company.

"Geological Survey of Canada. Section of Mines, Annual Report for 1904." Pp. 162. 6½x9½ in.; paper, 10 cents. Ottawa, 1906: Geological Survey of Canada.

"State Geological Survey of Illinois: Administrative Report for 1906." By H. Foster Bain. Pp. 37; illustrated. 6x9 in.; paper. Urbana, Ill., 1907: University of Illinois.

"Les Richesses Minérales de la Serbie. I. Les Gisements aurifères." By D. Iovanovitch. Pp. 107; illustrated. 7½x10½ in.; paper, 10 fr. Paris, 1907: H. Dunod et E. Pinat.

"Report on the Chibougamau Mining Region in the Northern Part of the Province of Quebec." By A. P. Low. Pp. 51. 6½x9½ in.; paper. Ottawa, 1906: Government Printing Bureau.

"Summary Reports of the Geological Survey Department of Canada for the Calendar Years 1905 and 1906. Two volumes. Pp. 350; illustrated. 6½x9½ in.; paper, 40c. Ottawa, 1906: Geological Survey of Canada.

"Results of Primary Triangulation and Primary Traverse, Fiscal Year 1905-6." By Samuel S. Gannett. U. S. Geological Survey, Bull. No. 310. Pp. 248. 6x9 in.; paper. Washington, 1906: Government Printing Office.

"Annual Report of the Director of the Mine for the Fiscal Year ended June 30, 1906. Treasury Department, Document No. 2457. Pp. 270; illustrated. 6x9 in.; cloth. Washington, 1906: Government Printing Office.

"Switchboards for Power, Light and Railway Service—Direct and Alternating Current—High and Low Tension." By Wm. Baxter, Jr. Pp. 192; illustrated. 5½x8 in.; cloth, \$1.50. New York, 1906: Derry-Collard Company.

"Etude Expérimentale du Rivetage." By Ch. Frémont. Mémoires publiés par la Société d'Encouragement pour l'Industrie Nationale. Pp. 146; illustrated. 9x11 in.; paper, 10 fr. Paris, 1906: Siège de la Société, Rue de Rennes, 44.

"Determination of Stream Flow During the Frozen Season." By H. K. Barrows and Robert E. Horton. U. S. Geological Survey, Water Supply and Irrigation Paper No. 187. Pp. 93; illustrated. 6x9 in.;

paper. Washington, 1907; Government Printing Office.

"Transactions of the American Ceramic Society, volume VIII, containing Papers and Discussions Read at the Meeting Held at Philadelphia, Pa., Feb., 1906, With Some Other Contributions." Pp. 409; illustrated. 6x9 in.; paper. Columbus, O., 1906: Secretary's Office.

"Annual Report of the Board of Regents of the Smithsonian Institution, Showing the Operations, Expenditures and Conditions of the Institution, for the Year Ending June 30, 1905." Pp. 556; illustrated. 6x9 in.; cloth. Washington, 1906: Government Printing Office.

"Eighth Report to the Alloys Research Committee on the Properties of Alloys of Aluminum and Copper;" by H. C. H. Carpenter and C. A. Edwards. Advance copy of report read before the Institution of Mechanical Engineers. Pp. 201; 20 plates. 5½x8½ in.; paper. London, 1906: Institution of Mechanical Engineers.

"A Bibliography of Ohio Geology. Part I—A Subject Index of the Publications of the Geological Survey of Ohio, from its Inception to and Including Bulletin Eight of the Fourth Series," by A. G. Derby. "Part II—A Bibliography of the Publications Relating to the Geology of Ohio, Other Than Those of the State Geological Survey." By Mary W. Prosser. Bulletin 6, Fourth Series, Geological Survey of Ohio. Pp. 332. 6½x9½ in.; cloth. Columbus, O., 1906: Geological Survey of Ohio.

"Electrical Engineering." By E. Rosenberg. Translated by W. W. Haldane and Carl Kinzbrunner. Revised by E. B. Raymond. An elementary text-book suitable for persons employed in the mechanical and electrical engineering trades, for elementary students of electrical engineering, and for all who wish to acquire a knowledge of the chief principles and practice of the subject. Pp. 347; illustrated. 6x9 in.; cloth, \$2. New York, 1907: John Wiley & Sons.

Contents: Fundamental Principles. Magnets—magnetic lines of force. The continuous-current dynamo. The electric motor. Accumulators. Working of direct-current dynamos in parallel. Electric lighting. Alternating currents. Alternators. Alternating-current motors. Multiphase alternating current. High tension.

"The Manufacture and Properties of Iron and Steel." By Harry Huse Campbell. Fourth edition, fully revised. Pp. 640; illustrated. 6x9 in.; cloth, \$5. New York, 1907: Hill Publishing Company.

Contents: The main principles of iron metallurgy. Primitive methods of making iron. The blast furnace. Wrought iron. Steel. High-carbon steel. The acid bessemer process. The basic bessemer process. The open-hearth furnace. Fuel.

The acid open-hearth process. The basic open-hearth process. Special methods of manufacture and some items affecting the costs. Segregation and homogeneity. Influence of hot working on steel. Heat treatment. The history and shape of the test-piece. The influence of certain elements on the physical properties of steel. Classification of structural steel. Welding. Steel castings. The iron industry of the leading nations—United States, Great Britain, Germany, France, Russia, Austria, Belgium, Sweden, Spain, Italy, Canada. Factors in industrial competition. Statistics.

This well known work is one of the classics of metallurgical literature. It is an example of the highest art in the preparation of a modern treatise in its field, describing not merely the means by which things are done, but also discussing the reasons why, and illuminating those discussions by the analysis of specific examples and by directing attention to the principles of physics and of chemistry which bear upon them. It is such handling of his subject that characterizes the master. Touching upon this, it is interesting to repeat a story which the author told in the preface to his second edition. A great electrician laughingly but earnestly declared that the chapter on the open-hearth was too abstruse for his intellect, while an uneducated open-hearth melter reported that he had learned, from that same chapter, how to build a furnace, how to run it, and how to make a good livelihood. "The melter understood my language, but to Edison it was a foreign tongue," said Mr. Campbell.

However, one does not have to be an open-hearth melter, or even an iron and steel metallurgist, to derive profit from Mr. Campbell's work. It is a treatise that may be read and studied profitably by every metallurgical engineer who has to do with furnace work. He will learn from it much about the practical principles of the combustion of fuel and the economical production of high temperatures that will be useful to him, besides many other things of value.

In preparing the fourth edition, Mr. Campbell has made many changes. By constant additions the book had grown too big to be convenient, so that every line has been gone over to eliminate unnecessary phrases or words. The detailed calculation by the method of least squares in chapter XVII has been omitted, and it has been deemed unnecessary to print the standard specifications in full, since they are constantly subject to change. On the other hand, much new matter has been added. A new determination of the effect of certain elements upon steel is given in chapter XVII, and at a hundred places new knowledge has been interpolated as suggested by recent progress, or by friends, both here and abroad, who have volunteered information, looking to the improvement of this book.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. B. Risque, manager of the Utah Consolidated Mining Company, is in New York.

L. R. Johnston, of Boulder, Colo., has gone to New York City this week on mining business.

H. F. A. Riebling has gone to western Chihuahua, Mexico, on some special metallurgical work.

J. H. Plummer, president of the Dominion Iron and Steel Company, was in Toronto recently.

W. W. Degge, an operator in Boulder county, Colo., has gone to Norfolk, Va., on a business trip.

J. Eaton, manager of the Dives-Pelican mines at Silver Plume, Colo., has gone on a visit to Florida.

George P. Earle, representing large interests in the Nipissing mine, was in Toronto March 12 last.

A. J. Carlson, of Idaho Springs, Colo., has returned from a trip on mining business to eastern points.

G. F. Crawford, of Kansas City, Mo., has been in Clear Creek county looking after interests in the Kinda Mining Company.

William Loack, manager of the Wolf Tongue Mining Company of Boulder, Colo., is on a business trip to eastern points.

Vivian P. Strange recently conducted an examination of the Ludwig and Nevada Douglas copper mines at Yerington, Nevada.

Harold I. Brosius has accepted the position of assayer and chemist to the Imperial Gold Mining Company at Apex, Colorado.

Richard Wallace, of Boulder, Colo., has gone to Chihuahua, Mexico, to examine mining property in the interests of Pittsburgh people.

J. B. Woodworth, formerly manager of the Nova Scotia mine, Cobalt, and H. V. Somerville, an English engineer, have left Cobalt for Mexico.

J. M. Cameron has left Goldfield, Nev., and has accepted the position of manager for the Butte Central & Boston Copper Company at Butte, Montana.

Carl E. Ambrosius, a member of the Colorado School of Mines class of 1888, who is located at Guanacevi, Mexico, has been in Colorado, on a business trip.

Walter H. Weed, mining geologist of New York, returned March 9 from an extended visit to Haiti, where he has been engaged in examining mining properties.

W. H. Knowles, a mining operator of Gilpin and Clear Creek counties, Colo., has gone to Los Angeles, Cal., having be-

come interested in the new Greenwater camps.

Marshall S. Walker has gone to Cable, Montana, representing J. V. N. Dorr, consulting engineer. He is to plan an installation of the Moore process at the Southern Cross mill there.

Arthur H. Collbran, of the Colorado School of Mines class of 1902, who is superintendent for a syndicate at Seoul, Korea, has been visiting in Colorado during the past month.

F. G. Scheffer, a German mining expert, has been looking at the mines of the Waldorf Company in Argentine district near Georgetown, Colo., in the interests of a London syndicate.

Albert A. Ireland, of Golden, Colo., superintendent of the Dewey and Waukegan companies in Summit county has also been appointed superintendent of the Atlantic Mining and Milling Company.

J. J. Bonner, formerly connected with the Revenue tunnel at Ouray, Colo., and with the Commodore property at Creede, Colo., has taken charge as manager of the Charter-Raton mines at Empire, Colorado.

H. Hayman Claudet, of Claudet & Wynne, Rossland, B. C., has been in Sonora, Mexico, the past few months and is now in Mexico City, in connection with installations of the Elmore vacuum oil separator.

W. D. Newcomb, chief engineer of the Osage Coal and Mining Company, and the Great Western Coal and Coke Company, of South McAlester, I. T., had an attack of heart failure a few days ago and is at Eureka Springs recuperating.

Harry D. Easton, of Hartshorne, I. T., assistant engineer for the Rock Island Coal Company, has resigned his position to accept that of division engineer of the Deering Coal Company, with headquarters in Chicago, and mines in Indiana and Illinois.

G. C. Hewett, of Colorado Springs, Colo., has been appointed consulting engineer of the London mine, in the Mosquito pass section, Leadville. Mr. Hewett is now on a trip to the East, his address being at Wyncote, Montgomery county, Penn., for the next month.

Dr. Robert Bell, of the Canadian Geological Survey, in giving evidence before the Canadian senate committee on Hudson bay, stated that he had gone into Hudson bay half a dozen times and was satisfied that the straits were navigable from the middle of July to November.

Philip Argall, of Denver, Colo., who was last year consulting metallurgist for the Golden Cycle Mining Company of Cripple Creek—but no longer connected with that company—is now busy designing two mills for the treatment of Cripple Creek ores on the mines in the district.

N. V. Hansell, of Hamilton & Hansell, mechanical, electrical and mining engineers, of New York, has just returned from Sweden, where he has been making a special study of the magnetic separation of iron ores and the magnetometric instruments for investigating iron-ore deposits.

T. H. Oxnam has succeeded Charles E. Finney as general manager of the Arizona Smelting Company, of Humboldt, Ariz. Mr. Finney has become president of the Dripping Springs Mines and Smelters, a new company, which has been organized to develop mines about 25 miles south of Globe.

Col. William Busby, of South McAlester, I. T., president of the Osage Coal and Mining Company, and the Great Western Coal and Coke Company, and Carl Scholz, of Chicago, president of the Rock Island Coal Company, have been in Washington, D. C., during the past week on business connected with their Government coal leases in the Indian Territory.

Henry White, of Spokane, Wash., is developing a copper property in the Inyo mountains, California, two miles east of Mt. Whitney station. Mr. White was the original owner of the property now being operated by the Granby Company at Phoenix, B. C., and was associated with Jay P. Graves in the early development of that property.

Charles S. Morris, for four years superintendent of the Utah Consolidated Mining Company's smelter at Murray, Utah, has resigned and will go to the Cerro de Pasco Mining Company, in Peru, which is now being operated under the direction of R. H. Channing, former manager of the Utah Consolidated. Mr. Morris is succeeded by Alexander Laist, formerly of the Washoe Smelting Company, at Anaconda, Montana.

Crowell & Murray, mining engineers, chemists, assayers and metallurgists, of Cleveland, O., succeeded to the business of Crowell & Peck last month. C. B. Murray, who has joined Benedict Crowell in the new firm, was formerly chief chemist at the Edgar Thompson works of the Carnegie Steel Company, and for the last three years has been president of the Metallurgical Laboratory at Pittsburg, Penn. The new firm has its office and laboratory in the Perry-Payne building, Cleveland, O. The entire office and technical force remains as previously.

Obituary

Sir Francis Tress Barry, head of Mason & Barry, Ltd., owning mines in Portugal, died recently in England at the age of 83 years.

Henri Moissan, the distinguished French chemist and metallurgist died in Paris, March 2. He was born on Sept. 8, 1852, and for the past 20 years his

life was devoted to scientific research. M. Moissan was one of the most brilliant students in the Ecole de Chimie Minérale and later (1877), while nominally employed by the National History Museum of Paris, he published a paper on the oxides of the iron group which obtained for him the doctorate of science at the University of Paris. Great chemical researches stand to the credit of M. Moissan. Taking up the work where Davy, Faraday, Fremy and others had failed, for instance, he succeeded in 1886 in isolating the element fluorine by the electrolysis of anhydrous hydrofluoric acid. Of late years Moissan devoted his attention to the study of the electric furnace, the preparation of refractory substances and a series of new chemical compounds. He succeeded in producing a number of artificial diamonds. They were extremely minute, but nevertheless diamonds. Other elements which were prepared by Moissan were chromium, tungsten, molybdenum, uranium, titanium, etc. Only the purely scientific side of these investigations appealed to the chemist and he did not develop his discoveries commercially. Other investigators carried on the work and made commercial successes of the preparation of calcium carbide and ferro-alloys. As a lecturer, as a chemist and as a man Henri Moissan will long be remembered among scientists.

It is reported that William Monroe, of Lansing, Mich., was among the passengers lost in the wreck of the "Berlin" at the Hook, Holland. Wm. Monroe was a native of Lansing, and graduated from the Michigan College of Mines. He was for several years after graduation an assistant in an assaying establishment in Houghton, and was then appointed to the management of several silver-lead mines in British Columbia. He subsequently opened an assaying office in Spokane, Wash., which he successfully conducted for several years. Later he removed to Tonopah, Nev., to look after the mining interests of an eastern mining syndicate. Wm. Monroe resided in Nevada for two years. For short intervals he was an assistant in the assaying offices of Messrs. Hewitt, Symonds & Atkins in Tonopah. Two years ago he was appointed managing engineer to an American corporation which is developing a colliery in Spitzbergen. He was on his way to Norway in connection with the corporation affairs when he met his death. He was a cultivated man, of high moral character, and his loss will be distinctly felt by many mining men who had the privilege of making his acquaintance on the various fields on which he was engaged.

Industrial

The Central Iron and Coal Company, operating Holt furnace at Tuscaloosa, Ala., is adding to its mine equipment, be-

ing in receipt of a No. 3 Thew automatic steam shovel to be used at its Woodstock brown ore mines. The delivery of a third large three-stage, Ingersoll-Sergeant air compressor, a compound air locomotive built by H. K. Porter & Co., and a duplex pump built by the Herron Pump and Foundry Company, Chattanooga, to be used at its Kellerman, Ala., coal mine, is expected.

The American Spiral Pipe Works, of Chicago, have taken over the entire business and good will of the American Forged Steel Flange Company, which has had a large business in making forged steel flanges for every class of work.

The plant, assets and good will of the St. Louis Portland Cement Company, manufacturer of the "Red Ring" brand Portland cement, have been purchased by the Union Sand and Material Company, of St. Louis. The manufacture of portland cement will be under the direct management of H. Struckmann, chief engineer and general manager, as heretofore. The capacity of the plant will be increased to 10,000 barrels per day. The new plant will be equipped with gas engines and producer gas will be used as fuel for the kilns, the whole plant being driven electrically.

Societies and Technical Schools

Senior Mining Society, Columbia University—This society, which consists of a limited number of students of the senior class of the School of Mines and some members of the faculty, has been in existence for a number of years. The object of the society has been to meet men prominent in the mining profession in an informal way, and to learn from them points of interest which they have gathered from their work in the field. The society has been addressed at one time or another by most of the prominent mining men of this country. So far this year the following gentlemen have addressed its meetings: A. A. Blow on "The Copper Deposits of Butte;" Juan Felix Brandes on "Mining as a Business;" Emil Weinheim on "Placer Deposits of Alaska," and John A. Church on "Mining Experiences in China."

American Society of Mechanical Engineers—This society was addressed on March 21 by John W. Lieb, Jr., vice-president of the society. The subject was "Vesuvius and Pompeii," and was illustrated by lantern slides from original photographs taken by F. A. Perret, who was in the Vesuvian observatory during the last eruption, and from photographs taken by Mr. Lieb during a visit to Vesuvius and Pompeii shortly after the eruption. A series of lantern slides, showing the state of the mechanic arts in Pompeii, had been especially prepared for this lecture. Through the courtesy

of E. Burton Holmes, a series of original moving pictures of Vesuvius in eruption, and of a flowing stream of lava were shown by Oscar B. Depue. The meeting took place in the spacious auditorium of the new Engineering Societies building at 29 West Thirty-ninth street, New York.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

B. F. Sturtevant Company, Hyde Park, Mass. Bulletin 125. Sturtevant Engineering Series. Pp. 8, illustrated; paper, 6x9 in.; February 1907.

The Westinghouse Machine Company, East Pittsburg, Penn. Catalog S. The Westinghouse Storage Battery for Stationary Use. Pp. 31, illustrated, paper, 6x9 inches.

Allis-Chalmers Company, Milwaukee, Wis. No. 4002. Allis-Chalmers Direct Current Motors and Generators Type "K" and Monthly Calendar. Pp. 4, illustrated, paper, 3½x6 in.; March, 1907.

Construction News

Enterprise, California—The Calonois Mining Company will soon put in a 10-stamp mill. W. C. Fowler is president and general manager.

Breckenridge, Colorado—A new hoist and pumping plant are to be installed at the Sallie Barber mine. J. C. Putner, of Denver, is the president.

Idaho Springs, Colorado—An electric plant is to be installed at the Gold Hammer group. H. J. Mortelon, Idaho Springs, Colo., is manager.

Black Hawk, Colorado—The Pewabic Consolidated Gold Mines Company is preparing to enlarge its mill. J. C. Fleschutz, Central City, Colo., is president.

Georgetown, Colorado—The Mendota Mining Company is considering the erection of a mill to treat 150 tons of ore daily. Mr. Gordon, of Georgetown, is manager.

Central City, Colorado—The School Hill Mining Company intends to add an air compressor and a new hoisting engine to its equipment. John N. Mackey, Black Hawk, Colo., is superintendent.

Phoenix District, Gilpin County, Colorado—The Champion Mining Company is preparing to put in pumps, hoists and a wire-rope tramway. S. P. Weller, Rollinsville, Colo., is president and general manager.

Loon Creek, Idaho—The Loon Creek Hydraulic Placer Company is preparing to equip its property with a complete hydraulic plant, including pipe, dynamos, giants, tailing stackers, etc. J. Frank Judge, Salt Lake City, Utah, is president and manager.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Denver, Salt Lake City, San Francisco and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 13—The manager of the Mountain Copper Company, Keswick, Shasta county, has sent out circulars in that county asking for shipments of quartz for fluxing purposes which shows that the company is again in the market for ore. This means a good deal to the small mine owners in this district and in Flat Creek, Lower Springs, Whiskey Town, Shasta and Old Diggings districts. There are scores of small mines as well as a few big ones that can now be worked profitably, for the company is willing to treat the ore for practically nothing, deriving its profit from the quartz for flux. The Mountain Copper Company will not be able to get flux as readily as it did before; the smelter company at Kennett has since entered the field, consuming nearly all the gold ore it can purchase, even making shipments from Oregon and Tonopah.

Owing to the increase of working hours from nine to ten hours daily, most of the men employed by the Grouse Creek Hydraulic Mining Company, near Callahan, Siskiyou county, have quit work. In years prior to this it has been the custom at placer mines in that vicinity that nine hours should constitute a day's work. This year, with the scarcity of miners, the same hours were adopted in the placer as in the quartz mines.

Negotiations are in progress for the purchase of the Sargent & Jacobs hydraulic mine, at Quaker Hill, near Nevada City. It is the intention of the men interested to run a bedrock tunnel from Dry Creek and work the ground by the drift process. The mine has lain idle for years. It was originally the property of the late A. A. Sargent and the late George F. Jacobs. They took out several hundred thousand dollars in gold by the hydraulic process. The drifting process will only handle the richer gravel nearest bedrock instead of washing the entire bank as in hydraulicking.

The Folsom Development Company, which is engaged in gold-dredging near Folsom, Sacramento county, is about to utilize the vast piles of cobblestones piled up by the "stackers" during the process of the work. It is these unsightly piles of cobbles which arouse the ire of those opposed to the dredging industry. The cobbles are now to be crushed on a large scale, and the crushings sized, to be used for railroad ballast, macadam and cement rock. It is estimated that the cobbles will be used as fast, if not faster, than the

dredge turns them up. In this event it would be but a short time until all the cobble pile between Folsom and the settlement of Dredge would disappear, and the land, which was previously in poor shape because of former mining operations, left level and solid and in condition for cultivation. It is a well known fact that the rock quarries which supply the Folsom prison crusher will probably give out within twelve or eighteen months. This rock has been in great demand from all parts of the State, and it is probable that the rock to be crushed by the Folsom Development Company will be in equal demand. It would not be surprising if in the future the new industry proved as profitable as the dredging operations. Crushed rock is in a very great demand all over the State, and especially in San Francisco, where vast quantities of concrete are being used.

Modoc county, in the extreme north-eastern portion of California, is coming to the front as a mining county. Numbers of prospects have been found, and are being developed to prove their worth. There have been numerous sales recorded lately, and preparations are being made for very active work this coming summer. Moreover, in addition to gold, prospecting is going on for coal at Stone Coal Valley, near Canby. It is thought that the coal deposits are quite extensive along the Pitt river, not only where the Pitt River Coal and Fuel Company is at present at work, but elsewhere.

Not only in the Greenwater mines, Inyo county, but elsewhere throughout the State good miners are scarce. At Greenwater the scale of wages is high: \$5 for men underground and about \$6 a day when work is done by contract. More miners could be employed if they could be obtained, so that development work is being retarded materially. A number of mines in the upper part of the State are being worked by one shift only when three shifts are wanted. The men can get work in San Francisco at from \$3 to \$6 per day, where there is more amusement for them than in the mountains and foothills, so they prefer the city. The \$3 a day rate does not satisfy them in the mines.

Salt Lake City

March 14—Slow progress has been made on the new Western Pacific Railroad, which is building westward from Salt Lake, during the past two months. However, over 115 miles of track are

down and the line is beyond the Nevada State line a considerable distance. All along the route of this new route much mining activity is in evidence; particularly in the Deep Creek district, in western Utah and eastern Nevada.

The washouts on the line of the San Pedro, Los Angeles & Salt Lake Railroad, in southern Nevada, have put through traffic on that road out of the question for several weeks, at least. In the meantime the southern districts are cut off from the Salt Lake markets. The trouble experienced last year and again this year has set the management to thinking about the advisability of building a new line to the west of the present one, in order to avoid the Meadow valley wash. Should this be done the main line would run within a few miles of Pioche.

The management of the Cactus mine, in Beaver county states that this month's net earnings will exceed \$250,000. About a car of crude ore and two cars of concentrate are being shipped per day.

Two sections of the new mill of the Utah Copper Company will be in operation by the end of March, by which time the power plant will be ready for commission.

The Alta Mizpah Copper and Gold Mining Company is the name of a new corporation that has just been organized to develop a property near Alta. The incorporators are: J. U. Eldridge, Lewis Levine, Jasper Billings and C. J. Jenkins, of Salt Lake. Considerable milling ore has been developed in the property.

The ore and bullion settlements in Salt Lake during the past week were reported by Salt Lake banks as being \$602,000 in all.

Denver

March 15—The State inspector of coal mines has just issued his twelfth biennial report, which shows that the tonnage in 1906 was 10,308,421. During the past year a large amount of capital has been invested in new fields, especially in Boulder, Weld and Las Animas counties, with modern equipment at the new mines.

Judging from the latest reports, the State's attorneys in Idaho believe that they have stronger cases against Haywood and Pettibone than against Moyer, the president of the Western Federation of Miners. A strong effort for a change of venue is being made on the part of the defense.

A suspension of operations was urged by President Bernard, of El Paso Con-

solidated Gold Mining Company, at the annual meeting of the stockholders, a few days ago, until the second drainage tunnel, on which work has just been commenced, shall be completed. A portion of the property is being worked under lease and that work will continue. The new tunnel will strike the property at a depth of about 1350 ft. During the year 1906 the mine produced \$801,447 worth of ore and up to date has paid \$1,242,045 in dividends. The average value of the ore shipped by the company was \$36.95. No change in the management of the company's affairs was made.

A strong effort is being made to get the railroad companies hauling the Leadville manganese ores to reduce the rates on the same. A large amount of these ores is shipped to the Illinois Steel Company at Chicago.

It looks as if the Union Pacific Railway Company will have trains running to Craig, Colo., in Routt county, before the Moffat line reaches that point. A large force of men and 200 teams are building a branch line from Wamsutter, Wyoming, and down Fortification creek. The heavy work of construction through Gore cañon will delay the completion of the Moffat line through Routt county.

A consolidation of the Central Colorado Power Company, capitalized at \$22,000,000, and the Northern Colorado Power Company, capital \$10,000,000, seems to be probable. The deal practically represents a consolidation of all the important small electric plants in the State. Former Governor M. T. Herrick, of Ohio, who is supposed to represent General Electric Company interests, has been here for some time. It looks as if all the electric lighting and power plants in Colorado are to be absorbed. The amount of capitalization of the combination is reported to be \$50,000,000.

An electric locomotive, the first one in the Telluride district, has recently been installed in the Tomboy mines at the Cincinnati tunnel, supplanting the horse-power used so long, and it seems to work satisfactorily, reducing the expense of haulage considerably.

Scranton

March 19—A unique action has been tried during the past week in the United States Court in Scranton, in which the Lehigh Valley Coal Company was sued for the royalty on coal mined under Scovel island, at the confluence of the Susquehanna and Lackawanna rivers, near Pittston. Experts from all parts of the anthracite region have been called to give testimony and a continuance has been made for 12 months, so that an amicable settlement will, in all probability, be made. The real issue in the case was the amount of coal underlying the island. Comparatively little mining has been done in that section since the caving in of the workings in the Twin shaft, in 1895, when

the whole territory collapsed, including that part now in dispute. For the time the gangways leading to the workings in the Scovel island tract were closed, rendering mining of the coal impossible until the new gangways were driven. The lease of the coal to the Lehigh Valley, however, provided that the company should pay a minimum royalty each year. These payments continued, until finally the Lehigh company claimed that the value of the coal workable under the island had been paid for. Thereupon Mrs. Bunnie L. Harris, one of the lessors of the coal, brought suit against the company, alleging that the royalties paid did not represent the aggregate value of the coal under the tract. During the case, to determine the amount of coal under the island, the cores from several bore-holes were brought into court and experts were called to give testimony as to what the cores revealed concerning the value of the coal veins. The coal men who watched the progress of the action claimed that the bore-holes could not be relied upon to prove the value of the coal veins on account of the variations in the seams. Finally a temporary agreement was reached, whereby two of the claims of the plaintiff were allowed, and the other claims are to be referred to arbitrators. The case has attracted great interest among coal operators throughout the anthracite region.

The anthracite miners are entitled to an increase of 6 per cent. in their wages for the month of March, according to the report of Commissioner C. P. Neill.

Some dissatisfaction is being expressed throughout the anthracite region at the delay on the part of the umpire in rendering his decisions in the cases which have been referred to him from the Conciliation Board. At the meeting of the board, held March 16, it was decided to communicate with Mr. Neill and ask that immediate action be taken by him in connection with these cases. These grievances have been sent to him since last July. One of them is the famous "bony" case from the employees of the Delaware & Hudson Company, in Plymouth, which he decided once previously, but which was again taken before the board and again sent to the umpire.

Cobalt, Ont.

March 15—Shipments of Cobalt ore for the week ending March 9 over the Timiskaming & Northern Ontario Railway were as follows: Buffalo, 60,000 lb.; Coniagas, 62,850; Cobalt Central, 34,920; Colonial, 34,250; La Rose, 65,000; Nipissing, 128,840; O'Brien, 64,740; Trethewey, 193,590; total, 644,190 pounds.

There is a considerable influx of prospectors to James township and adjacent localities up the Montreal river, lying immediately east of the Temagami timber reserve, and partly included in it. Some

native silver has been found, and the similarity of the formation to that of the Cobalt area is a stimulus to exploration. From 300 to 400 claims have been staked, and the arrivals are estimated at about a hundred per day.

London

March 9—The prospectus of the Vancouver Copper Company, Ltd., has been issued this week. This company has been formed to float the Lenora mine, on Mt. Sicker, Vancouver Island, together with other property, including the railway to Crofton, the local hotel, and a number of town sites. Your readers may remember that the mine was first opened up in 1899, and that it adjoins the property of the Tyee Copper Company. For some years it was worked, and large amounts of ore extracted, but latterly it has been shut down. During the time it was not worked the care-takers discovered other bodies. The plant is still in place and is capable of handling 140 tons a day. Now that copper is so high in price it is expected that a good profit can be made by handling the ore. It is intended to ship it to the Crofton smelter. The capital of the new company is £110,000, of which £80,000 is being offered for subscription. There are also £20,000 in debentures. The purchase price is £100,000, payable as to £20,000 in debentures, £30,000 in shares, and the remainder in as much cash as is available. The reports on which the company is floated are by E. P. Gilman and Henry Croft.

Although the Champion Reef and Coromandel mines, in India, have shown signs of coming to the end of their life, their old original parent, the Mysore Gold Mining Company, continues to prosper. During the year 1906, the amount distributed in dividends was £418,674, which is practically identical with the distributions during 1903, 1904, and 1905. Since the commencement of operations in 1886, the total distribution has been nearly five million pounds. During 1906 the ore crushed was 185,900 tons, yielding 184,163 oz. of bar gold. By cyaniding, 21,755 oz. were extracted from 158,848 tons of tailings. The total production was 205,918 oz., which realized £809,413. The expenditure during the year was £318,923. The new orebody referred to in last year's report has continued to open up well, and promises to be a most valuable addition to the resources of the mine. The unreliability of water falls for the purpose of generating power at mines has been well exemplified at Mysore this year by the failure of the Cauvery falls to supply the expected amount of power. The stamp batteries and other metallurgical and mining plant have had to fall back on their steam engines during part of the year, and the amount of development has been curtailed, all through the droughty nature of the season.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

KNIGHT'S ISLAND

Wm. Egan has made a sale of the copper property in Two Arm bay, southeast end of Knights island, for \$100,000 to Paul Denhart, of Nome, Ed. Becker and John Kirn, of Fairbanks.

COPPER RIVER

Alaska-Bremner—This company is preparing to work this summer a group of 16 claims on Bremner creek, a tributary of Copper river. George Davison is in charge.

Arizona

GRAHAM COUNTY

Arizona Copper Company, Ltd.—This company reports the production of its works at Clifton for the month of February at 1286 short tons of copper.

YAVAPAI COUNTY

Commercial Copper Company—The parties leasing on this company's property in Copper Basin are shipping two cars of ore per day to the Humboldt smelter.

Logan Copper Company—Parties from Chicago have taken over the majority interest in this company, and will commence development work on a large scale in the near future.

California

AMADOR COUNTY

Bright—This property is being unwatered under direction of Geo. Tucker for intending purchasers, and a careful examination will be made.

Bay State—While the mill on this mine has not yet been started, it soon will be. A good-sized body of ore of fair quality has been found.

BUTTE COUNTY

Caloanis Mining Company—This company has been organized, with W. C. Fowler as president and general manager, to work a mine near Enterprise, in which a shaft has been sunk 400 ft. A two-stamp prospecting mill is in use and this will be enlarged to 10 stamps.

EL DORADO COUNTY

Last Chance—A new 10-stamp mill has been placed on this mine at Nashville, owned by Dr. A. Smith, of Portland, Oregon, who has been developing the property several years.

Shaw—Arrangements are being made to reopen and work this mine near El Dorado.

Delwich—This mine, near Georgetown, is being examined with a view of reopening it and working on a larger scale than formerly.

Mount Pleasant—In this mine, near Grizzly Flat, a 3-ft. ledge carrying high-grade ore has been found at the cross-cut on the 1000-ft. level.

INYO COUNTY

Gladstone-Greenwater Company—The tunnel to tap the ledge of this property at Greenwater, R. E. Tally, superintendent, is now in 300 ft. and will be continued for about 200 ft. further.

Greenwater-Calumet Copper Company—In this property, west of Furnace, a new ledge has been found. This group was recently sold for \$100,000.

Greenwater-Copper Mines and Smelting Company—This company has been incorporated in Delaware with a capital of \$25,000,000. The company was formed to take over the Greenwater-Death Valley, United Greenwater and various Brock claims in that district. The head of the new company will be Charles R. Miller, vice-president of the Tonopah Company, of Nevada. Charles M. Schwab has a large interest in the new company. The directors will be C. R. Miller, J. W. Brock, C. M. Schwab, W. Heyward Drayton, 3d, M. R. Ward, L. H. Dessar, Malcolm MacDonald, D. B. Gillies, J. E. Brown and Frank Keith. M. R. Ward will be vice-president.

Rice's Camp—This section of Greenwater district is about 20 miles south of the town of Greenwater. W. M. Alter has obtained options on several claims at Rice's, carrying lead, silver and copper. Some rich rock has been found in that locality recently.

Strike—A new strike of gold ore has been made seven miles northeast of Rhodes Springs, and a number of locations have been made by C. W. Patrick, John Perdue, W. H. McElvain, J. J. McLaughlin, Thomas Bradbury, A. J. D'Arcy and others.

KERN COUNTY

Tungsten—Another carload of tungsten ore has been shipped from Atolla to Germany.

MODOC COUNTY

Discovery—Kafader Bros., owners of this mine in Hoag district, 10 miles north of Bidwell, have struck the 5½-ft. ledge for which they have been tunneling this winter. The rock is of satisfactory value.

NEVADA COUNTY

Mineral Point—At this mine, near Gaston, owned by Arthur C. Smith and J. B. Grissel, they have a 30-ft. ledge of quartz upon which two tunnels are being run.

Coan—At this mine, near Nevada City, owned by Thomas N. Coan, a four-stamp mill has been erected and started up by water power.

Maryland Consolidated Mining Company—It is stated that this mine at Grass Valley will be re-opened shortly, General Manager Bray Wilkins having succeeded in obtaining necessary funds. It is the intention to sink the shaft 1000 ft. deep and open up a large area of virgin ground.

Colorado

CLEAR CREEK COUNTY

Cardigan Mining and Leasing Company—Pittsburg, Penn., people have taken up the option on the Cardigan, paying the sum of \$25,000, and are installing new machinery. Herman Karpeles, Idaho Springs, is manager.

Arapahoe Group—A syndicate of English capitalists is reported to have purchased this property, paying \$40,000 spot cash to J. J. White and others of Georgetown. High-grade gold and silver ores have been found in the property, and heavy developments will be carried on.

GILPIN COUNTY

Calhoun Tunnel and Mining Company—Chicago and Denver people have purchased the Calhoun group of claims in Leavenworth gulch, for a reported sum of \$40,000, have started operations on the 1000-ft. shaft and intend to drive a lateral from Newhouse tunnel to open up property with increased depth. H. C. Eastman, Central City, is manager.

Chase—St. Louis, Mo., people, the owners and leasers, have opened up ore in the 300 east level which gives high values. J. A. Gilmour, Central City, is manager.

Santa Loreta—It is reported that arrangements are being made to install an air-compressor plant at the Colorado-Carr mine. Heavy developments will be carried on, and the leasing system will be inaugurated. F. H. Symonds, Providence,

R. I., is president and Joseph Tuckfield, Central City, Colo., is superintendent.

Sharon—Manager G. P. Goodier, Central City, Colo., has arranged for the installation of an air-compressor plant, heavier hoisting machinery and enlargement of shaftbuildings on the Gem in Russell district. The property is producing high-grade mill and smelting ores.

Castleton—Cleveland, O., people are interested, and they have resumed operations, and are making tests with cyanide treatment on their ores at the Woods establishment in Denver. If the treatment is a success it is reported that they will purchase a mill at Idaho Springs and will treat their tonnage at that point. Large bodies of low-grade ores have been opened up in the property. W. M. Kirk, Russell Gulch, Colo., is superintendent.

Gold Collar—A compressor plant is to be purchased and heavier developments will be carried on. A. Skeels, Central City, is manager.

LAKE COUNTY—LEADVILLE

Black Prince—This property, Breece hill, is under lease to Hanifen & Reynolds, who sunk the shaft deeper, drifted and caught a fair body of ore from which they are shipping regularly. The same parties are also leasing on Penn No. 1 and shipping a car of good iron daily; the ore is being taken from the old Breece shoot that was opened a number of years ago.

Bug Gold—Recently a sample carload of free milling ore was sent from this property, English gulch, to Denver and netted ½ oz. gold per ton. Another car will be sent out during the week and if the returns are as satisfactory a mill will be erected on the property this summer to treat the body of this grade of ore that is in sight.

Cloud City—In this mine, down-town section, the main shaft is down 625 ft. and exploration work is being carried on from this point with the diamond drill. Prospect work is also being carried on in the main portion of the property.

Dome—This shaft, Rock hill, belonging to the Iron Silver Mining Company, has been sunk to the lime contact and extensive prospecting is being carried on in various directions.

Forest City—This mine, Yankee hill, is owned by the Small Hopes Consolidated Mining Company. The Kerens shaft has been leased to Thomas Gilroy, who has started work in the old workings. There is still a large body of ore left which Gilroy will work and also extend the drifts into virgin territory. Isaac Nylander is leasing on the Result shaft, 400 ft. southwest of the Kernes shaft and shipping oxidized iron from the 200-ft. level.

Green Mountain—The lessees on this property, Ball mountain, have secured the right to drive the Tiger tunnel ahead to cut the Green Mountain vein. When the

vein is caught, all of the work will be carried on from the tunnel level.

Ibex—Albert Hahnewald and associates are leasing at the 800-foot level of No. 4 shaft, and have opened the richest body of ore that has been found in the mine for a number of years. The orebody is 8 ft. wide, and 2 ft. of it runs high in gold. All of the rich ore is sacked, and the lessees are shipping.

Midland—This company, Iowa gulch, is driving a tunnel from the base of the hill to cut the Mansfield shaft at a depth of 175 ft.; the shaft is down 700 ft. and the water is up to the collar. At the 175-ft. level there is a good streak of ore which will be developed with the hope that it will lead to an orebody. The same company is working the Helena and shipping a good grade of galena and sulphide ores.

Morocco—This company, Harrison avenue, is shipping 600 tons a month of manganese ore to the Pueblo steel works; the ore comes from the 400-ft level.

O'Donovan Rossa—In this mine, on the southern slope of Carbonate hill, improvements on the surface are completed and the shaft, 330 ft., is being re-timbered; when this is completed the shaft will be sunk 270 ft. deeper. Development work will be carried on from this point toward the Wood fraction.

R. A. M.—This mine, on the northwest slope of Iron hill, has been leased to the Langlola Mining Company, with Edward Hanifen, manager. Work will be carried on at the 1018-ft. level where bodies of zinc ore are available; in addition to this work will be carried on in the iron ore channel.

Silent Friend—This mine is in South Evans and located on Little Ellen hill. A new plant of machinery has been installed and the lessees will sink the shaft another lift of 100 ft.; the present depth of the shaft is 387 ft. From the upper workings the lessees have shipped considerable ore.

SUMMIT COUNTY

Abundance—This company has just held its annual meeting in Kansas City, at which Dr. S. B. Prevost was re-elected president. The company has laid out a plan for extensive operations this year.

New York—This group, on Gibson Hill, is receiving attention. A trial shipment of the complex ore containing lead, zinc and iron pyrites has been made to the sampler, where its value will be determined and thence to testing works where the best method of treatment will be ascertained.

Sallie Barber—This silver, lead and zinc property, on Bald mountain, has been sold to J. C. Putner, of Denver. A hoisting and pumping plant is to be installed immediately on the top of the main shaft.

Beaver Creek—This company has been reorganized under the title of the Swas-

tika Mining Company, with a capital of \$2,000,000. S. H. Dunlap is manager,

Reliance Dredging Company—J. A. McDonald, the dredgemaster, has been having his plant thoroughly overhauled but is now awaiting the decision of the Colorado Consolidated Mining and Electric Power Company in connection with the intended sale of the Gold Pan plant to the large placer company now owning the Swan and Blue river placer lands. The dredges to be operated on the Swan and Blue rivers are to be propelled by electric power and the Reliance Company is trying to make arrangements for like power. Ben Stanley Revett is at the head of both of these enterprises.

Swandyke Gold—This company has been carrying on a series of experimental tests on ore obtained from the Three Kings mine and, on good authority, it is stated that the results were better than was expected. It is the intention of the company to further exploit the orebodies and their treatment with the idea of installing a large treatment plant.

Idaho

CUSTER COUNTY

Loon Creek Hydraulic Company—This company has commenced work on its big ditch, and is preparing to work its placer property on Loon creek, on a large scale.

Illinois

Ohio Oil Company—This company, the local representative of the Standard Oil Company, shipped about a million barrels of petroleum from Illinois in February. In addition, three other companies shipped small quantities of oil.

Indiana

PIKE COUNTY

William Jackson, who recently resigned as superintendent of the Princeton Coal Company, has begun testing several hundred acres of land north of the Massey mines, on the Evansville & Indianapolis Railway, with a view of sinking a shaft and opening a coal mine. The Massey vein is 7 ft. in thickness, and the mine has doubled its output during the past year. Although the shaft is in Gibson county, the coal is being mined from under Pike county.

Blyth Hendricks, of Petersburg, has also leased a thousand acres of land east of Jackson's investment, on the Southern Railway, and he is preparing to operate an extensive mine this year.

Michigan

HOUGHTON COUNTY—COPPER

Osceola Consolidated—The annual meeting, which was called for March 14, in Boston, was postponed until April 1, the Bigelow party having obtained from

the United States Circuit Court a temporary injunction against the voting of the stock and proxies held by the Caiumet & Hecla, and against the holding of the meeting. The hearing on the preliminary injunction is set for March 25 next.

Missouri

ZINC—LEAD DISTRICT

Connor Land—The Hawkeye Zinc Mines Company, recently organized, has purchased the 20-acre lease of the Lyon Mining and Investment Company on the Connor land, south of Carterville, and will soon begin the erection of a modern 300-ton concentrating plant at the shaft on the south 10 acres.

Deep Drilling—Much interest has been shown in the deep well being drilled by this Mercantile Metal Milling Company at their Congress mine on the Guinn land, north of Webb City. The well was drilled for the purpose of supplying pure water for the boilers at the mine, but the different strata penetrated by the drill have been studied with much interest. The drilling was stopped at 1000 ft. From 50 ft. down to 300 ft. mineral was found at intervals, but at that depth hard rock was penetrated, and the drill continued in very much the same ground until the drilling ceased. Of course, the finding of no ore below 300 ft. was a slight disappointment, but does not signify that there is no ore, even in that locality, as there are several blank holes down to 200 ft., and some of the best mines in the entire district are on this land. Deep deposits of ore have been found near Joplin, and other points, in drill-holes that were sunk below 1000 ft. Up to the present time, however, it seems that the largest bodies of ore are found not deeper than 300 feet.

Guinn Land—The Ice Plant Mining Company, operating on the Guinn land, north of Webb City, is erecting a modern 250-ton concentrating plant, which will be operated by electricity. Drifting on an 11-ft. face of ore, sufficient development work has been done to insure steady operation. The company owns a lease on 10 acres.

Missouri Land and Zinc Company—This company has begun the installation of an addition to its electric power-house in Joplin, enlarging the capacity to 1600 h.p. A steel and concrete structure, 45x60 ft. is to be erected beside the present frame building.

Porto Rico—This camp is between Prosperity and Duenweg, southeast of Webb City. Eighteen months ago the only producing mines in that vicinity were the three or four on the north end of the Porto Rico tract, more commonly known as the Ground & Irwin lease. Today there are between 15 and 20 new concentrating plants in operation, all of which have been built within the past year, while as many more shafts are being sunk.

Montana

BUTTE DISTRICT

Anaconda—Shipments of ore from the mines of this company are heavy, all work having been concentrated on the veins. The output for March will be large, barring trouble. The Neversweat, Anaconda, High Ore and Mountain Consolidated are the leading producers, the new vein struck recently in the latter adding materially to the output.

Boston & Montana—The company has suspended all development work, pending a settlement of all differences between it and its employees concerning wages, but expects to resume soon. It began pumping water from the shaft on the Greenleaf March 12, with a view of confining the seepage to the lower openings. This shaft is 700 ft. deep and contains 200 ft. of water. The company is mining and treating more ore in its smelter now than it has in several months, the quantity averaging about 5600 tons a day. The two blast furnaces from which the fire was drawn early in the winter, on account of a shortage of coke, are again in commission. Sinking will be resumed in the Badger State and West Colusa mines within a week.

Davis-Daly—Drifting is progressing east and west on the 10-ft. vein struck recently south of the 500-ft. station of the Smokehouse. This vein contains some commercial copper-silver ore, but the quantity is limited. It is better in the west drift than in the east. The face of the former is 170 ft. from the crosscut and that of the latter 126 ft. The shaft on the Colorado is 730 ft. deep and that on the Mt. Moriah 600 ft. The face of the crosscut south of the 1800-ft. station of the Original has advanced 1450 ft. without having cut ore in paying quantity.

North Butte—The company announces an increase in ore production, a total of 1300 tons a day. It has crosscut the Edith May vein at a depth of 1800 ft., and is finishing a station in the main shaft at this depth. There are large ore reserves on the 1600-ft. level.

Nevada

NYE COUNTY—TONOPAH

Ore Shipments—Shipments over the Tonopah Railroad for the week ending March 7 were: Tonopah Company, 900 tons; Tonopah Belmont, 380; Tonopah Extension, 290; Midway, 42; Montana Tonopah, 74; total, 1686 tons. Additional shipments from Goldfield were 400 tons, making a total of 2086 tons.

Montana-Tonopah—The general manager has issued a report dealing with the company's operations during the three months ended Feb. 28. In that period 1463 ft. of development work was done, including 1327 ft. of drifting and 136 ft. of raising. Over 6000 tons of material

was mined and raised, including 1398 tons of shipping ore, 999 tons of mill ore and 3926 tons of waste. Mining costs average \$7.99 per ton when the ore is sorted in the mine and ore only is raised, and \$3.64 per ton when ore and waste are mined together and sent to the surface. The gross returns from 2315 tons of ore shipped recently averaged \$53.53 per ton. The mine is developing well. The second and third levels have been prepared for stoping ore of mill grade. The ore in the 515-ft. level is from 4 to 6 ft. in width and averages \$16 per ton. The shaft has been sunk to a depth of 862 ft. and drifting will shortly be commenced. The power employed in the mine is compressed air generated by electric machinery, supplied with an electric current by the Nevada Power, Mining and Milling Company. Rapid progress is being made with the erection of the new 40-stamp mill, and the company is negotiating with the Nevada Power Company for the supply of an electric current for the mill machinery.

Edgar A. Collins, of the Combination mine, has been appointed superintendent of the Montana, and Henry Pengelly has succeeded Owen Owens as mine foreman.

New Mexico

SIERRA COUNTY

Victoria Chief—Our local correspondent communicates the following: The company owns practically all the claims on the west flank of the Caballos mountains. The ore occurs in shoots, in vertical fissures in quartzite. The minerals are malachite, cuprite, chalcopryrite and boronite in quartz and calcite. Sorted ore goes 25 per cent. copper. The chief work—adits from side-hill on two claims—shows shoots 50 to 100 ft. long and up to 10 ft. wide, but few in number. The opinion of several engineers who have visited the property is that the ore deposits are probably shallow and confined to the quartzite. There is lead above, in the limestone, and gold below, in the granite. A small tonnage of copper ore from the Oahu claim was shipped on burros, years ago, by the former owners. The impression received on a recent visit was that the money being spent on roads, etc., would be better used in finding ore. The ore deposits of the Caballos mountains were described in the JOURNAL of July 29, 1905, page 149.

Oregon

BAKER COUNTY

Virtue—This mine is now the property of an Eastern syndicate under the local management of J. K. Romig, of Baker City. While doing development work on the Foster vein, a strike of rich ore was made. The ore is a white quartz. Mr. Romig has just completed the electric power line from Baker City to the mine, and has received the first 85-h.p. motor,

which will be installed at once. The Baker City power will be used until Mr. Romig can utilize the power which he is developing on Main Eagle.

Pennsylvania

ANTHRACITE COAL

Delaware, Lackawanna & Western—This company has resumed operations at the Hampton colliery, Scranton, after a thorough renovation of the plant at a cost of \$40,000. New patent pickers have been installed in the breaker, which is now electrically equipped and among the best in the company's system. Its capacity has been doubled and it will deal with 3000 tons of coal per day.

Kingston Coal Company—Notwithstanding the award of the Strike Commission, which provides that no miner or laborer shall leave work without first filing a grievance with the Conciliation Board, the men employed at Nos. 2 and 4 collieries of this company, at Edwardsville, went on strike, March 18, because the foreman discharged two men who absented themselves from work on pay day.

Plymouth Coal Company—This company will sell its Plymouth washery to the Kingston Coal Company, which will make some extensive alterations and enlarge the plant.

Philadelphia & Reading Coal and Iron Company—By the ignition of gas in one of the gangways of the Shenandoah colliery of this company, caused by the flame from a miner's lamp, a fire was started which threatened to ruin the colliery. No explosion attended the ignition of the gas, which set fire to the timbers and gained considerable headway before the water could be obtained.

A number of changes have been made among the mine foremen of this company in the Shamokin district. Adam Reiland, for many years foreman at the Burnside colliery, has resigned, owing to advancing years, and Thomas Myers, foreman at the Sterling colliery, has been transferred to the Mahanoy City district. Reiland will be succeeded by William Quinn, of Burnside, and Myers will be succeeded by David Blystone, of North Franklin.

South Dakota

CUSTER COUNTY

Caledonia—Superintendent Pilger has opened up a ledge in the 45-ft. tunnel giving good values in gold. Only one wall has so far been encountered. This property has just been purchased by the Hartwell Mining Company.

Interstate—This mine has been sold to a New York company, which is now patenting the ground and will commence active work at once. A large vein of copper ore has been discovered, and a mill is built on the property.

LAWRENCE COUNTY

Blue Bell—A shaft is being sunk on a vein of ore which is believed to be a continuation of the vein on the Finlander group. The shaft is now 35 ft. deep and will be sunk at least 50 ft. more. The vein, which was 2 ft. wide at the surface, widened until at the present depth it measures almost 6 ft. It is a partly decomposed blue quartz carrying free gold.

Globe—The mill building is being put in shape for the installation of the machinery, which has been ordered. The boilers have been received and will be put in this week. A new body of ore about 10 ft. wide was encountered about 50 ft. northwest from the mill. It will be necessary to pump out the shafts and tunnels before work can be continued. The litigation which has caused delays for the past two years is practically settled.

Hercules—Two tunnels are being run to tap the orebodies; one will have to be put in about 350 ft. and the other 430. This latter will intersect the old Cooper tunnel and at the point of meeting a winze will be sunk until the second contact of ore is reached. The company owns 700 acres of land.

PENNINGTON COUNTY

Deep Down—A large block of stock in this company was sold to Ontario people and the proceeds will be devoted to development work to begin at once. There are two 50-ft. shafts on the ground, and one of them discloses ore.

Keystone-Holy Terror—Some difficulties among the management have caused the temporary closing of this property. At a recent meeting in Deadwood it was decided to commence operations in a short time, when arrangements would be such that the mine would be operated steadily. All back taxes have been paid. Work will be done in the Holy Terror and the old mill renovated.

Utah

BOX ELDER COUNTY

Wasatch Copper Company—The management is about to inaugurate shipments from the property of this company, which is located near Brigham City. W. D. Pypier, of Ogden, is manager.

Salt Lake Copper Company—This corporation, which is controlled by the Lewisohns, of New York, is conducting a vigorous campaign of development at the Copper Mountain mine in the New Foundland district.

IRON COUNTY

Big Fourteen—Sensational ore has been developed in this property at Stateline. A 3-ft. body has been disclosed that carries high gold and silver values.

JUAB COUNTY

Tintic Ore Shipments—Bad condition

of roads reduced the ore shipments from the district last week to 124 carloads, the contributing mines and respective amounts being: Ajax, 2; Beck Tunnel, 6; Bullion Beck, 9; Eureka Hill, 2; Gemini, 4; Godiva, 2; Grand Central, 11; Mammoth, 10; May Day, 3; Scranton, 6; Swansea, 3; Tintic Iron, 6; Uncle Sam, 2; Victoria, 2; Yankee Consolidated, 6 cars.

Centennial Eureka—It is expected that work will begin on the foundations for the new shaft house within 10 days.

Lower Mammoth—The two electric hoists installed recently are in service and the company is working the usual force of men again.

Colorado—Very satisfactory reports come from the 250 level of this property where one of the most important orebodies ever found in the mine was recently opened.

Uncle Sam Consolidated—A new orebody has been opened on the 800 level of this property, containing values of about \$40 per ton. There is a full breast of it.

Utah Mine—Shipments of high-grade ore continue from this property in the Fish Springs district. The values run principally in silver.

Carisa—This company has been reorganized under the laws of the State of Maine, without any change in the capital stock. Heretofore the company has been operated under Utah laws.

Bullion Beck—The directors have declared a dividend of 10c. a share, payable to shareholders this month.

SALT LAKE COUNTY

Bingham Mary—A body of 6 per cent. copper ore has been encountered in a cross-cut from the 100-ft. level of the shaft.

Bingham Amalgamated—An electric hoist is being installed at the Illinois property, owned by this company.

City Rocks—This Alta company has straightened out some entanglements about titles, and is now ready to proceed with the opening of the property upon a broader scale than heretofore, and to resume ore shipments at an early date.

TOOELE COUNTY

New Stockton—An upraise from the 850-ft. level has broken into a 10-ft. body of shipping ore, the values running about 50 per cent. lead and 30 oz. silver.

Washington

FERRY COUNTY

Washington & Great Northern Railway—In the injunction case of this company against the Spokane & British Columbia Railway, the former has given notice of appeal from Judge Carey's decision in the Superior court to the Washington State Supreme Court.

Straight Mines Company—A body of iron sulphide ore was struck on the lower adit level 375 ft. from the portal, the extent of which is not yet known. The first sample taken assayed \$8 in gold and 13c. in silver per ton.

Winnipeg—A sample of ore from a streak in the adit assayed well in gold, silver and copper.

Sunset—This mine, near Northside, on the Columbia river, looks well. Machinery, good for 1000 ft. depth, has been installed, consisting of a duplex hoist and Sullivan air compressor.

Silver Crown—At this mine, on Iron creek, about 40 miles southeast of Republic, the adit is in over 300 ft., and a vein of ore, assaying in copper, nickel and silver, has been intersected across 3 feet.

West Virginia

Virginian Railway Company—This company has been organized, with \$33,500,000 capital stock, to consolidate the Deepwater and Tidewater railroads, now under construction as a new outlet for West Virginia coal to tidewater at Lambert's Point, near Norfolk. The Virginian Terminal Railway Company has also been organized to build docks, etc., at the seaboard terminus. As is well known, H. H. Rogers, of New York, is the chief backer of the enterprise. Another purpose of the company is the development of coal fields in the Gauley mountain region around Ansted. Surveys have been made also for an extension from Surveyor Station to the Ohio river, about 90 or 100 miles. About 60 miles of track have been completed on the Deepwater Railway from Deepwater, on the Kanawha river, to Mullens, W. Va., and this is being operated. On the Tidewater Railway in Virginia 60 miles of track are also in operation between Jarratt and Algren, the latter point being near Suffolk.

The officers of the Virginian Terminal Company are Walter H. Taylor, president; W. H. T. Loyall, vice-president; William H. White, Jr., secretary. The officers of the Virginian Railway Company include William N. Page, president, Ansted, W. Va.; Thomas D. Ranson, vice-president, Staunton, Va.; George H. Church, treasurer, 44 Wall street, New York.

Wisconsin

ZINC DISTRICT

Calvert—This mine, at Benton, is one of the most recent of the rich strikes to attract attention. It has also the strongest water to contend with of any of them. At a recent meeting of the directors, held at Darlington, Wis., it was decided to install one of the best pumping and power plants obtainable, and a contract was awarded the Galena Iron Works Company, of Platteville. There will be two 80-h.p. high-pressure boilers, two double,

extra strong 12-in. Galena pattern cross-head pumps, a double cylinder cut-gear steam hoist and an Ingersoll-Rand piston inlet class A compressor, having a capacity of 194 cu.ft. of air.

Platteville Lead and Zinc Company—The annual meeting of this company was held at Platteville recently and an entirely new board of directors was elected. With the retirement of the old president, it is claimed a new policy in the management will be instituted. Owing to the fact that a great deal of the stock has changed hands during the last six months those in favor of a new policy were in the majority. The capitalization has been held at the original figure so far, but it is now proposed to increase the stock.

Canada

NOVA SCOTIA

Dominion Coal Company—At the recent annual meeting in Montreal it was announced that the differences with the Dominion Steel Company would be settled shortly and the suits pending withdrawn. The following directors were elected: Lord Strathcona, R. B. Angus, Jas. Crathern, J. Dimock, Senator McKeen, W. D. Matthews, J. K. Osborne, James Ross, W. D. Ross, F. L. Wanklyn, J. R. Wilson. At a meeting of the directors James Ross was re-elected president and F. L. Wanklyn vice-president.

Dominion Iron and Steel Company—For the past two months mining experts and a large force of laborers have been at work boring for coal on the Burchell areas, and on other properties at Point Aconia recently bonded by this company, and they have made good progress. A 7-ft. seam has been struck on the Plant farm, with a surface of 156 ft. The company has bonded nearly 500 acres on the western side of Little Bras d'Or, which is said to be rich in coal.

ONTARIO—COBALT DISTRICT

Beaver Mine—The new power house at Cobalt is completed and ready for the installation of the plant.

Foster—It is the intention to connect the three shafts which are down, respectively 85, 72 and 78 ft., by tunnels, considerable drifting having been done. An eight-drill compressor and an electric-light plant are in operation, and four new drills are ordered. A cage for the hoisting of ore cars is being installed.

Kerr Lake (Jacobs)—In all 15 veins have been discovered on this property, Cobalt, where a 14-drill compressor is being installed. One shaft is down 180 ft. and the other some 60 ft. About 350 ft. of drifting has been done. No second-grade ore has been shipped.

O'Brien—A large cage is being installed in the shaft, which will enable ore cars to be run right into the shaft at the different

levels, hoisted and run to the ore-house. Stopping is being done at the 50-ft. level.

Progress—On this property, Cobalt, which adjoins the Timiskaming mine, a steam plant has been installed. The shaft, which is now down 70 ft., will be sunk to the 200-ft. level. The vein has a width of 4-in. cobalt carrying good silver values.

Silver Leaf—There are four shafts being put down, the main one being 100 ft. deep, with considerable drifting at the 80-ft. level. A six-drill compressor is in operation.

Mexico

COAHUILA

Mexican Coal and Coke Company—Complete order is said to have been restored at the mines at Esperanzas where the most appalling disaster in the history of Mexican mining occurred on the night of Feb. 18. The total deaths were 67 Mexican and Japanese and one American. Whether the explosions were due to coal dust or gas has not been determined, and will probably never be known to a certainty.

SONORA

Anita Copper Mines Company—At Corcorit, this company is preparing to blow in its new 250-ton smelting plant. This property is showing up with some 4000 ft. of development work.

Belen Copper Mining Company—T. B. Bassett, manager of this company at Cumpas, is quoted as saying that his company will soon start on the construction of a railroad from the property to connect with the Southern Pacific, a distance of about 40 km. This company is just completing the construction of a 40-ton copper-smelting plant. The ores run about 8 per cent. copper and it is the intention to produce 50 per cent. matte. The difficulty of obtaining labor is the only thing which has prevented the erection of the 100-ton plant that was at first contemplated.

El Tigre—The Federal district judge at Hermosillo has given a decision in favor of the Ensenada Mining Company, of Kansas City, Mo., as claimant to this mine, and against B. F. Graham and associates. The decision will support the title of the Kansas City people to the property. The case has been through various courts.

Asia

INDIA—MYSORE

Kolar Goldfield—The production in February is reported at 43,224 oz. bullion. For the two months ending Feb. 28 the total was 101,552 oz. bullion in 1906, and 89,234 oz. in 1907; a decrease of 12,318 oz. The bullion reported this year was equal to 80,311 oz. fine gold, or \$1,660,028 in value.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 20.—The chief topic in the coal trade in the West is the general advance in freight rates made by the railroads, which varies from 5 to 10c. per ton. This is especially felt by mines which have contracts to deliver through the balance of the year, and by others which are shipping coal under sharp competition from other districts.

In the East there is little or no change in conditions, except as they are affected by the approach of spring and milder weather.

COAL-TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to March 9 were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite.....	978,013	960,292 D.	17,721
Bituminous.....	7,122,784	6,943,445 D.	179,339
Coke.....	2,408,737	2,598,507 I.	189,770
Total.....	10,509,534	10,502,244 D.	7,290

Coal tonnage originating on the lines of the Southern Railway for the year 1906 was: Tennessee district, 1,496,253; Alabama district, 1,874,654; total, 3,370,907 short tons.

Coal receipts at Boston for the two months ending Feb. 28 are reported by the Chamber of Commerce as follows:

	1906.	1907.	Changes.
Anthracite.....	215,688	272,991 I.	57,303
Bituminous.....	479,008	378,573 D.	110,435
Total domestic....	694,696	641,564 D.	53,132
Foreign coal.....	147,692	81,953 D.	65,739
Total.....	842,388	723,517 D.	118,871

The foreign coal comes chiefly from Nova Scotia, with some from Great Britain.

The Chesapeake & Ohio Railroad reports coal and coke tonnage for the seven months of its fiscal year from July 1 to Jan. 31 as follows, in short tons:

	Coal.	Coke.	Total.
New River.....	3,113,238	115,477	3,228,715
Kanawha.....	2,066,051	49,649	2,115,700
Kentucky.....	96,479	.....	96,479
Connecting lines...	267,745	68,305	336,050
Total.....	5,543,513	233,431	5,776,944
Total, 1905-6.....	5,085,907	278,379	5,364,346

Deliveries this year of tonnage originating on the line were: Points west of mines, 2,487,688 tons coal and 123,539 tons coke; points east, 1,059,002 tons coal and 41,587 tons coke; tidewater, 1,729,078 tons coal.

Anthracite-coal shipments in January were 4,563,720 long tons; being 684,226 tons less than in January, and 148,379 tons less than in February, 1906. For the

two months ending Feb. 28 the shipments were as follows, in long tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Reading.....	2,125,732	20.9	1,998,118	20.3
Lehigh Valley....	1,784,891	17.6	1,665,770	17.0
N. J. Central.....	1,344,828	13.2	1,237,919	12.6
Lackawanna.....	1,620,588	16.0	1,623,031	16.5
Del. & Hudson....	1,009,017	9.8	969,053	9.8
Pennsylvania....	887,645	8.7	911,649	9.3
Erie.....	974,341	9.6	990,218	10.1
N. Y., Ont. & W....	423,141	4.2	427,908	4.4
Total.....	10,170,183	100.0	9,813,666	100.0

The total decrease this year was 356,517 tons, or 3.5 per cent. The tonnage of the Delaware, Susquehanna & Schuylkill—Coxe Brothers Company—is now included in that of the Lehigh Valley Railroad. The chief decreases this year were on the Reading, the Lehigh Valley and the New Jersey Central.

New York

ANTHRACITE

March 20.—The hard-coal market during the past week has been inactive, consumers holding off until the new schedule of prices goes into effect; it is generally understood that this schedule will show the usual discount of 50c. per ton on prepared sizes and will take effect April 1. Nothing official has been announced, but operators show no hesitancy in speaking about it. There is a great scarcity of small steam sizes, especially Nos. 2 and 3 buckwheat. Broken, egg, stove and chestnut are in plentiful supply, and little or no trouble has been experienced from lack of car supply during the week. Until April 1 prices remain at \$4.75 for broken, \$5 for egg, stove and chestnut. Small steam sizes are quoted nominally at \$3 for pea, \$2 to \$2.50 for buckwheat, \$1.50 for rice, \$1.40 for barley, all f.o.b. New York harbor shipping points.

BITUMINOUS

The Atlantic seaboard soft-coal trade is fairly active, consumers endeavoring to get all the coal they can before the increased prices go into effect April 1. Contracts are being closed daily and, up to the present time, about 50 per cent. of the total have been taken care of. Car supply seems to be in better shape, with the exception of one main line.

Trade in the far East is active and consumers are taking on all the balances procurable on old contracts. Trade along the Sound is calling for more coal than can be delivered.

New York harbor trade is fairly active. Prices are quoted at \$2.70@2.75 for fair

grades of steam coal f.o.b. New York harbor shipping ports. Transportation from mines to tide is fairly regular; car supply has been much improved during the week with the exception of the Baltimore & Ohio, which has been very unreliable.

In the coastwise vessel market vessels are in fair supply. We quote freight rates from Philadelphia on large vessels at \$1@1.05 and discharge to Boston, Salem and Portland. The rate from New York to the same points is \$1 and discharge for small vessels. In both cases the loading and discharging clause is included. With the coming of spring, lower freight rates are expected.

Birmingham

March 18.—The railroad car shortage is interfering again with coal production in Alabama, and time is being lost at several collieries. The production, however, is equal to what it was at this time last year. Development in this State is being pushed; no less than eight new mines will be ready to produce coal daily as soon as transportation facilities can be provided.

There is a demand for every ton of coal that can be mined, and contracts in hand will provide for steady operation at the mines for months to come. Inquiries among the coal operators in this district indicate that there will be no time lost during the summer, now fast approaching. Good prices obtain, and the operators are making effort to get delivery.

Chicago

March 16.—The local market for coal continues weak, owing to large supplies, notwithstanding a general effort on the part of shippers to reduce supplies. Eastern coals, which have heretofore been stronger than Western, are sharing in the dullness, owing chiefly to better transportation conditions, though the demand is naturally easing with the coming of spring. Anthracite is, of course, in very light demand with the prospective April discount so near.

It is reported that some of the Illinois mines are about to close for a time, to get rid of the demurrage surplus that has forced prices down. Prices of Illinois and Indiana continue about the same as last week: \$1.85@2.50 for lump and egg, \$1.65@2.15 for run-of-mine, and \$1.25@1.50 for screenings.

Smokeless run-of-mine continues in good demand, but other kinds are dull; run-of-mine brings \$3.40, the circular

price. Hocking Valley is not in large supply, but the demand is not great; such coal as is moving brings \$3.40. Youghio-gheny likewise is in light supply and demand, with 3/4-in. selling at about \$3.20. Pittsburg No. 8 is in fair demand at \$2.90 for 3/4-in. Cannel coal is in good demand.

Cleveland

March 19—Owing to the heavy rains and washouts in the Ohio river and Pittsburg district, local soft-coal values were advanced 5c. per ton this week. This applies to spot shipment. Deliveries on future dates remain about the same, with Pittsburg run-of-mine at \$2. The local coal market was very weak last week, owing to a heavy supply on track, coal being sacrificed to save demurrage at 35 to 40c. below cost. Absence of deliveries to the city during the week has cleared up this supply and dealers predict a steady market.

Indianapolis

March 16—At a conference with Union B. Hunt, president of the Indiana State Railroad Commission, operators of the coal mines representing 85 per cent. of the coal output of Indiana filed with the commission a formal complaint protesting against the proposed advance of 10c. a ton in rates on coal hauled from points in Indiana to Chicago, and asked the commission to take the matter up with the Interstate Commerce Commission. In compliance therewith a committee of Indiana operators, W. J. Woods, of the Indiana commission, and John Mitchell, of the Mine Workers, entered a formal complaint before the Interstate Commission in Washington, March 15. The commission held that it had no jurisdiction to prevent the railroads from ordering a 10c. increase in freight rates, but sent a letter to each of the railroads stating that, "while the commission can have no opinion as to the justice of the proposed changes, but in view of the serious consequences which will apparently result, it does seem to us that opportunity should be given these parties to be heard before the new rates are put in force. The commission is inclined to hold that complaints may be directed against a rate which has been filed, but which has not yet become effective. If, therefore, your rates were to be made effective not less than 60 days after filing notice of intended change, sufficient time would be allowed in which to file a complaint and have the same heard by the commission. You are asked to give this matter prompt and careful attention." The Indiana operators are greatly pleased over the letter.

The Indiana operators and miners allege that the proposed rates will disturb the differentials which have been long in effect, thereby disarranging the various wage scales now in force. They further allege that many contracts for coal are in effect

which do not expire until April, 1908, in which the price was based upon the present freight rate, with the assurance upon the part of some of the railroads that rates would not be increased.

Pittsburg

March 19—The flood caused a suspension of coal-mining operations in the Pittsburg district for several days, as the railroads were paralyzed, and could not furnish cars. None of the mines was affected by the high water and yesterday a good supply of cars was received at most points and conditions are fairly good. It is expected that all will be running to capacity before the end of the week. Some damage was caused to a few tipples along the river, but it is being speedily repaired, and there will be no delay in getting all the river mines started. Despite the large tonnage loaded and ready for shipment there were no losses of any consequence, and when the rivers become navigable there will be a large shipment to the Southern ports. Prices are firm on a basis of \$1.15@1.25 for mine-run coal at the mine.

Connellsville Coke—The railroads leading into the Connellsville coke region suffered severely by the flood, and shipments were seriously retarded. Most of the blast furnaces and foundries had a few days' supply, and there are few instances where any serious inconvenience was occasioned. Prices are firmer, furnace coke for prompt shipment and for last half being quoted at \$3@3.10, and foundry coke at \$3.75@3.85 for spot. The Courier gives the production in both fields for the week ending March 9 at 413,572 tons. The shipments aggregated 14,640 cars distributed as follows: To Pittsburg, 5231 cars; to points west of Connellsville, 8565 cars; to points east of Connellsville, 844 cars.

Foreign Coal Trade

March 20—Imports of coal into Germany in January were, in metric tons:

	1906.	1907.	Changes.
Coal.....	636,214	840,573	I. 204,359
Brown coal.....	693,447	596,284	D. 103,163
Total.....	1,329,661	1,436,857	I. 101,196

Imports of coke this year were 19,911 tons; of briquets, 3266 tons.

The production of coal in Germany in January is reported as below, in metric tons:

	1906.	1907.	Changes.
Coal.....	11,881,344	12,296,774	I. 415,430
Brown coal.....	5,116,227	5,131,531	I. 15,304
Total mined..	16,997,571	17,428,305	I. 430,734
Coke made.	1,608,493	1,768,304	I. 159,811
Briquets made,	1,266,794	1,255,746	D. 11,048

The briquets made are largely from brown coal, or lignite.

The exports from Germany for January were, in metric tons:

	1906.	1907.	Changes.
Coal.....	1,837,899	1,403,013	D. 434,886
Brown coal.....	1,372	1,278	D. 94
Total.....	1,839,271	1,404,291	D. 434,980

Exports of coke for the month this year were 304,624 tons; of briquets, 104,243 tons.

Iron Trade Review

New York, March 20—The iron and steel trades show little change from last week. Pig-iron buying has been comparatively quiet, but in finished material there is a fair volume of business. In some quarters there is a fear that prices have reached a point where they may serve as a check to consumption, and this feeling seems to have some reason to support it. However, new business continues to come in, though not in as great volume as in November and December.

The floods at Pittsburg last week caused a good deal of damage, and interfered seriously with the working of mills and furnaces. As most of them are already behind in deliveries, some trouble will result. Moreover, the floods and their resultant damage made the railroad situation still worse than it had been, causing further delay in deliveries.

Pig-Iron Production—On March 1 there were 319 coke and anthracite furnaces in blast, with a total weekly capacity of 511,000 tons. This is the highest ever reported, with the exception of Dec. 1, 1906, when the total was 513,900 tons. Taking the estimate made by the Iron Age, with an allowance for the charcoal furnaces, the output of pig iron in January was 2,240,600 tons; February, 2,078,000; total for the two months, 4,318,600 tons. The average daily output for January was 72,278 tons; for February, 74,214 tons, showing a gain of 1936 tons.

Baltimore

March 19—Imports of spiegeleisen for the week were 310 tons; of ferromanganese, 1149 tons. Imports of iron ore were one cargo, 4815 tons from Farrucha, and three cargoes, 10,074 tons from Beni-saf, Algeria; a total of 14,889 tons.

Birmingham

March 18—The Southern pig-iron market is strong. The railroad car shortage is being felt. The consumers are giving indications of a shortage of raw material. The inquiry for iron for delivery during the latter part of the year is strong. More furnaces now report having sold up the probable make to October. The furnace companies are not willing to sell their product for delivery to the last of the year at a reduction on quotations. If there is any iron being sold under \$18.50 per ton, No. 2 foundry, it is being done in a quiet way, and several companies announce that the price is \$19 per ton. Sev-

eral consumers were in this market recently hunting small lots of iron for immediate delivery, offering a strong premium, but were not successful. Spot iron brings \$24 per ton, No. 2 foundry, what little there is to be found. The Woodward Iron Company has blown out a furnace for repairs. The Tennessee Company has blown out a furnace for repairs. The Tennessee Company is rushing repairs on three furnaces, but it will be a month yet before they can go into operation.

Chicago

March 18—The iron market continues firm, and is, to all appearances, a waiting market, as last week. No disposition exists on the part of melters, to judge from orders, to buy more raw material than they need to keep business moving. Such purchases as are being made are at the prices of last week—\$18@18.50 Birmingham for Southern No. 2, for second-half deliveries—and \$23.50 for Northern. On quick-delivery and second-quarter lots prices run \$2 to \$3 higher. The demand for early lots is not large.

Local furnaces are taking advantage of the lull to go out of blast for repairs, and the market is likely to be dull for the next month. It is the prophecy of well informed men in the pig-iron trade, however, that after a spell of dullness the market will be stronger than ever, all prospects being for continued heavy consumption of iron.

Coke is in good supply and moderate demand, the best Connellsville bringing \$6.65 for quick deliveries and \$6.40 on contracts, which are increasing.

Cleveland

March 19—Iron-ore prices on the docks remain steady and the market is reported without change from last week. At present writing it is figured that vessel capacity to move between 35,000,000 and 36,000,000 tons of ore has been tied up for the season, which promises to be a record-breaker from the opening. An estimate of 42,000,000 tons of ore is placed for this year. Vesselmen are refusing yearly contracts in anticipation of advances in lake rates later in the season.

Pig Iron—Iron for spot shipment is perhaps a little firmer, owing to low supplies, but there is not much activity. Prices are quoted at \$25@26 at furnace.

Philadelphia

March 20—The pig-iron situation is practically the same as it has been for a number of weeks. There is a large number of small buyers who either through inability or lack of foresight have not been carrying large stocks. This element constitutes a steady demand for delivery of material between now and June 30. The market is active, particularly for those brands of iron used in engineering

plants and for special purposes. Foreign iron is not attracting quite as much attention as usual. It is a very difficult matter to size up all of the various conditions and influences that are at work, in the trade; but it is not an unsafe judgment to say that present conditions will continue. Basic iron is \$25; standard forge \$23; No. 2 foundry \$25.25, for the earliest possible deliveries. For later deliveries differences of about \$1 are observable.

Steel—The steel manufacturers have all they can possibly do to keep their customers supplied. Soft steel, of course, is very active and small orders command \$34.

Bars—While there is not the slightest weakness there are some slight modifications made to secure certain desirable orders as to size and quality of iron. Contracts are being placed for refined iron for delivery six months hence. Steel bars are very strong.

Sheets—The mills continue to strain their capacity in order to keep their customers in good humor.

Pipes and Tubes—The pipe market is as strong as at any time for months, and the tube situation could not be improved upon. Discounts are entirely nominal and premium prices are the rule. A further advance is thought to be imminent.

Plates—Buyers of plate are not so urgent in ordering for future requirements as they were a few weeks ago. A great many have already made satisfactory arrangements for early summer supplies.

Structural Material—A great deal of local work is to be prosecuted this summer, calling for structural material. The mills are making special efforts to accommodate the small trade.

Rails—Light sections and rails for trolley purposes are being inquired for in liberal quantities, but no heavy transactions have been recently announced.

Scrap—There is an active demand for all kinds of scrap. Some big sales of railroad scrap have been made at high prices. Heavy melting scrap is being hunted for and badly wanted. Machinery cast is worth about \$20 per ton.

Pittsburg

March 19—The flood that visited this section during the week was the greatest ever known, and affected nearly every blast furnace, iron and steel plant along the Allegheny, Monongahela and Ohio rivers. Some rapid cleaning up was done and operations were resumed at most of the plants on Sunday; with but few exceptions all will be going again before the end of this week. It is impossible to give an intelligent estimate of the loss, but several attempts have been made, and included in them is millions of dollars for loss in production. This is not regarded

as a loss, as all orders on the books must be filled, and there will be only a further delay in delivery. The actual loss is the expense of cleaning up and putting the machinery in shape, and also the loss in wages of the thousands of men who were thrown out of employment for several days.

The Carnegie Steel Company, as usual, recovered more quickly than other large interests. Twenty of its blast furnaces, the Edgar Thomson, Carrie, Isabella and Lucy groups, were closed on Thursday night, and all were started again on Saturday night without any damage having been done. The Edgar Thomson, City Mills, Painters and Lindsay & McCutcheon plants were entirely closed by the high water, and the big Homestead and Duquesne works were slightly affected. All were running in full on Sunday night. The Mingo plant, near Steubenville, O., suffered more than the rest, and did not get started until this morning. The other plants of the Carnegie Company were not affected at all. The idle furnaces would have produced over 20,000 tons of pig iron during the two days' suspension, but it was asserted today that this will not have to be made up by the purchase of outside iron, as the mills that would have used the iron were out of commission at the same time.

Among the greatest sufferers was the American Sheet and Tin Plate Company. All the mills in the Vandergrift department up the Allegheny river, La Belle, Aetna and Wellsville plants in the Wheeling district, which were closed Thursday, were started this morning. The large Wood plant and the United States works at McKeesport will not be in shape for operation for some time. It is not known when the Monongahela works, in this city, will get started, as they were more unfortunate than the others. While the plant was surrounded by water, a fire broke out and destroyed the warehouse and sorting rooms. The firemen were compelled to fight the flames by carrying the hose to the fire in skiffs.

All the plants of the American Steel and Wire Company, which are located along the Monongahela river, resumed operations yesterday. The National Tube Company was hit hard by the closing of four of its plants in this city, and the big works at McKeesport. Its three blast furnaces were banked, and it will be impossible to resume operations before the end of this week.

As a result of the flood the iron and steel markets are decidedly quiet. One of the events of the past week was the withdrawal of all quotations by the National Tube Company, and independent pipe interests advanced prices from one to two points, or \$2 and \$4 a ton. In sending out notices of the withdrawal of prices the leading interest announced that it would accept orders for delivery after June 1, subject to the new quotations

which are to be made some time before that date. The fact that prices will be higher, and that the majority of the plants of the company are temporarily idle did not deter buying, as orders aggregating 10,000 tons were received on Saturday, and as large a tonnage was booked yesterday. The business in merchant pipe and boiler tubes is enormous.

Pig Iron—The pig-iron market appears to be stronger, although buying for second-half delivery is still being delayed. Furnaces are holding firmly for \$21.50, Valley furnaces, for bessemer iron, but consumers evidently believe that a concession will be made. There is no prompt bessemer iron, and for second quarter \$22, Valley, is quoted. It is reported that about 30,000 tons will be available for that delivery. No. 2 foundry iron remains firm at \$24 to \$24.50, Valley; second-quarter is quoted at \$23@23.50. Sales for the last half are being made at \$21.50@22. Gray forge is not in demand, and is quoted nominally at \$21.85, Pittsburg.

Steel—There is no change in the steel market. Bessemer billets are quoted nominally at \$29.50, and open-hearth at \$32. Steel bars continue at 1.60c., and plates at 1.70c.

Sheets—The mills are filled up and cannot guarantee deliveries this side of July. Prices remain unchanged at 2.60c. for black sheets and 3.75c. for galvanized for No. 28 gage.

Ferro-Manganese—Prompt ferro continues to be quoted at \$75@76 per ton.

BY TELEGRAPH

Pittsburg, March 20—The Cambria Steel Company today bought 36,000 tons bessemer pig, second-quarter delivery, and the Carnegie company 8000 tons, April; all at \$22, Valley.

London

The British Iron Trade Association has reported the production of pig iron for the year as follows, in long tons:

	1905.	1906.	Changes.
Forge and foundry...	4,276,943	4,587,606	I. 310,663
Hematite.....	4,070,222	3,990,820	D. 79,402
Basic.....	1,057,999	1,263,317	I. 205,318
Spiegel, etc.....	187,573	307,645	I. 120,072
Total.....	9,592,737	10,149,388	I. 556,651

The total gain was 5.9 per cent. In 1904 the total make was 8,562,658 tons, and in 1903 it was 8,811,204 tons. Last year there was a decided gain in the later months, the make for the first half having been 4,905,424 tons, while for the second half it was 5,243,964 tons. Stocks at the close of the year were low.

The total number of blast furnaces standing was 517, and the average number working last year was 367¾. This makes the average output per furnace 27,598 tons. The largest average make was 45,127 tons, in the Cleveland district; the smallest was 14,158 tons, in Derbyshire.

Metal Market

NEW YORK, March 20

Gold and Silver Exports and Imports.

At all United States Ports in February and year

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1907..	\$1,027,058	\$ 3,275,933	Imp. \$2,248,875
" 1906..	8,486,330	2,079,683	Exp. 6,406,647
Year 1907..	3,477,130	6,546,438	Imp. 3,069,308
" 1906..	14,227,995	4,685,392	Exp. 9,542,603
Silver:			
Feb. 1907..	4,223,970	3,693,061	Exp. 530,909
" 1906..	6,435,129	4,480,449	" 1,954,680
Year 1907..	8,990,935	7,350,102	" 2,640,833
" 1906..	13,951,797	9,167,160	" 4,784,637

These statements cover the total movement of gold and silver to and from the United States. These figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

Gold and Silver Movement, New York.

For week ending Mar. 16 and years from Jan. 1

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week.....	\$ 67,973	\$ 819,405	\$ 27,355	
1907.....	1,717,226	1,686,816	7,700,488	489,827
1906.....	3,027,379	482,185	16,365,971	394,550
1905.....	30,138,071	2,220,118	8,041,840	591,840

No gold was exported during the week; the silver went to London. Imports for the week, both gold and silver, were from South America and the West Indies.

The joint statement of all the banks in the New York Clearing House for the week ending March 16 shows loans \$1,053,576,600, a decrease of \$13,380,300; deposits, \$1,003,574,500, a decrease of \$15,914,700, as compared with the preceding week. Reserve accounts show:

	1906.	1907.
Specie.....	\$180,451,700	\$183,454,400
Legal tenders.....	77,630,600	70,572,300
Total.....	\$258,082,300	\$254,026,700
Surplus.....	\$5,174,175	\$3,083,100

The surplus over legal requirements shows an increase of \$981,375, as compared with the previous week.

Special holdings of the leading banks of the world, March 16, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York			\$183,454,300
England.....	\$179,918,680		179,918,680
France.....	522,750,965	\$146,193,175	668,944,140
Germany.....	166,245,000	55,415,000	221,660,000
Spain.....	77,115,000	123,615,000	200,730,000
Netherlands....	26,320,000	28,562,000	54,882,000
Belgium.....	16,810,000	8,405,000	25,215,000
Italy.....	161,790,000	24,718,000	186,508,000
Russia.....	595,420,000	27,045,000	622,465,000
Aust.-Hungary..	231,785,000	61,505,000	293,290,000
Sweden.....	20,530,000		20,530,000

The banks of England and Sweden report gold only. The New York banks do not separate gold and silver in their reports.

Shipments of silver from London to the East are reported by Pixley & Abell as follows, for the year to March 7:

	1905.	1906.	Changes.
India.....	£ 4,109,910	£2,661,610	D. £ 1,448,300
China.....			
Straits.....		85,050	I. 85,050
Total.....	£ 4,109,910	£2,746,660	D. £ 1,363,250

Imports were £8000 from the West In-

dies, £123,000 in bars and £91,000 in Mexican dollars from New York; a total of £212,000. Exports were £38,000 coin to Adelaide, £258,900 in bars and £56,500 in Mexican dollars to Bombay; £353,500 in all.

The foreign trade of the United States for the two months ending Feb. 28 is reported as follows by the Bureau of Statistics of the Department of Commerce and Labor:

	1906.	1907.
Exports.....	\$312,369,611	\$348,845,590
Imports.....	210,754,404	249,772,143
Excess, exports....	\$101,615,207	\$99,073,447
Add excess of exports, silver.....		2,640,833
Total.....	\$101,714,280	\$101,714,280
Deduct excess of imports, gold.....		3,069,308
Net export balance.....	\$98,644,972	

The gold and silver movement in detail is given in the table at the head of this column.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars.....	\$0.51½	\$0.53½
Peruvian soles and Chilean.....	0.484	0.51
Victoria sovereigns.....	4.854	4.87
Twenty francs.....	3.86	3.89
Spanish 25 pesetas.....	4.78	4.80

SILVER AND STERLING EXCHANGE.

March.	Sterling Exchange.	Silver.		March.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
14	4.83½	67½	31½	18	4.83	66½	31½
15	4.83½	67½	31½	19	4.83½	66½	31
16	4.83	67½	31½	20	4.82½	66½	30½

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Other Metals

Daily Prices of Metals in New York.

March.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			New York, Cts. per lb.	St. Louis, Cts. per lb.
14	25¼	25¼	109½	42	6.00	6.85	6.70
15	25¼	25¼	107½	41½	6.00	6.85	6.70
16	25¼	25¼	107½	41½	6.00	6.85	6.70
18	25¼	25	106½	41½	6.00	6.85	6.70
19	25¼	25	105½	41	6.00	6.85	6.70
20	25¼	25	106½	40½	6.00	6.85	6.70

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b.s. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotation on spelter are for ordinary western brands; special brands command a premium.

Copper—Consumers are already well provided for their immediate requirements, through previous purchases, and, owing to the unsettled financial conditions, both on this side and in Europe, they have become indisposed for the moment to contract for such small supplies as are still needed and have withdrawn from the market. Consequently, the premiums which have been ruling for nearly by shipment have disappeared, owing to small offerings from second hands for which a ready outlet could not be found. The market closes dull at 25¼@26c. for Lake copper; 25@25¼c. for electrolytic in ingots, cakes and wirebars. Casting copper is quoted at 24½@24¾c.

In sympathy with the liquidation in the share markets, there has been a great deal of selling of standard copper, for long and short account, which brought about a serious break in the market. The closing is cabled at £106 5s. for spot, £107 10s. for three months.

Statistics for the first half of the current month show a decrease of 200 tons in the visible supplies.

Refined and manufactured sorts we quote: English tough, £113@114; best selected, £116@117; strong sheets, £124@125.

It was stated in this column last week that the average price realized for Lake copper by the Quincy Mining Company last year was 19.259c. per lb. This was an error, the correct figure being 19.5c. as the average for 16,194,838 lb. copper.

Copper Sheets—The base price of copper sheets is 32c. per pound.

Copper Wire—The base price of copper wire, No. 0000 to No. 8, is 27¼@27½c. per pound.

Tin—The London market shows an extreme decline, and although prices here have been lowered correspondingly, buyers do not show any inclination to take hold. At the close the London market is cabled at £186 for spot, £183 15s. for three months. The metal is offered in this market at 40.75c.

Lead—The quotation for desilverized remains unchanged at 6c. New York; 5.92½c., St. Louis.

In sympathy with the other metals, there has been a shading off in the London quotation, which at the close is reported at £19 13s. 9d. for Spanish lead, £19 16s. 3d. for English lead.

St. Louis Lead Market—The John Wahl Commission Company reports as follows: Lead is very quiet. Latest sales are on a basis of 6.05@6.07½c. for Missouri brands.

Spelter—The demand for this metal has subsided and a weaker tendency prevails. Offerings are on a somewhat freer scale, particularly for future delivery. The close is nominal at 6.80@6.85c. New York, 6.65@6.70c. St. Louis.

The London market for spelter is an ex-

ception to the general rule and closes steady at £26 7s. 6d. for good ordinaries, £26 12s. 6d. for specials.

Silesian Spelter Market—Paul Speier writes from Breslau, Germany, under date of Feb. 28, that the market weakened during the month, but recovered toward the end. Spelter was quoted at 52.50@53.75 marks per 100 kg.—5.67@5.80c. per lb.—f.o.b. works. Zinc sheets were unchanged. Zinc dust was in demand, closing at 50.75@51.50 marks per 100 kg.—5.48@5.56c. per lb.—delivered at Stettin. The movement of zinc and zinc ores in Germany for January was, in metric tons:

	Imports.		Exports.	
	1906.	1907.	1906.	1907.
Spelter	2,476	2,083	5,621	6,375
Zinc sheets	22	3	1,173	1,528
Zinc scrap	223	136	683	562
Zinc dust	.....	69	.....	330
Zinc oxide	.....	464	.....	1,214
Lithopone	75	165	863	603
Zinc ores	15,037	10,761	3,887	3,017

The larger exports of spelter this year were 3329 tons to Great Britain and 1342 tons to Austria-Hungary.

Zinc Sheets—The base price is now \$8.50 per 100 lb. (less discount of 8 per cent.) f.o.b. cars at Lasalle and Peru, in 600-lb. case for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; the lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 pounds.

Antimony—The market is very dull, but quotations are substantially unchanged; Ordinaries, 22¾@23½c.; Hallett's, 23½@24c.; Cookson's, 24½@25½c.

Nickel—For large lots, New York or other parallel delivery, the chief producer quotes 45@50c. per lb., according to size and terms of order. For small quantities prices are 50@65c., same delivery.

Platinum—Demand continues strong and prices high. Unmanufactured platinum is quoted at \$38 per oz. for ordinary and \$41 per oz. for hard. For good scrap \$31.50@32 is paid.

Quicksilver—Current prices in New York are \$41 per flask of 75 lb. for large quantities, and \$42 for smaller orders. San Francisco orders are \$38@39 per flask, according to quantities, for domestic orders, and \$37@37.50 for export. The London price is £7 per flask, but £6 16s. 3d. is quoted by jobbers.

Aluminum—Prices are steady and demand good. Prices for ton lots, or over, are: No. 1, over 99 per cent. pure metal, 36c. per lb.; No. 2, over 90 per cent., 34c. Small lots are 1 to 3c. higher, according to size. Rods, according to size, are 1c. per lb. up over the price of ingots. Granulated metal is 2c. per lb. over ingots.

British Imports and Exports

Copper—Imports and exports in Great Britain for the two months ending Feb. 28 were as follows, in long tons; the totals giving the copper contents of all material:

	1906.	1907.	Changes.
Copper ore	19,146	17,115	D. 2,031
Matte and precipitate	14,261	11,141	D. 3,120
Fine copper	10,927	13,290	I. 2,363
Total imports	19,973	20,573	I. 600
Exports	7,261	8,556	I. 1,295
Re-exports	2,943	4,375	I. 1,432
Total exports	10,204	12,931	I. 2,727
Balance	9,769	7,642	D. 2,127

Of the total imports the United States furnished 61 tons of matte and 5020 tons of fine copper in 1907; against 937 tons.

Tin—Imports and exports of tin in Great Britain for the two months ending Feb. 28 were as follows, in long tons:

	1906.	1907.	Changes.
Straits	6,322	5,300	D. 1,022
Australia	774	937	I. 163
Other countries	356	721	I. 365
Total imports	7,452	6,958	D. 494
Re-exports	5,926	4,624	D. 1,302
Exports	1,089	1,671	I. 582
Total exports	7,015	6,295	D. 720
Balance	437	663	I. 226

The re-exports are largely of Straits tin sent to the United States.

Lead—Imports and exports of lead in Great Britain for the two months ending Feb. 28 were as follows, in long tons:

	1906.	1907.	Changes.
United States	2,530	2,010	D. 520
Spain	15,572	15,712	I. 1,140
Australia	8,814	10,025	I. 1,211
Germany	2,888	2,708	D. 180
Other countries	627	589	D. 38
Total imports	30,431	32,044	I. 1,613
Exports	8,116	8,880	I. 764
Balance, imports	22,315	23,164	I. 849

The lead credited to the United States is chiefly foreign lead, refined here in bond.

Spelter—Imports and exports of spelter in Great Britain for the two months ending Feb. 28 were as follows, in long tons:

	1906.	1907.	Changes.
Spelter	17,214	13,737	D. 3,477
Zinc sheets, etc.	2,823	3,700	I. 877
Total imports	20,037	17,437	D. 2,600
Exports	960	654	D. 306
Balance, imports	19,077	16,783	D. 2,294

Imports of zinc ores are not reported separately.

Quicksilver—Imports of quicksilver into Great Britain for the two months ending Feb. 28 were 7882 lb. in 1906, and 797,122 lb. in 1907; an increase of 789,240 lb. Re-exports were 569,006 lb. in 1906, and 567,430 lb. in 1907; a decrease of 1576 lb. this year.

Missouri Ore Market

Joplin, Mo., March 16—The highest price reported paid for zinc ore was \$53.50; the assay basis price was \$49 to \$51 per ton of 60 per cent. zinc, and the average price was \$49.16.

The highest price for lead ore was announced at \$83.50, a decline of \$2 per ton, and the average price was \$82.92 per ton.

The combined value of the zinc-lead shipment for the week was \$435,846, a sum \$40,000 greater than any previous week of record. Purchasing agents de-

voted their time more to shipping than to buying, and as a consequence the demand for unpurchased ore was lighter throughout the week; closing, however, with a stronger demand, as soon as it became apparent that the enormous shipment would cut down the reserve stock in the bins.

Following are the shipments of zinc and lead from the various camps of the district for the week ending March 16:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.	4,119,860	1,003,060	\$144,121
Joplin.....	3,144,770	494,780	100,477
Galena-Empire.....	1,491,880	151,550	43,511
Alba-Neck City.....	1,593,530	.....	41,431
Badger.....	825,920	.....	21,473
Duenweg.....	485,360	156,300	18,542
Oronogo.....	534,990	20,640	14,444
Granby.....	625,000	60,000	13,150
Aurora.....	591,970	11,730	11,915
Prosperity.....	315,140	37,710	9,223
Spurgeon.....	249,790	57,650	6,958
Zincite.....	113,120	8,710	3,184
Baxter Springs.....	118,500	.....	2,962
Sherwood.....	60,810	16,340	2,160
Stott City.....	53,840	.....	1,238
Playter.....	42,280	.....	1,057
Totals.....	14,366,760	2,018,470	\$435,846
Eleven weeks.....	130,977,430	18,600,850	\$3,870,000
Zinc value, the week, \$353,219; 11 weeks, \$3,090,810			
Lead value, the week, 82,627; 11 weeks, 779,190			

Average prices for ores in the district, by months, are shown in the following table:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1906.	1907.	Month.	1906.	1907.
January...	47.38	45.84	January...	75.20	83.53
February...	47.37	47.11	February...	72.83	84.58
March.....	42.68	.....	March.....	73.73	.....
April.....	44.63	.....	April.....	75.13	.....
May.....	40.51	.....	May.....	78.40	.....
June.....	43.83	.....	June.....	80.96	.....
July.....	43.25	.....	July.....	74.31	.....
August.....	43.56	.....	August.....	75.36	.....
September..	42.58	.....	September..	79.64	.....
October....	41.55	.....	October....	79.84	.....
November..	44.13	.....	November..	81.98	.....
December..	43.68	.....	December..	81.89	.....
Year.....	43.24	.....	Year.....	77.40	.....

Wisconsin Ore Market

Platteville, Wis., March 16—The zinc market is still strong, and the buyers purchased every pound produced. The strength of the market, in view of existing local conditions, is quite noticeable. The gain during recent months has brought the price of 60 per cent. ore up from \$40 to \$52. The majority of the mines in this district pay handsomely on a \$40 basis.

The camps of the district loaded ore for the week ending March 16, as follows:

Camps.	Zinc, Lb.	Lead, Sulphur, Lb.
Platteville.....	489,710	58,900
Buncombe-Hazel Green..	429,000	.....
Linden.....	275,350	.....
Benton.....	99,500	.....
Galena.....	83,400	.....
Highland.....	66,000	.....
Bewey.....	57,930	56,500
Livingston.....	55,000	.....
Mineral Point.....	45,930	.....
Total for week.....	1,601,820	115,400
Year to Mar. 16.....	18,125,814	800,420

The scarcity of labor, in and about the mines, is quite a factor in the production of the district. The early spring has created a demand that will be hard to supply. The cry for more cars is still heard.

The various camps produced on an average about the same as last week, but the loading facilities vary so that the tonnages reported at shipping points do not this week represent total production.

Chemicals

New York, March 20—The chemical markets are generally strong, with good demand for nearly all sorts of material.

Copper Sulphate—Under strong demand from the agricultural and export trades, prices have again advanced. For carload lots and over, we quote \$7.50 per 100 lb., while smaller parcels bring \$7.75 per 100 lb. in the local market. Supplies are quite large, but hardly equal to current demand.

Nitrate of Soda—Spot supplies are still scarce and the market is strong. Quotations are unchanged, 95 per cent. for 1907 delivery, all positions, commanding \$2.45 @ 2.47½ per 100 lb., and 96 per cent. \$2.50 @ 2.52½. For 1908 delivery quotations are \$2.42½ and \$2.47½, respectively.

Phosphates—Exports of phosphates through the port of Savannah in February, as reported by J. M. Lang & Co., were 5643 tons to Germany and 2501 tons to Holland; 8144 tons in all.

Mining Stocks

New York, March 20—The general overturn of last week on Wall street was exciting enough while it lasted; at one time it looked as though something like a panic would develop. It was followed by speedy recovery, however, though the general market has continued weak and uncertain.

Mining stocks have been affected, and have followed the course of the general market. At the close there is still a downward tendency, and the heavy liquidation of the past week will be felt for some time.

Boston

March 19—Copper mining shares received one of the worst setbacks, the past week, ever witnessed. "Terrible" Thursday it was well named. The recovery the following two days was about 75 per cent. of the decline, but renewed liquidation the past two days has been pronounced, although the market has absorbed stocks well and the tone tonight was considerably improved. Whether liquidation has been completed or not, it is hard to say; but one thing can be said, and that is, brokerage houses have reduced their liabilities amazingly. A great deal of cash buying has been going on in the market at the reduced level of prices, which has strengthened the position amazingly. Money has been snug and continues so, call money ranging from 8 to 10 per cent. in this center, and time from 6½ to

7. with copper shares not considered the best collateral.

Amalgamated made a low price at \$81, Thursday, a drop of \$24.37½ in 24 hours, from which it recovered to \$97 in the next 24 hours; it closed at \$92 tonight. Copper Range broke \$14, to \$73.50, closing at \$82 tonight. One of the worst declines occurred in North Butte, which broke from \$103.25 a week back to \$77.75, a fall of \$25.75; subsequently it recovered to above \$92. Butte Coalition took a \$10 drop to \$23, selling to above \$30 since. Bingham tumbled \$6.50 to \$18.50, closing at \$21 tonight; Boston Consolidated \$6 to \$22, going back to above \$27.

Greene Consolidated went off \$5.62½ to \$21.87½, recovering to above \$25, and Michigan fell \$2.75 to \$14.75, recovering to \$16. Mohawk made its low price at \$74, a drop of \$14; it has touched \$86 since. Old Dominion broke \$14.75 to \$44, recovering over \$5, and Osceola broke \$26 to \$130, with a \$15 recovery. Quincy's low was \$109, a fall of \$16, selling at \$120 later the same day. Trinity slumped \$8.75 to \$19.25, later rising to above \$25, with the final \$24 today. Utah also suffered a decline of \$14.62½ to \$51.50, recovering to \$63 and closing at \$60.50 tonight. Calumet & Hecla touched \$875 and Calumet & Arizona \$148.

The Osceola annual meeting last Thursday flushed out and owing to the injunction proceedings the meeting was adjourned to a later date. Calumet & Hecla people control the stock and will take charge of affairs in due time.

Curb stocks suffered in the general decline, but not in the same proportion as listed shares. Several changes have occurred in the Raven directorate. This company will double its capital to 1,000,000 shares, par \$1, and offer 100,000 shares to stockholders, retaining 400,000 shares in the treasury.

Colorado Springs

March 15—The local stock market has been decidedly off color this week. Trading in most of the stocks has been dull and lifeless. El Paso, Isabella and Jennie Sample have shown slight activity. The report that El Paso mine was about to be closed down and the denial of the report have caused this stock to fluctuate in price. The work on the drainage tunnel is progressing slowly.

San Francisco

March 13—As predicted last week, the San Francisco Mining Exchange and the San Francisco & Tonopah Mining Exchange have consolidated as the San Francisco Mining Exchange, with the following officers: Walter Turnbull, president; E. H. Kramer, vice-president; S. E. Hertel, secretary, and M. Meyer, treasurer. On Monday of this week active business was started and there is already considerable rivalry between the new mining ex-

change and the "Old Board." The San Francisco & Tonopah Exchange has now ceased to exist. It was the first to call the stocks of the new Nevada camps, when the old board declined to do so. Meantime the San Francisco Stock and Exchange Board is proceeding in the direction of rejuvenation. The committee on constitution and by-laws, consisting of W. H. Moise and W. C. Ralston, has engaged the services of a prominent attorney to advise in the construction of a new plan of procedure for the board which shall be in conformity with the methods adopted by the large exchanges in the Eastern States. The present constitution and by-laws are based on the San Francisco custom of 40 years and are somewhat antiquated.

STOCK QUOTATIONS

Table with columns for NEW YORK Mar. 19 and BOSTON Mar. 19, listing various stock companies and their prices.

N. Y. INDUSTRIAL

Table listing industrial stocks in New York with columns for company names and prices.

ST. LOUIS Mar. 16

Table listing stock companies in St. Louis with columns for company names and prices.

Table with columns for S. FRANCISCO Mar. 13 and NEVADA Mar. 20, listing various stock companies and their prices.

New Dividends

Table listing new dividends for various companies, including columns for Company, Payable, Rate, and Amt.

Assessments

Table listing assessments for various companies, including columns for Company, Delinq., Sale, and Amt.

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Table showing monthly average prices of silver in New York and London for the years 1906 and 1907.

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

Table showing monthly average prices of copper in New York and London for the years 1906 and 1907.

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Table showing monthly average prices of tin in New York for the years 1906 and 1907.

AVERAGE PRICE OF LEAD

Table showing monthly average prices of lead in New York and London for the years 1906 and 1907.

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

Table showing monthly average prices of spelter in New York, St. Louis, and London for the years 1906 and 1907.

New York and St. Louis, cents per pound. London in pounds sterling per long ton.