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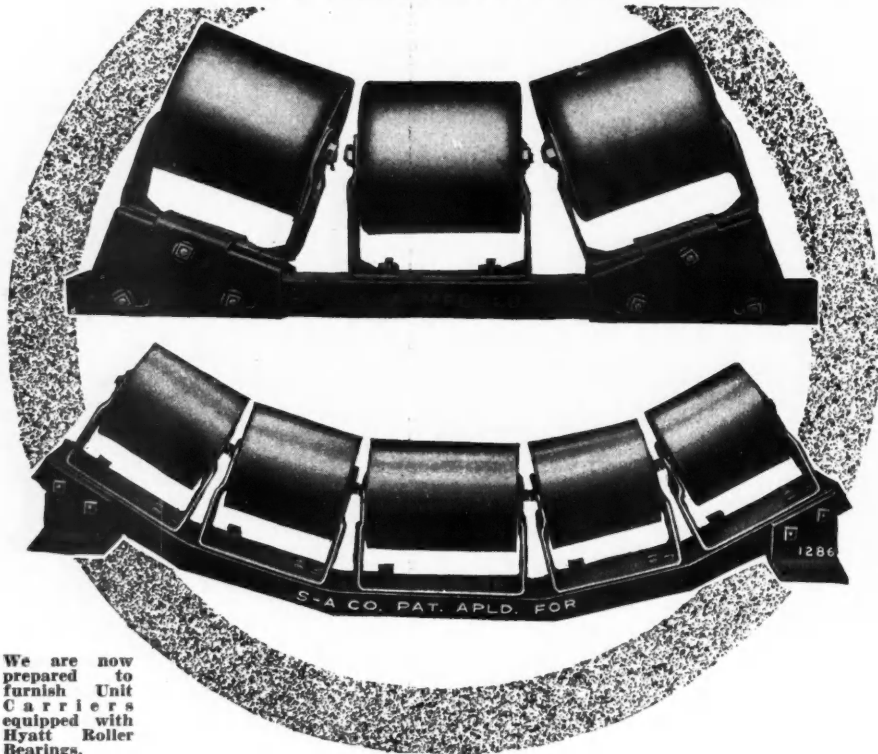


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The Massey Copper Mine, Ontario, Canada

By FRANCIS CHURCH LINCOLN

Director Mackay School of Mines, University of Nevada, Reno.

In a territory 50 miles west of Sudbury the Massey mine has produced a siliceous flux that is susceptible to flotation treatment. Geological history of the district and description of vein formation are noted in detail.

NORTH of Lake Huron and west of the Sudbury nickel-copper district lies a region in which there are many chalcopryrite veins. These veins have been known for some time, having been exploited to provide flux for the Sudbury ores, but their commercial importance has recently been considerably increased as a result of the introduction of the froth-

The Massey copper mine was discovered in 1900 and in succeeding years produced several thousand tons of copper ore. Part of this was shipped to Copper Cliff and to Victoria Mines, to be smelted with nickel ore. Then, in 1904, an Elmore oil-flotation plant was erected at the mine, but there, as elsewhere in America, the process was a failure and in 1907 the mine was shut down. At the opening of the present year the property was acquired by the Kenyon Copper Mines, Ltd. This company has erected an experimental Callow flotation plant in the old Elmore mill and is planning to develop the mine, build a large flotation mill and install a hydroelectric plant.

The town of Massey is on the Sault Ste. Marie branch of the Canadian Pacific R.R., 58.4 miles west of Sud-



NO. 1 SHAFT—500 FT. IN DEPTH

NO. 4 SHAFT—OPEN CUT

VIEWS OF PORTIONS OF THE MASSEY COPPER MINE, ONTARIO

flotation process and of the rise in the price of copper. Among the mines of this region are the Bruce mine of the Mond Nickel Co., which is supplying converter flux from a quartz-chalcopryrite vein; the Dean Lake mine of the Sudbury Nickel Co., which is now under development and is said to have opened a 1500-ft. vein from 4 to 6 ft. in width, containing chalcopryrite, calcite, feldspar and quartz, with the copper content running from 4 to 6%; the Cheney mine in Houghton Township, which shipped 16% copper ore last winter and is now under development; the Hermina mine in Salter Township, which is at present idle; the Massey mine in the same township, which is described in the present article.

bury. It is a small but thriving town with post office, bank, hotel and stores, and is mainly supported by the lumber industry, which is now active at a considerable distance from the railroad. The Massey copper mine is three miles by branch railway northwest of the town of Massey.

The topography of the region is glacial, with many low rounded hills which rarely exceed a hundred feet in height, rising like islands from the sea of drift. Except for occasional farm clearings, the ground is covered with a thick second growth of birch, poplar and pine. The district is drained by the Sable River. Two miles to the northwest of the mine this stream, flowing southward, makes a sudden 3½-mile detour to the east

and then continues on its southerly course, entering the Spanish River near the town of Massey. The Spanish River is a navigable stream flowing into the not far distant North Channel of Lake Huron. Falls on both the Sable and Spanish Rivers afford excellent hydro-electric power sites, and it is at Cameron Falls, on the Sable River just before it makes the detour described, that power for the Massey mine is to be developed.

The country rock of the Massey mine consists of greenstone-tuff schists and quartzite schists which are believed by Coleman to belong to the Sudbury Series, but which may be of Keewatin age since they differ materially from the rocks of the locality type as ex-

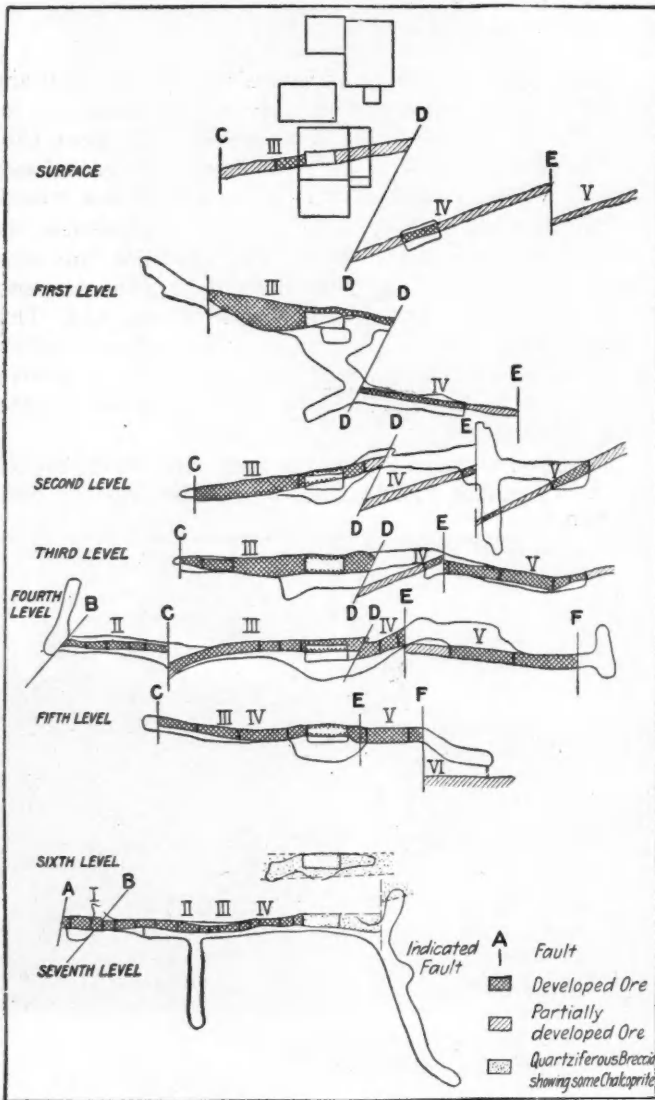
posed fifty miles to the eastward. These rocks were originally beds of medium-basic volcanic ash and of sand, which were formed in very early geologic time, consolidated into tuffs and sandstones, and finally metamorphosed into schists having a general east-and-west strike and a steep northerly dip to their schistosity.

Shaft No. 1 of the Hermina mine, which is said to disclose a deposit similar in character to those at the Massey mine. It is therefore probable that the Massey and Hermina mines are on the same ore-bearing zone and that copper deposits occur beneath the glacial drift between them.

The Massey ore deposits are parallel to the schistosity and have more or less well-defined walls. It is quite possible that at one time a continuous orebody extended the full length of the property and that this has since been broken up by minor faulting into a series of smaller orebodies. However true this may be, the outcrops at the western end of the ground are of such a character as to indicate that there were originally several parallel orebodies.

Copper ore has been found in the lowest workings at a depth of 530 ft. from the surface, and its general character is such as to make it seem probable that the ore will extend to considerable depth.

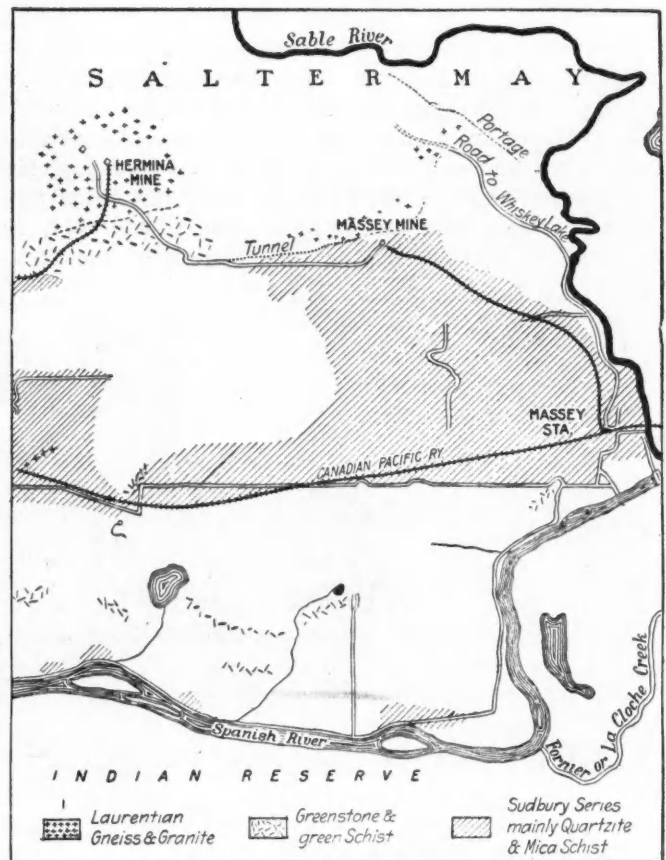
The ore deposits have been metamorphosed. This metamorphism has occurred, in part at least, subse-



LEVEL PLANS OF THE MASSEY MINES SHOWING THE FAULTS

posed fifty miles to the eastward. These rocks were originally beds of medium-basic volcanic ash and of sand, which were formed in very early geologic time, consolidated into tuffs and sandstones, and finally metamorphosed into schists having a general east-and-west strike and a steep northerly dip to their schistosity.

The copper deposits at the Massey mine, having a length of nearly a mile, occur in an east-and-west zone in these schists. A mile to the westward of the most westerly workings, across a drift-covered plain, is



GEOLOGICAL MAP OF THE DISTRICT SURROUNDING THE MASSEY COPPER MINES

quent to the minor faulting mentioned, and has erased the planes formed by this faulting. So thoroughly has this been done that the casual observer is led to conclude that the orebodies are distinct lenses in the schist, and their true character of faulted and metamorphosed veins only becomes clearly evident when the orebodies on different levels are plotted. This may be seen in Fig. 1, which shows the ore occurrences at the main shaft. The faults are lettered A to G, and the fault-blocks numbered I to VI. It will be noticed that the western fault-blocks are displaced toward the north;

¹22nd Ann. Rep. Ontario Bureau of Mines (1913), p. 155.

or in other words, in walking west along the vein the faults are found to displace the ore toward the right hand. These displacements are also seen to decrease with depth, indicating that the faulting is either dying out or is pivotal in character and will reverse in direction with greater depth. That the latter is more probable seems likely when one considers the crushed zone between the fifth and seventh levels, which strongly suggests that this portion of the deposit was the pivot of many faults, a conclusion that is strengthened by the apparent reversal of the indicated fault G on the seventh level.

The primary ore mineral is chalcopyrite. Associated with this is a very little silver and a trace of gold. Since these do not concentrate with the copper, they are evidently present in some other mineral than chalcopyrite. The chalcopyrite was deposited together with pyrite, magnetite, specularite and white milky quartz. These minerals have all suffered metamorphism. A



NO. 1 SHAFT AND 100-TON FLOTATION MILL
MASSEY COPPER MINE

large proportion of the filling material is country rock that has undergone a comparatively slight mineralogical change where quartzite and a most profound one where greenstone-tuff. In the latter case, only the small amount of original quartz has been preserved as such, but the other original minerals have almost completely disappeared, the feldspars having been changed to epidote and the ferromagnesian constituents to chlorite.

Although the ore deposits belong to a remote geological age, the gossan development and secondary sulphide enrichment are extremely superficial, never extending downward for more than a few feet and at times being altogether lacking. This is due to the geologically recent glaciation of the region, which took place in Pleistocene time and completely removed what gossan and secondarily enriched ore may have been formed in previous geological ages. Limonite is the principal constituent of such little gossan as exists, chalcocite distinguishes the zone of secondary enrichment, and below that the primary ore minerals make their appearance.

Thus the geological history of the Massey mine may be summed up briefly as follows: In early Archæan time beds of sand were deposited in the vicinity of what is now Massey and volcanoes discharged medium-basic ash to form interstratified beds in the sands. After the sand had consolidated to sandstone and the ash to tuff,

copper-bearing mineral veins were formed in these rocks possibly as an after-effect of the intrusion of Laurentian granite, which occurs in the near neighborhood. Metamorphism ensued, and before it was complete, the veins were subjected to minor faulting, the fault planes later vanishing as a result of continued metamorphism. Then came Pleistocene glaciation, since which only a negligible amount of gossan formation and secondary enrichment have occurred. This leads to the conclusion that any variation in the value of the ore with depth, aside from that encountered with the first few feet, must be due to variation in the original deep-seated deposition of the ore and can have no relation to the present surface.

The present developments on the property constitute three groups separated by 1500-ft. intervals of unprospected territory. The branch railway from Massey extends to the No. 1 shaft at the eastern end of the property. Here the greatest amount of development work has been done. The shaft has been sunk to a depth of 530 ft. at an inclination of 76°, and seven levels have been run from it. Practically all the ore produced by the Massey mine has come from between the first and fifth levels in this shaft. In the center of the property are situated No. 4 shaft (which is 50 ft. in depth) and two long opencuts. On the western end of the ground is a 100-ft. tunnel gaining a back of 50 ft., and another long opencut. Elsewhere on the mine are numerous small pits and cuts disclosing ore. The ore that has been developed by these workings has an average width of about 4 ft. and contains about 3½% copper.

The general conditions affecting mining and milling are good. The branch railway line solves the transportation problem. The town of Massey offers good business facilities, and the mine telephone may be used for long-distance connections. Plenty of wood suitable for fuel and for mining purposes is available. Several water-power sites that can be easily and cheaply developed exist in the vicinity. Among the drawbacks should be noted the cold and snow of winter and the fact that there is no custom copper smelter in eastern Canada.

Miners are paid \$4 per 8-hr. day. This enables the management to obtain picked men, since the scale at Sudbury—the nearest large mining camp—is \$3.50. The ground is hard and stands well without timbering, but requires machine drilling.

The ore is well adapted to froth flotation, it being found possible to produce heads containing from 20% to 25% copper with a recovery of 95%. The freight on these concentrates to New York City is \$5.78 per ton.

Iron-Ore Shipments

Shipments of iron ore from Lake Superior in June were 9,639,991 tons, an increase of 132,415 tons over last year. For the season to July 1 shipments were, in gross tons:

| Port: | 1916 | 1917 | Decrease |
|------------------|------------|------------|-----------|
| Escanaba..... | 2,602,824 | 2,205,297 | 397,527 |
| Marquette..... | 1,154,140 | 625,949 | 528,191 |
| Ashland..... | 2,204,263 | 1,909,268 | 294,995 |
| Superior..... | 3,878,915 | 3,526,082 | 352,833 |
| Duluth..... | 6,325,990 | 5,128,894 | 1,197,096 |
| Two Harbors..... | 3,449,435 | 2,739,645 | 709,790 |
| Total..... | 19,615,567 | 16,135,135 | 3,480,432 |

The decrease this year was due to the late opening of navigation on the Lakes.

Remedies for the Petroleum and Gasoline Situation

BY FREDERICK G. CLAPP

Consulting Petroleum Engineer, 120 Broadway, New York

The country's annual production of petroleum is decreasing although consumption of gasoline is increasing alarmingly. The development of gasoline substitutes will take time. Of the many remedies proposed, utilization of oil shales and the discovery of new fields are the only ones that can furnish more than a temporary relief. The latter can be accomplished with certain success if the petroleum geologists of the country are organized under a central bureau for the systematic examination of all possible fields in the most rapid and efficient way and with a minimum duplication of work.

AMONG the unusual situations existing at the present time, one of the most serious is that relating to petroleum and its chief refined product, gasoline. The dangerous elements in the situation are accentuated by the fact that the decline of the supply is not due mainly to the war, but to the natural laws of supply and demand which were leading toward a serious decline in production and an increase in consumption even before the outbreak of war in 1914. Let us examine the situation.

The exact computation of the supply of petroleum remaining in the earth is of course impossible. Arnold¹, in 1915, estimated the fields of the United States as 36% exhausted. In February, 1916, a report was made to Congress² by the United States Geological Survey showing the quantity of petroleum produced and the estimated future production on that date. These figures are as follows:

ACTUAL PRODUCTION AND POSSIBLE FUTURE SUPPLY OF PETROLEUM IN THE UNITED STATES

| Field | Product on (1859-1915) (in Millions of Bbl.) | Estimated Percentage of Total Exhaustion | Possible Future Production (in Millions of Bbl.) |
|---------------------|--|--|--|
| Appalachian | 1,150 | 70 | 481 |
| Lins-Indiana | 438 | 93 | 31 |
| Illinois | 251 | 51 | 244 |
| Kansas-Oklahoma | 617 | 25 | 1,874 |
| North Texas | 44 | 8 | 848 |
| Northwest Louisiana | 58 | 22 | 124 |
| Gulf Coast | 236 | 13 | 1,500 |
| Colorado | 11 | 65 | 0 |
| Wyoming-Montana | 12 | 2 | 540 |
| California | 835 | 26 | 2,345 |
| | 3,652 | 32 | 7,993 |

According to these estimates the oil fields of the nation were 32% exhausted.

We are now brought to the ways and means of finding new fields. In the early days of the oil business these were discovered by blind chance; during a later period they were found mainly by the weight in numbers of wells drilled in advance of known fields. Within the last few years, however, this condition has been improved by the introduction of geological science in prospecting. As long ago as 1885 White³ discovered the

structural relations between petroleum, gas and salt water, and from his observations evolved the anticlinal theory, which was modified from time to time during the succeeding 25 years by various investigators, until it is now recognized in the structural classification⁴ of oil fields, by the understanding of which their discovery is greatly facilitated.

It is impossible to make a general statement of the absolute value of geology to oil development, since this factor varies in different fields with structural, petrographic, hydrologic and topographic conditions. In some fields the writer has had 100% of success, but this should not be uniformly expected. In the only extended developments, over a series of years, where a careful comparative record was kept of successes prior to and subsequent to the introduction of geology, it was found that the proportion of dry holes prior to the introduction of geology was 47% while in those wells located by geology the percentage dropped to 33. This was a difficult new field and one in which little accurate geological work was done. The total proportion of geological dry holes is much less than this, even including wildcat territory, and noticeably so in a region known to be petroliferous. An excellent paper by Hager⁵ has recently appeared, in which he classifies all fields of Oklahoma and Kansas and shows that 94.7% of them correspond with identifiable geological structures, and that in 1913, 66 $\frac{2}{3}$ % of the pools were found by geologists.

Many factors besides structure govern the occurrence of petroleum, as explained by the writer in 1909⁶, so that a careful study of them all is necessary to assure complete success. The point which must be made here is that geology has come to occupy a prominent part in the oil business and that few large companies now do without it. Those which pretend to do so are, as a rule, awake to all opportunities of accumulating territory in proximity to that reported on by another company's geologists, and of taking full advantage, in an informal or semi-scientific way, of whatever can be learned of the structure and underground conditions. There are in the United States at least 250 true petroleum geologists, according to late estimates, who may be classified somewhat as follows: United States Government Survey, 5; state surveys, 10; educational institutions, 5; employ of oil companies, 200; consulting petroleum geologists, 30; total, 250.

So widely has the term "geologist" come to be accepted that this number would probably be increased to 500 should we include all geologists, engineers, surveyors, scouts, promoters, pseudo-experts, etc., who call themselves oil geologists or are so called by their employers. The number is not large, except in a relative

¹F. G. Clapp, "A Proposed Classification of Petroleum and Natural Gas Fields Based on Structure," "Econ. Geol.," Vol. V, 1910, pp. 503-21.

²Dorsey Hager, "The Evidence of the Oklahoma Oil Fields on the Anticline Theory," Bul. Am. Inst. Min. Engr., February, 1917, pp. 195-8.

³F. G. Clapp, discussion of a paper by M. J. Munn; "Econ. Geol.," Vol. IV, 1909, pp. 565-70.

¹Ralph Arnold, "Econ. Geol.," Vol. X, 1915, p. 710.

²Senate Document 310.

³I. C. White, "Science," N. S., Vol. V, 1885, pp. 521-2, and other writings.

sense. In reality, even the minimum estimate is in numbers equal to about half the membership of the Geological Society of America, which includes all geologists of recognized standing in the country. There are in the oil business single companies that now employ more geologists than does the United States Geological Survey.

The activities of government, state and educational geologists will not be discussed here, as their duties are fully laid out for them. These men, however, are in a sorry minority, and besides them are two or three hundred petroleum geologists, who are either in the employ of particular oil companies or doing consulting work for various companies. One consulting geological firm has over a hundred clients, has reported in detail on over 100,000 square miles of prospective oil territory, and in a reconnaissance way on several million square miles, at times being employed to report on the oil possibilities of entire nations. Its staff includes some of the best-known experts, its library and equipment rival those of the leading government surveys and exceed those of most oil companies. Such firms as this are not merely geologists, but act as advisory experts on all phases of petroleum engineering from the advance examination of the property to the completion of the wells. They have the confidence of the principal oil producers, as well as of national and state geological surveys and the general public, and have become a recognized accessory of the world's oil industry.

PETROLEUM PRODUCTION OF THE NATION

Beginning with the discovery of oil in Pennsylvania in 1859 and during its consequent development in that state and in many others during the latter half of the Nineteenth Century, the production increased with few setbacks. The year 1916 witnessed a high point in marketed production of 295,000,000 bbl., and a person unfamiliar with the business might readily suppose that 1917 and succeeding years would continue to show an increase. If, however, we examine the production of individual fields or states, we find that most of them have long since passed the high point in their production and are on the down swing.

During the years 1859 to 1891 the production of Pennsylvania and New York increased, with fluctuations, to a maximum of 33,000,000 bbl., and since 1891 has dropped to less than 9,000,000 bbl. In the same way the production of the Ohio fields was at its maximum in 1896, West Virginia in 1900, Indiana in 1904, Illinois in 1910 and California in 1914, while it appears probable that Oklahoma and Kansas will have passed their combined maximum by 1918. Nearly all fields have long since started on their decline. On the basis of existing fields, therefore, the nation's supply may be expected to reach its maximum in the present year, and henceforward we may expect a decline.

RELATION BETWEEN PRODUCTION AND PRICE

It is true that the production of no state has increased or diminished at a regular rate, and all of them have shown certain reversals during even their best years. This is due to the fact that within an oil-producing state every individual field has its rise and fall, even as in a given field every individual well starts out with a certain production and then drops off to the minimum

amount that can be extracted profitably. The habit of oil producers, like gold seekers, farmers and lumbermen, is to follow the crowd to the most productive field and to develop it fully; then, when a serious decline manifests itself, to move on to another field. Many companies are so large that they are able to operate successfully in various fields and to prospect far in advance of where production is known; but this does not belie the statement that the centers of development are always where results are believed to be best, and that when valuable wells cease to be discovered in a given field, the operators flock elsewhere.

During the period when prices paid for crude oil were comparatively low, drilling was considerably curtailed in years of greatest production, because crude-oil prices repeatedly declined under the influence of increased production, so that less encouragement existed for additional drilling. It was generally not until a decline in production occurred, and additional oil was needed to replace the deficiency, that prices were raised as an incentive to additional drilling in search of new pools, and sooner or later these efforts were rewarded by success. The oscillations between periods of rising prices of crude oil with intense activity in drilling, followed by an increased production with consequent lowering of price, manifest the law of supply and demand, as in other commodities. While a certain amount of price manipulation may have taken place in the past, as inferred from Government investigations and other agitations, it is true that the underlying cause of all fluctuations is the law of supply and demand.

CONSUMPTION OF PETROLEUM AND GASOLINE

Though the decline of petroleum production is not a material exception to that of many other minerals and natural resources, we are now experiencing an added danger in the fact that at a time when this decline is imminent, the consumption of gasoline—which is the most important product of petroleum—has been greatly increasing and shows no signs of letting up. In 1916 there were 2,350,000 more automobiles than in 1910, using 1,000,000,000 gal. more of gasoline; and the number of automobiles is constantly increasing.

The danger in the present emergency was recently outlined by Manning, who mentioned the following figures as paramount in importance:

STATISTICS SHOWING THE RAPID INCREASE OF GASOLINE CONSUMPTION OVER PRODUCTION

| | | |
|---|----------------------------------|----------|
| Oil stocks held by pipe lines and transportation companies: | | |
| Jan. 31, 1916 | 170,000,000 bbl. | |
| Dec. 31, 1915 | 150,000,000 bbl. | |
| Representing a decline of | 20,000,000 bbl. in 11 months | |
| Number of automobiles in 1916 | 2,750,000 | |
| Number of automobiles in 1910 | 400,000 | |
| An increase of | 2,350,000 in 6 years | |
| Total gasoline-engine horsepower built and sold in United States: | | |
| 1915 | 22,500,000 | |
| 1913 | 11,200,000 | |
| An increase of | 11,300,000 horsepower in 2 years | |
| Increased amount of gasoline used in 1916 | 28,000,000 bbl. | |
| over that used in 1910 | | % |
| Proportion total gasoline production of United States used in automobiles in this country | | 55 to 60 |
| Proportion exported | | 20 to 25 |
| Proportion used in stationary engines, motor boats, tractors, etc. | | 25 to 35 |
| Increase of crude petroleum consumption: | | |
| 1915 over 1914 | | 12% |
| 1916 over 1915 | | 13% |

*Van. H. Manning, an address on "The Petroleum and Gasoline Situation," delivered before Editorial Conference of Business Publishers Association, Washington, May 25, 1917.

Although the increased use of petroleum and gasoline is due largely to the enormous increase in the number of automobiles, it is also due, to a limited extent, to that of tractors, motor boats, etc., and a future increased demand may be attributed to the automobiles, motor-boats and airplanes that will be needed in the war. We have no way of estimating the demands that will be made on us for war purposes, but we know they will be great. Consequently, there is every reason to believe that the increase in consumption in 1917 and 1918, both of crude petroleum and of refined gasoline, will far outdistance that in past years. At the same time there is every probability that the total production of petroleum in the United States in 1917 will be less than in 1916; and Manning estimates that the consumption this year will so far exceed the production that 60,000,000 bbl. must be drawn from storage, out of a total of 150,000,000 bbl. that was in storage on Jan. 1, 1917.

As stated by Manning, "We should not pass the situation with an optimistic statement that when the time comes new fields will be discovered, as has happened in the past, or that new methods will be found whereby this threatened shortage will be overcome. We should undertake to anticipate this problem as best we can, for we certainly will encounter it in the not distant future.

The fact we must face is that the production of petroleum is not increasing as rapidly as the production and consumption of gasoline. The petroleum in time will reach its maximum production and start to decline."

In view of the imminence of this probability and of the disastrous effect of a real petroleum shortage while we are at war, it behooves us to take as radical steps, if necessary, for the solution of the petroleum and gasoline problem as we do in that of raising an army, of increasing our output of munitions or of conserving the food supply. The following are some of the remedies that have been suggested in the past or are suggested now: (1) Decrease in certain uses; (2) possible discovery of substitutes; (3) more efficient methods of oil production; (4) extraction of more gasoline from equivalent amount of crude petroleum; (5) increased extraction of natural-gas vapors; (6) utilization of oil shales; (7) use of foreign petroleums; (8) increase in efficiency of petroleum prospecting.

DECREASE IN CERTAIN USES AND POSSIBLE DISCOVERY OF SUBSTITUTES

There is little likelihood of a general and voluntary decline in the utilization of either crude petroleum or gasoline on an extended scale. One method that has been suggested is that the burning of crude petroleum under boilers for the generation of steam, as has been done by many railroads and industrial plants in the West, might be stopped; since, in this way large quantities of byproducts of great value for refining are consumed with the crude oil. This use of petroleum may be as dangerous to the petroleum supply as the use of natural gas in smelters, glass works and other industrial establishments is to the natural-gas supply¹, but there is little chance that it will or can be stopped, especially as fuel in ocean transportation, to which it is especially adapted. Certain railroads using crude oil in their loco-

motives have recently discovered that this was not economical, owing to the increasing length of haul, rising prices, etc., and have commenced to reduce the number of oil-burning locomotives in favor of coal locomotives. It is believed that natural causes will tend toward a total reduction of their practice within a few years, but we may fairly question whether this ought not immediately to be done through purely patriotic motives, and whether the proposed emergency control by the Government of all commodities ought not to be extended to that of oil, under which such a ruling could be made.

As to the discovery of substitutes for gasoline, it is, of course, inevitable that they will come into use in this country in time, as they have to a certain extent in Europe. In view of the imminence of a gasoline shortage and of the greater imminence of prices beyond the reach of the consumer, we, as a nation, must fully investigate this question. It will, however, involve changes in carburetors and in other mechanical details, which have not been perfected, and some delay may elapse before a satisfactory and economical substitute can be utilized. Meanwhile we must continue to investigate the other possible remedies for the approaching shortage.

MORE EFFICIENT OIL PRODUCTION AND HIGHER EXTRACTION OF GASOLINE

In the past there have been some inefficiency and losses in the production of oil, as in that of other resources, due not so much to waste as to a lack of understanding of condition in the sands. The ignorance has now been dissipated in part by the petroleum work of the United States Bureau of Mines, which, starting in 1911 with work of the writer, and continued by various individuals, has extended to many of the details of the business.

Of late something has been done, with apparent success, toward removing a greater proportion of the oil from individual wells; as, for instance, the process of forcing air or gas into the sand in order to drive out a greater amount of oil than formerly was obtained. In other places the employment of water to concentrate the oil in a field has been successful in increasing the yield of certain wells. Methods of increasing the efficiency of production are commendable; but they can only delay the ultimate decline of any field, and we must look beyond for a radical remedy.

In recent years a considerable saving has arisen from the improvement in refining methods, more particularly from the so-called cracking process. The cracking of petroleum last year "furnished 7½% of the total gasoline production." The process is being rapidly developed and more extensively installed and will still further increase the gasoline supply over what it would otherwise have been, even during the present year. The problem still remains, however, to forestall and delay as long as possible the ultimate shortage and its consequent prohibitory prices.

For some years it has been possible to extract gasoline from so-called casing-head gas in certain fields, the gases directly accompanying the oil being most suitable and available. The process involves compression and refrigeration of the natural gas, and about 3,000,000 bbl. of gasoline was produced (including naphtha mixture) by it during 1916. It has been possible to oper-

¹Ralph Arnold and F. G. Clapp, "Wastes in the Production and Utilization of Natural Gas and Means for Their Prevention"; United States Bureau of Mines, Technical Paper 38, 1913, 29 pp.

ate profitably on gases carrying only one gallon of gasoline per 1000 cu.ft. of gas. By the absorption process it is now possible to extract as low as one pint of gasoline from 1000 cu.ft. of certain gases. This use of casing-head gas has been valuable in keeping down the price of gasoline and in supplying the increased demand, and can be somewhat expanded; but in most cases the native gasoline, which is more volatile and considerably more dangerous than refined gasoline, must be diluted to render it usable. Gasoline from natural gas will necessarily be continued in use; but its employment, like other factors, cannot prevent the final exhaustion of the oil fields.

UTILIZATION OF OIL SHALES AND FOREIGN PETROLEUMS

We now come to the consideration of a radical departure in the oil business, and one that has been carried on profitably in Scotland for many years and to a limited extent elsewhere. The process in question is the distillation of certain shales, of which enormous deposits exist in various parts of the United States, whose value has already been foreseen. But even at the past prices of crude petroleum, the oil in shales has hitherto not been extractable with profit on a commercial scale. The day is coming when this departure must be taken up on a large scale, and at least one firm of geological engineers is prepared to report on the possibilities of any district and to plan the development of those that are found to be commercially valuable. This utilization of oil shales is the first process that appears to offer a chance of largely increasing the production of refined petroleum.

The question of foreign oils was discussed for the Americas by Arnold¹ before the Pan-American Scientific Congress in 1915 and for the world at large in a pamphlet recently issued. The present writer is, however, more optimistic than Arnold regarding certain countries. From the viewpoint of the increased cost and from the accompanying loss of prestige to American oil business, it will be unfortunate to be obliged to import petroleum or the refined product from other countries; but this must ultimately be necessary, unless the cost of shale oil can be made lower than that of foreign oil. We must expect to develop and buy oil from Mexico, Canada, South America, and perhaps from Asia, in all of which extensive deposits exist. Much of this petroleum is of excellent quality for fuel in ocean transportation.

Several experienced American geologists are ready to say definitely where foreign oil explorations shall be made, and American petroleum engineers are prepared to plan these undertakings when capital is ready to proceed with them. One large firm of consulting engineers has explored extensively in Canada, Mexico, South America, Europe and Asia; and individual geologists have explored in such countries as Mexico, Colombia and Venezuela, where prominent seepages and other well-known forms of surface indications exist; but little work has yet been done in the innumerable favorable areas where few seepages are known. There is no doubt that unsuspected areas in Brazil, Argentina, Bolivia, undeveloped parts of Peru, and many in Asia and the islands of the Far East compare in promise with the

best fields of Ohio, West Virginia and Oklahoma, where oil seldom appeared on the surface until tapped by the drill; yet where geological conditions formed an almost perfect guide when studied by an expert.

Several objections are raised to the exploration and prospecting for petroleum in South America and the Eastern Hemisphere, namely: That no oil is definitely known in particular localities; frequent remoteness from transportation routes.

Both these objections are respected by a petroleum engineer, but they do not constitute as real an obstacle as would be inferred. We must remark, first, that most of the great oil fields of Pennsylvania, West Virginia, Ohio and Oklahoma would not have been discovered if operators had waited to find seepages, since these do not exist in any quantity in those states; and, secondly, that localities in South America and Asia that are now inaccessible will be easily reached when railroads are constructed in the next few years. Moreover, a railroad would prove profitable if built to practically any great oil field, considered with the other potential resources of the respective countries.

INCREASE THE EFFICIENCY OF PETROLEUM PROSPECTING

The eighth and last remedy in mind has not been previously suggested. It is to increase the efficiency of the prospective stage of the oil business, which includes activities from the preliminary geological explorations to the drilling of the wells. It will here be discussed at some length.

In petroleum prospecting we include not only the drilling of test wells, but also the leasing of the property and the making of the accompanying geological and other surveys and reports. The actual drilling has come to be done in a fairly efficient way. Indeed, this is true of leasing and geologizing if applied to an individual company or group. There is, however, a class of inefficiency that comes from intense competition, and this is perhaps nowhere more noticeable than in the business of oil production. As witness of this fact, we may remark that little inefficiency exists in those fields that are entirely controlled by a single experienced company. Inefficiency in prospecting may be grouped as follows: Disastrous overpayments in competition for leases; unnecessary drilling where no chance of oil exists; wastes due to drilling wells in close proximity; duplication of geological investigations.

These inefficiencies are the fault of no particular individuals or groups. They arise from the intensity of commendable competitive industry and in the expansion of the demand for petroleum. In order to obviate the trouble, the system must be modified. Let us therefore consider the respective inefficiencies.

DISASTROUS OVERPAYMENTS AND UNNECESSARY DRILLING

Searchers for oil have the faculty of great optimism and easy delusion, so that a showing of oil discovered in a new well, even in a remote field, starts a rush of scouts, geologists and leasers in that direction, very much like an old-time gold rush. Indeed, history will liken the present-day oil rushes to the gold fevers of last century. It is very easy to build air castles of great wealth about some insignificant seepage or oil showing or report. Consequently, we see prices of real

¹Ralph Arnold, "Conservation of the Oil and Gas Resources of the Americas," "Econ. Geol.," Vol. XI, 1916, pp. 203-22; 299-326.

estate and of leases increasing five-, ten- and frequently one-hundred-fold within a wide area surrounding every field or new well or promising indication of oil. Land formerly worthless will sometimes be leased with a bonus of \$25, \$100 or even \$1000 an acre when indications of oil are discovered on it, if several companies are after territory in the same region.

There is no particular economic loss to the community through payment of high bonuses, since this stimulates a healthy monetary circulation and fixes a value (even if fictitious) on land otherwise worthless. There is, however, a decided loss due to the duplication of time and energy and of overhead charges by many companies in fighting one another for supposedly favorable tracts. It is this time and energy and overhead loss that we now seek to eliminate as a war measure.

Formerly a large amount of drilling was done in localities entirely unfavorable geologically for oil, owing to widespread ignorance of conditions under which it occurs. Mistakes of this nature are not made so often now, yet they do occur, and it would be well if an efficient scientific bureau existed whose duty was not only to recommend against, but to prohibit, the drilling of wells where not one chance in a million exists of finding oil in paying quantities.

In thousands of instances in the oil fields, ordinary custom, competitive pressure and even state laws require the drilling of offset wells on property adjoining wells in which oil is found. For many years this was supposed to be a business necessity in fairness to the adjoining land owners, from whom the oil otherwise would be drawn away. The time has now come when we must recommend perfect conservation—not in the sense of hoarding up oil resources, as formerly supposed, but of eliminating waste of oil, time and funds. During the present shortage of labor and casing, we ought not to allow the sinking of offset wells except in cases where they are sufficiently far distant to increase the total oil supply materially, considering the whole life of the field.

In a financial sense, too, where the result of a well is in doubt, the time and labor are of more value to the nation if utilized in an outlying and promising territory than on an offset well 100 to 600 ft. distant from neighboring wells. This matter of drilling ought, in the present emergency, to be controlled by a Government bureau in charge of an expert competent to decide these difficult matters. The proper interval between wells differs according to depth and geologic formation; but wells in general are drilled too close together for ultimate economy.

DUPLICATION OF GEOLOGICAL INVESTIGATIONS AND THE PROPOSED REMEDY

This brings us to the fourth and perhaps most expensive class of collective inefficiency in oil prospecting, namely, the geological explorations. In order to be efficient, one or at the most three geological reports (if corroboration be necessary) should be made on an area. Under the prevailing system, however, every company is a competitor for promising oil territory wherever it may be found, and this leads to a five-, ten- or one-hundred-fold duplication of geological reports on some areas. Localities as yet untested are known to the writer of this article, which have been examined or

studied in detail by geologists of practically every important oil company in the United States. Few fields exist where only a single examination has been made.

The matter of expense in these investigations is not the chief evil, but the waste of time and energy is serious, comprising, as it does, one of the causes of the high price of oil and gasoline. For instance, if 10 geologists or geological groups (all of whom may be presumed, for the purpose of this exposition, to be properly qualified) report on a given tract of 100 square miles, as is true in many cases, they could, if controlled by some central authority, be collectively instructed to report once only on a tract of 1000 square miles. Or, if necessary, the most competent geologist for the particular field could be instructed to report on the 100-square-mile tract, setting the other men free for some other national service. All this would doubtless be accomplished under the German system; and if we are to defeat the Germans, we must first learn from them the best of their own system and organization.

The main point is that we are confronted by a serious petroleum and gasoline shortage. We must have these substances in order to win the war, just as we must have powder, men and food. The oil and refining companies are at their wits end to prevent the shortage, and our only hope is to discover new fields, and the duty falls on the geologists to replete the declining production. Assuming that 230 qualified geologists are available for searching for new fields and that they can average two square miles of detailed work per day (a fair average for work accurately done), they can then, if properly organized and controlled, work and report in detail on 460 square miles per day, or 167,900 square miles per year.

At present this ideal is nowhere approached, but probably not over 50,000 square miles of new territory per year is studied thoroughly, the rest of the work being duplication or of a reconnaissance nature. If the ideal were realized, we could make a complete appraisal of the probabilities, including individual well locations, in all of Oklahoma, Kansas, and northern Texas in one year, and of the entire country in 15 years.

Instead, however, there is only an area estimated at about 200,000 square miles, out of a total of nearly 1,000,000 square miles, which have oil possibilities, in the United States, exclusive of Alaska and the Philippines, that has been geologically studied in full detail. There remains 800,000 square miles having possibilities that must be studied before we should declare the petroleum situation to be absolutely hopeless.

With this in mind and in view of the present emergency, we ought to have the geologists of the United States properly organized under some efficient and qualified expert with authority to assign them to their respective spheres of operation. Probably 60% of the total number could be set free for employment in other lines of national service. The remaining 100 would constitute an efficient corps with which scientifically to make a "drive," before it is too late, for the discovery of all untested fields that exist.

The detailed workings of the plan for the mobilization of an entire profession can properly be left to the expert intrusted with its fulfillment, but they would not be difficult. The individual oil companies can pay into the central bureau such amounts as they now expend in

their explorations and can be assigned to favorable territories, when discovered, proportionately to their investments. Or, more economically still, the central bureau may be entrusted with all geologizing, leasing, testing and marketing and simply pay to the subscribing companies their individual proper shares of the profits.

The proper method of carrying out such a mobilization appears to be Governmental action. Any slight disadvantages accruing to individuals would be excusable in view of the great national service rendered by a comprehensive plan. Even aside from its benefits as a war measure, it would be helpful to all individual companies, since it would investigate all possible undiscovered fields, instead of only a few as at present, with the consequent certainty of finding some new ones of value. Great economies could be expected owing to the systematizing and precaution against duplication, and we might reasonably expect thereby to open up sufficient production to tide us over many years of war.

Iron and Steel in Great Britain

The production of finished steel in Great Britain in 1916 is reported by the Iron and Steel Federation as follows: Bloom, billets and rods, 1,945,000; shet bars, 1,272,000; rails, 271,000; plates, 1,153,000; sheets, 78,000; shapes and angles, 757,000; beams and girders, 346,000; galvanized sheets, 132,000; tin plates, 577,000; total, 6,531,000 gross tons. The production of steel castings was 207,000 tons, of which 18,000 tons were made in electric furnaces. The production of wrought iron (puddled bars) was 960,000 tons.

Graphic Determination of Heat Units in Coal

The thermal values of fuel as determined from analysis are not usually to be depended upon, as the results so obtained are seldom of sufficient accuracy to be of value. The formula commonly used for computing the heat value from the ultimate analysis is credited to Dulong. The original formula has been modified to suit special applications by W. C. Stripe and is given in *Power*, Jan. 11, 1916, as

$$\text{B.t.u. per pound of dry coal} = 14,600 C + 62,000$$

$$\left(H - \frac{O}{8} \right) + 4000S$$

in which *C*, *H*, *O* and *S* are the proportionate parts by weight of carbon, hydrogen, oxygen and sulphur. It is customary to determine ultimate analysis on the dry-coal basis, and this formula is correct only with reference to analysis so determined. The thermal valuations determined by calculation are only approximate, and equally satisfactory results may be obtained by graphic representation, as shown by Fig. 1.

Assume a coal having the following ultimate analysis: Carbon, 79.90%; hydrogen, 4.98; oxygen, 4.31; nitrogen, 1.85; sulphur, 1.13; ash, 7.83; moisture, 2.91%.

Referring to Fig. 1, the upper arrowed line shows that the carbon represents approximately 11,660 B.t.u. The lower heavy dotted line shows that approximately 2750 B.t.u. must be added for the 4.98% hydrogen, when 4.31% oxygen is present. The light dotted line shows that approximately 45 B.t.u. will be obtained from the

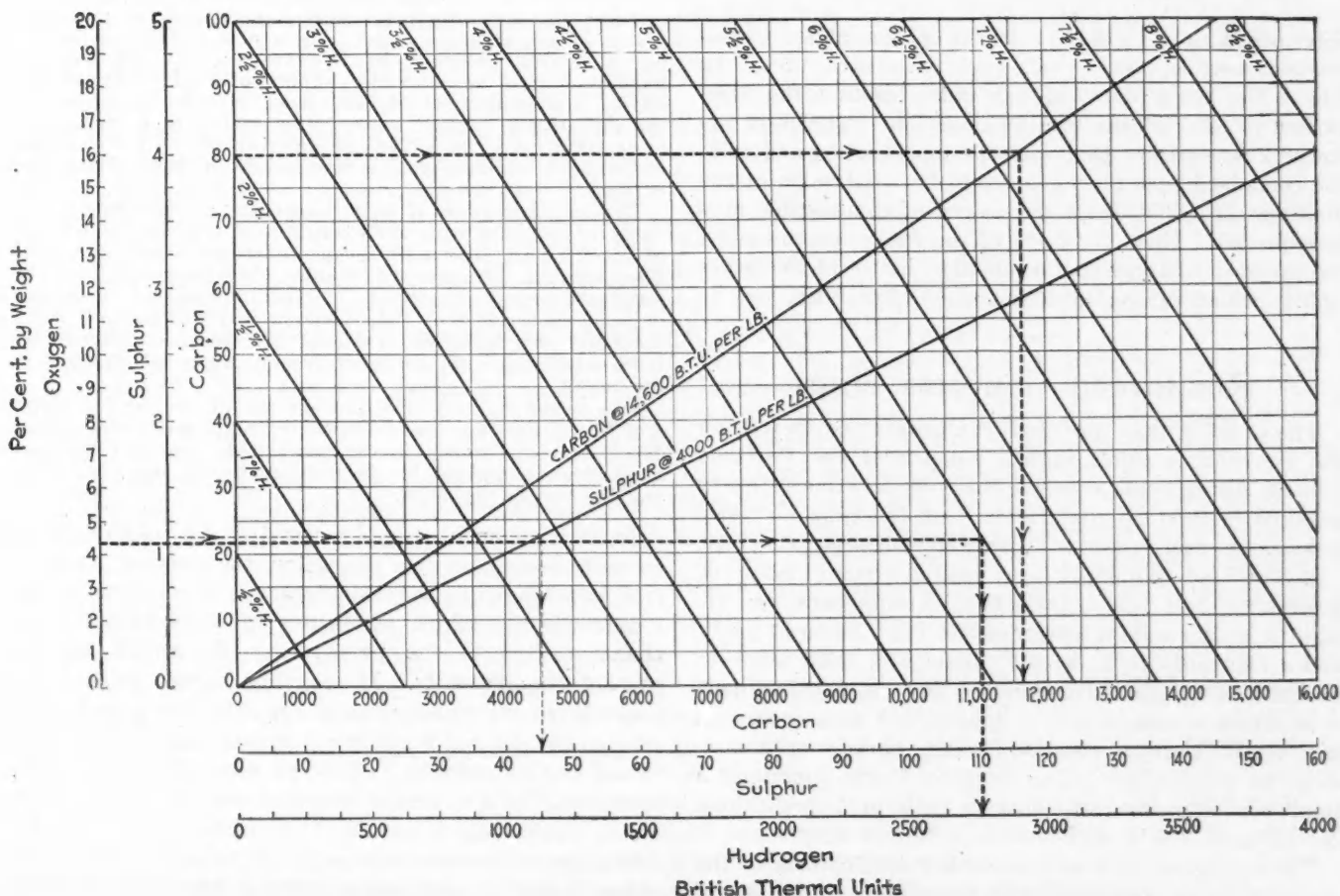


FIG. 1. GRAPHIC REPRESENTATION OF DULONG'S FORMULA FOR HEAT VALUE OF COAL

1.13% sulphur. The summation of these three values gives 14,455 B.t.u. as the total approximate thermal value of this fuel. Calorimeter tests on coal of the foregoing analysis have shown a value of 14,380 B.t.u., hence the results obtained graphically are satisfactory. The curve shown by Fig. 2 represents this relation and was plotted from 66 analyses made by the United States Geological Survey, of coal from 18 different states. Assume a coal having the following approximate analysis,

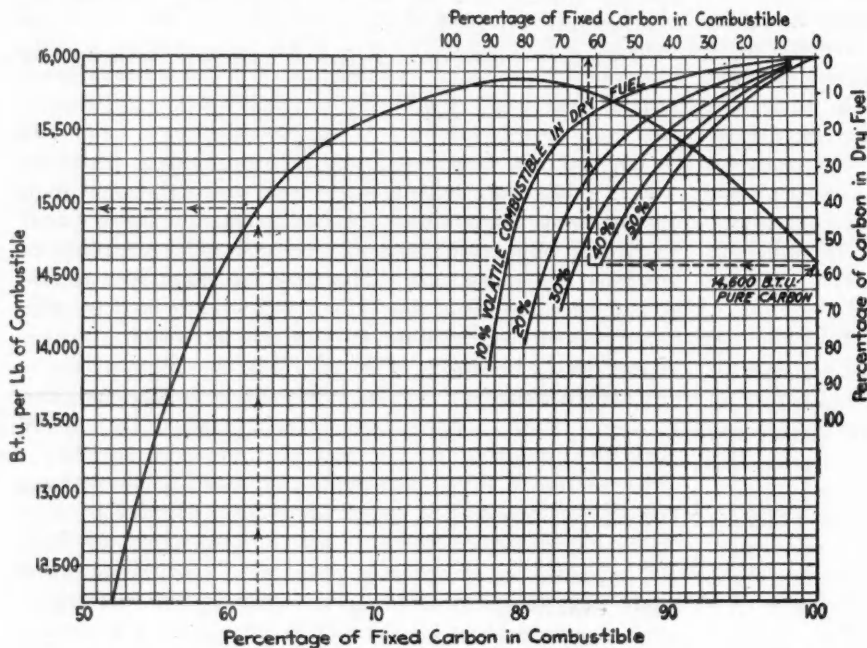


FIG. 2. RELATION BETWEEN FIXED CARBON AND THERMAL VALUE

determined on a dry basis: Fixed carbon, 57.5%; volatile combustible, 35.0%; ash, 7.5%; moisture, 4.5%. In Fig. 2 the heavy arrowed line indicates that the fixed carbon is 62% of the total combustible. The light arrowed line indicates that with the fixed carbon and volatile combustible so proportioned, a thermal value of approximately 14,950 B.t.u. per pound of combustible may be expected. Then, if 92.5% of the fuel is combustible, the thermal value per pound of dry fuel is 14,950 times 92.5%, which figures approximately 13,828 B.t.u.

Reinforced Concrete Ships

The problem that confronts our country of increasing the merchant marine, says a bulletin of the Portland Cement Association, requires the consideration of every possible method or material of construction. Several prominent engineers have suggested reinforced concrete.

A San Francisco paper mentioned in a recent issue the interesting fact that a local firm of engineers was designing a ship with a length of 330 ft., a beam of 44 ft. and a depth of 31 ft., with a capacity of 4500 tons—to be built of reinforced concrete. This is nothing new. A concrete schooner was employed for some years in the north Atlantic coasting trade, having been constructed about 1898. The London *Times* mentions a small boat of reinforced concrete built by a Frenchman in 1849 and still in service after a test of 68 years.

The concrete ship is only a further development of the concrete barge, and such craft have been in successful use for years. A concrete barge has been in service on

the Welland Canal since 1910 and has seen hard usage. It has a length of 80 ft., a beam of 24 ft. and is 7 ft. deep. It is interesting that the walls which were constructed between forms are 2½ in. thick, reinforced with steel rods, yet the barge is used for carrying loads of stone, etc., with conspicuous success. Concrete lighters have been used for the last six years on Chesapeake Bay, supplying coal and water to dredges, carrying loads of sand and gravel. With such a craft there is no necessity for calking or painting, the up-keep is small and there is no danger of decay. Barnacles will not collect on a concrete hull. Since 1910 reinforced-concrete barges have been built for use on the various sections of the Panama Canal, and their experience has enabled the engineers to develop a very efficient type of vessel. Recently, concrete pontoons were constructed for service as landing stages for boats up to 65 ft. in length. These pontoons have a length of 120 ft., a beam of 28 ft. and are 8 ft. deep. They are very thoroughly reinforced. Vessels that are more like ships than barges have been built of reinforced concrete in Norway. The following quotations that have been selected from the report of the American Consul General at Christiania indicate the extent of the work under way at that time:

The inventor, M. Nicolai Fougner, an engineer, claims to be able to construct a ship of any size demanded. He is now building a lighter for a mining company at Sydvaranger for the oversea export of iron ore and the import of coal. The vessel, having a displacement of 3000 tons, is to be ready before the end of the current year. It is stated that these concrete ships can be sailed or engined like other vessels, and experts consider that a new epoch in shipbuilding has arrived.

The ship resembles a large barge and is constructed entirely of concrete with the exception of the ribs, which are of steel. This new method has attracted much attention. The Swedish Minister of Marine, M. Brostrom, one of Sweden's largest shipowners, immediately ordered a lighter of some thousand tons' displacement and was present when the craft was launched at Moss. He was accompanied by four experts, all of whom expressed much satisfaction at the result.

Two other lighters are now on the stocks, and a large slip for a 4000-ton craft is nearly completed. More than 200 men are working in the new yards, and five lighters have been contracted for in addition to the one completed and the two on the slips.

In view of such examples proving the usefulness of concrete vessels of this character, the Cement Association bulletin urges the consideration of concrete in the construction of ships which are to increase our merchant marine to the proportions demanded by the present requirements. If seagoing barges were to be constructed or smaller craft suitable for lake traffic, this would release for other purposes many ships now in use in this capacity. The presence of the necessary materials for a concrete vessel at so many convenient places would make it possible to provide a large tonnage, and progress in construction would be faster than with ships of steel or even wood. The system seems to have advantages of great promise.

The Manganese Ore Market

SPECIAL CORRESPONDENCE

Prior to the war the bulk of the manganese imported into this country came from the Caucasus. The cost of production there was so low that it did not pay to produce manganese ore in this country. Next in importance to the Caucasus came India, then Brazil. On account of the Black Sea being closed to all shipping, no Caucasus ore to speak of has been exported from Russia, though I understand that during certain months some of it was shipped by water through the Caspian Sea, up the Volga River, ultimately to Archangel and thence to Great Britain. The war demand has advanced the price for manganese to such an extent that this complicated way of shipment still left the seller with some profit.

Caucasus ore being practically unobtainable for this market and Indian ore obtainable only under permit, buyers are looking around for other sources of supplies—the more so as the importation of ferromanganese also became more and more restricted. The consumption of manganese in this country is equivalent to 85,000 tons of manganese ore monthly, and this quantity has to be found in order to keep the steel industry going. Brazil has improved its mining to a large extent because of the higher prices paid and a considerable tonnage is now reaching us from that quarter. Costa Rica and Porto Rico are also contributing to our demands, though in a much smaller degree. Cuba, too, has helped to swell the quantities imported. Japan is shipping to this country some manganese ore of high grade suitable for the chemical trade. To ship the furnace ore from Japan and China, where excellent ore can be obtained, is at present impossible, as no freight at reasonable rates is available.

The advance of prices for manganese ore, and the buyers' willingness to overlook impurities or partly to forego penalties for such impurities, also their willingness to accept much lower-grade ore than ever before, have brought into line a number of miners in this country, and much activity is shown in the manganese deposits in California, Montana, Arizona and Arkansas. Considerable business has been entered into with California producers, but I understand that the mining end is principally in the hands of small miners and many of the contracts entered into have not been carried out. Buyers will, therefore, not make contracts for any length of time, but will accept deliveries when actually made upon schedule prices. The schedules have been altered continuously, and high-grade ore running 49% and over, which was quoted around 40c. in the early part of the war, is now offered at \$1.10 per unit, f.o.b. buyers' works. Formerly, ore under 38% could hardly be sold—now buyers are prepared to take material from 33% upward. Again, ore containing over 8% of silica was subject to a penalty, and the maximum silica allowed, before the ore was rejected, was 12%. Today some of the buyers are ready to accept manganese ore even if it contains up to 20% of silica. Excess of silica over 8%, however, is penalized at the rate of 50c. per ton for each unit of silica.

The United States Steel Corporation is still accepting manganese ore with a penalty of only 15c. for the excess of silica over 8%. Other buyers deduct 1% of man-

gane for each 1% of silica in excess of 10. Phosphorus, also, is penalized, and a penalty of 15c. a ton for each point over 0.1% is charged. The maximum allowance for phosphorus is 0.2%. Though these limits have been set, it is possible by actual negotiations to get an otherwise unacceptable ore taken by the buyers, and it is the best for the mine to ship a trial car or cargo since, according to the general and physical character of the ore, a price can often be fixed which is in excess of the actual schedules submitted.

I have always been of the opinion that the scale of prices paid was wrong in proportion to the actual value of ores to the furnace, depending on whether they are high- or low-grade. Assuming that a standard ore running 50% or better in manganese, 5% to 6% silica, under 3% iron, under 0.1% phosphorus, and under 5% moisture, is worth \$1 a unit, it could easily be shown by actual figures that an off-grade, which would run 40% manganese, 10% iron and 12% silica is not worth nearly half as much when due consideration is placed upon the excess slag volume and excess amount of stone and fuel.

The Carnegie penalty is 15c. per unit per ton for each unit in excess of 8% silica, with the privilege of rejecting any ore running over 12%. While it is true that this excess of silica would cost only about \$2.50 if you ignored the cut in production, yet if that were taken into consideration, it would cost very much more.

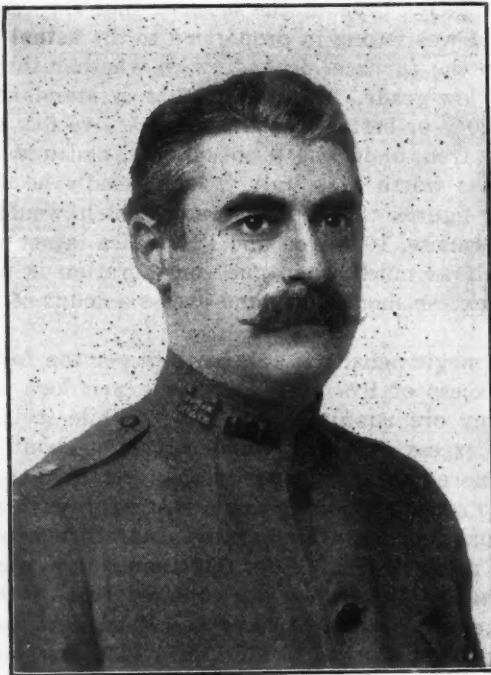
By actual demonstration at our furnace it was proved that our production of 80% ferromanganese was cut almost exactly 50% when we changed from standard ores to an ore such as I have described. At today's high prices for finished product, provided you can get standard ores, it can readily be seen that it does not pay to use the low grades, even if they were given to you.

The United States has been producing quite a tonnage of ore during the high-price period. I would not be surprised to see the production for 1917 equal 60,000 to 100,000 tons, but I doubt very much if 10% of this present production would qualify for standard ore, which will mean, when ordinary prices for ferromanganese again prevail, unless something unexpected is discovered, the United States will return to approximately her production prior to the war.

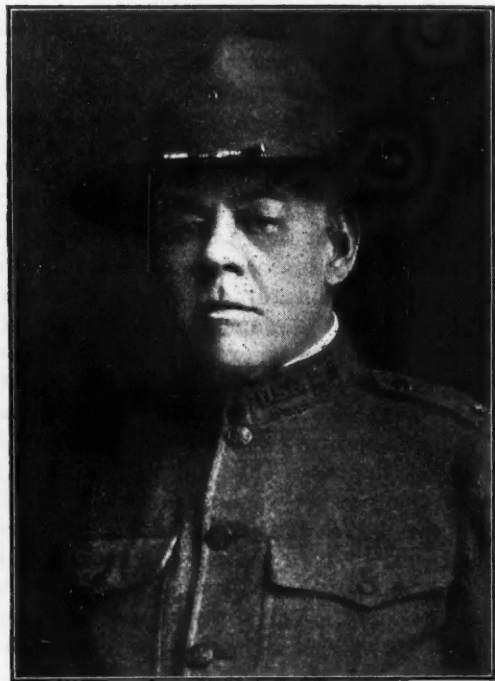
If the war continues for any length of time and shipping conditions become more restricted and complicated, the home industry has a good chance of developing profitable manganese mines, though I am afraid that the nature of the deposits and the high cost of labor in this country will prevent these mines from continuing when ample supplies of foreign ore are again available. This thought has so far kept the larger interests from going into manganese mining in this country to any large extent.

MT. BISCHOFF TIN MINE, TASMANIA, has recently declared its 451st dividend of 2s. 6d. per share, bringing total dividends to date up to £2,464,500. This is a record of steady production that might be envied by any mining company. The Mt. Bischoff Tin Mining Co., Ltd., was registered in 1873 and has a paid-in capital of only £29,600, the company being divided into 12,000 shares of £5 each. The Mt. Bischoff mine is at Waratah and the smelting works at Launceston, Tasmania.

Prominent Mining Engineers Serving in the
National Army



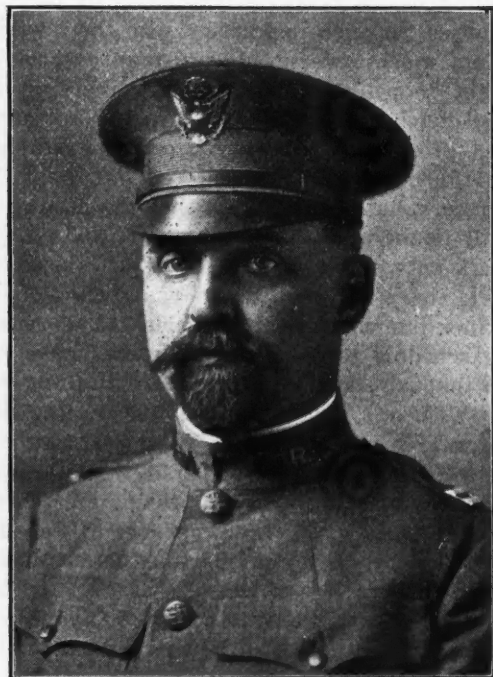
MAJOR GEORGE S. WEINBERG



MAJOR RUCKARD HURD



CAPTAIN J. D. IRVING

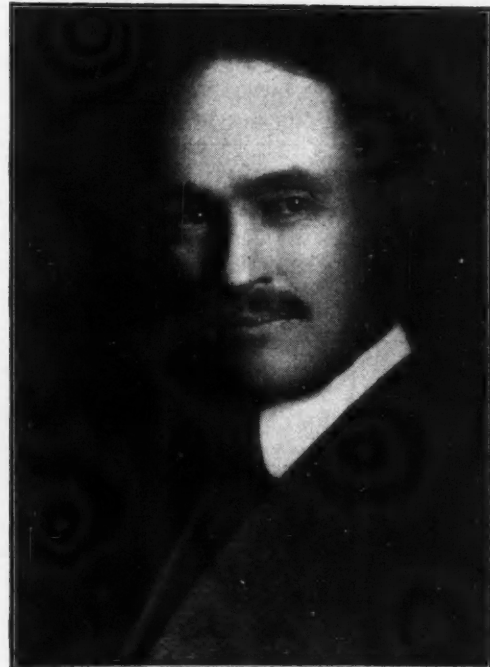


CAPTAIN H. J. STEHLI

Prominent Mining Engineers Serving in the
National Army



MAJOR ARTHUR S. DWIGHT



MAJOR SEELEY W. MUDD



CAPTAIN HENRY M. PARKS



LIEUTENANT WILLIAM HAGUE

Use of Smelting Gas in Chile

BY MARK R. LAMB

We in the States, who know more about everything connected with mining and metallurgy, think of smelting smoke only as an aid in selling a poor farm. In other places, however, where they are belated, a different use is found for smoke—a more commonplace and less imaginative use.

At Potosi part of the gas is used as fuel under boilers and furnishes enough power to run the furnace blower. Part is used to heat the mixture of sulphur and whatever else it is they use in precipitating silver. (Yes, I could look it up, but you probably know, anyway.) Another part of the gas heats and melts the tin in the refining pots. The rest goes to waste. I am sure none of it is used to heat the hotel, because this is not heated by anything except by the guests.

In Chile, Don Gregoria Donoso had much difficulty in smelting his slags clean, while still using a small quantity of coke. He has a difficult ore—all rock and



DISUSED SMELTER STACK, VOLCAN, CHILE

iron and lime and stuff—and besides that, he runs a huge ranch and a prominent bank and his family consists of nine children and a boy, so that as he could not be constantly at the mine, and in order to have the smeltery run when he was not there and continue to make hot, thin slag, he used the smoke.

At the time of my visit he casually walked me up to a steel plate almost on the floor level and nearly let me step on it before advising me that it was the charge roof—not floor. I looked around for the furnace as casually as possible, but he was watching me gleefully. "There wasn't any furnace."

This plate had an edge turned down six inches, dipping into a launder making a water seal. To charge the furnace, the plate is swung off and the charge dumped in. You may be sure there is never a "hot top" in this furnace.

Even after seeing this, I kept trying to figure out where the gas went. Where to do suppose? Why, out through the forehearth!

All the heat of combustion of coke, iron and sulphur is used either to melt charge or superheat the

slag. See how easy it is? Merely admit enough air to the tuyeres to get a fine fluid melt, and enough air to the forehearth to burn up the gas, and there you are. Try it. Try it on a 19% zinc ore, or try it where you want to run a high-silica slag.

Don Gregorio's mine is at the end of a railway, the construction of which he opposed tooth and nail. Curious that he should oppose it when it relieved him of maintaining hundreds of oxcarts hauling coke and supplies. And his reason for opposing it was simply appalling. He said, "It is not good business for the government to build such a long railway merely to help me and a few agricultural congressmen." The railway runs once a week, returning the same date and continues to cost the government thirteen times the gross receipts.

But to return to smoke—at Chuquicamata the smoke is used for an entirely different purpose; to wit, to harden and make sturdy the children of the camp. There is no doubt about this being done successfully, as any child who has survived the smoke would consider it a picnic to live in Belgium.

Besides the smoke from the cathode furnace, which has a piquancy all its own, an added interest to live in camp is given by the touch of nitrous fumes from the acid plant. Sulphur is not expensive, as it is brought from the mines in Bolivia at Ollague, so that it is unnecessary to take particular pains to prevent the escape of sulphur fumes. Besides, the acid plant was located windward so that the only time when the denizens of this camp are startled by the lack of fume is when the wind is in the other quarter and they get the dust from the tailings pile. While on this topic I would suggest to the management that they are overlooking an important source of revenue. Besides this they could be patriotic and make money at the same time.

In the electrolytic plant an elaborate system of gas-flue exhausters should be installed over the vats and all the fume taken to a compressor house and shipped thence in steel bottles to the trenches. There is no doubt, judging from the results obtained at present with the fumes in a very diluted state, that if it were applied to the Germans in a concentrated form, we would soon again be their good friends.

Electric Steel Production

The production of steel in electric furnaces last year was about twice that of 1915, four times that reported in 1912, and nearly three times that of 1913. The production reported for two years past has been in gross tons:

| | 1915 | 1916 | Charges |
|----------------------|---------|---------|------------|
| Germany..... | 129,000 | 180,335 | I. 51,335 |
| United States..... | 69,412 | 169,918 | I. 100,506 |
| Great Britain..... | 22,000 | 49,256 | I. 27,256 |
| Austria-Hungary..... | 23,895 | 47,247 | I. 23,354 |
| Canada..... | 61 | 43,790 | I. 43,725 |
| Totals..... | 244,368 | 490,546 | I. 246,178 |

No reports from France for the two years are available; that country made 18,000 tons of electric steel in 1913. The production of the United States in 1916 was five and one-half times that of 1913. Electric steel was made last year in Sweden, Norway, Russia and Italy, but no figures can be secured for the quantities.

New Army Tables of Organization

The National Defense Act of June 3, 1916, changed the organizations of all the units of the Army, which necessitated the preparation of entirely new Tables of Organization, which give in minute detail the number and amount of personnel and matériel. The new tables were approved by Secretary of War Baker, May 3, 1917. The preparing and issuing of this almost infinite amount of detail in eleven months is a creditable piece of work. The *Army and Navy Journal* gives the following extracts from the tables, which are published in pamphlet form and may be obtained from the Adjutant General.

The aggregate maximum strength of a division of Infantry is 28,334 officers and men, and the total of wagons is 1009, and of motor wagons 493. There are 42 field pieces, 92 machine guns, 20,345 rifles and 8651 pistols. In this division there are three Infantry brigades, one Field Artillery brigade, one regiment of Cavalry, one regiment of Engineers, one Field Signal battalion and one Aéro squadron.

The total maximum strength of an Infantry brigade of three regiments aggregates 6193 officers and men, a total of 83 wagons, 6 motorcycles, 219 riding horses, 18 riding mules, 75 pack mules, while 344 draft mules are required, which makes a total of 657 animals. The number of rifles required is 5473, and 606 pistols and 18 machine guns.

The Cavalry brigade, composed of three regiments, has a total maximum strength of 4756 officers and men, 113 wagons, 6 motorcycles, 4635 riding horses, 18 riding mules, 87 pack mules and 464 draft mules. This makes a total of 5204 animals. Eighteen machine guns are required, 4033 rifles and 4518 pistols.

A Field Artillery brigade (divisional), composed of two regiments armed with 3-in. field guns, and one regiment armed with 3.8-in. howitzers, has an aggregate maximum strength of 4030 officers and men, with 72 guns, 216 caissons, 18 battery wagons, 21 store wagons, 21 reel carts and 6 motorcycles. There are 1233 riding horses and 2160 draft horses, making a total of 3393 horses; 290 mules are required, 13 rifles and 3936 pistols.

The maximum strength of the Field Artillery brigade (Corps) armed with heavy guns or howitzers and horse-drawn, composed of three regiments, aggregates 4135 officers and enlisted men; 72 guns are required, 216 caissons, 18 battery wagons, 21 store wagons, and 30 reel carts; 1326 riding horses are needed, 2862 draft horses, 12 riding mules, 6 pack mules, and 296 draft mules; 13 rifles are required, and 4008 pistols.

A Field Artillery brigade (Corps) armed with heavy guns or howitzers, motor-drawn, and composed of three regiments, has an aggregate maximum strength of 3685 officers and men. It has 72 guns, 108 caissons, 108 ammunition trucks, 27 store trucks, 90 tractors, 9 repair trucks, 21 repair cars, 9 passenger trucks, 9 tank trucks, 37 supply trucks, 297 motorcycles with side cars, and 30 reel carts. There are 723 riding horses, 108 draft horses and 3 pack mules; a total of 834 animals. There are 13 rifles in the brigade and 3558 pistols.

The maximum strength of a regiment of Engineers is 1098 officers and men. It requires 27 wagons, 292 riding horses, 49 pack mules, 112 draft mules, 978 rifles and 348 pistols.

A battalion of mounted engineers has a total maximum strength of 387 officers and men. It requires 12 wagons, 376 riding horses, 37 pack mules, and 52 draft mules, 333 rifles and 363 pistols.

The maximum and minimum strength of a Field Signal battalion aggregates 259 officers and men, with 16 wagons, 170 riding horses, 16 draft horses, 17 pack mules, 36 draft mules, and 251 pistols.

The maximum and minimum strength of an Aéro squadron is 173 officers and men. It is provided with one motor car, 23 motor trucks, 24 trailers, 2 repair trucks, 6 motorcycles, 12 airplanes, 154 rifles, 173 pistols and 12 machine guns.

The total strengths of the regiments of the several arms of the service are as follows: Engineers, 1098, officers and men; Cavalry, 1579; Horse-drawn Artillery (heavy), 1372; Motor-drawn Artillery (heavy), 1222; Light Artillery, 3-in. guns, horse-drawn, 1337; Artillery (horse), 1176, and Mountain Artillery, 1081. An Infantry regiment consists of 2058, officers and men.

"Clinton" Gas Pools in Ohio*

BY L. S. PANYITY*

The Cleveland, Ohio, gas pool is the northern extremity of the great "Clinton" sand-gas development in Ohio. Numerous gas pools have been developed in this formation, which are now more or less connected, link by link, forming an almost continuous gas pool, starting at Cleveland and running thence southward through Cuyahoga, Medina, Wayne, Ashland, Richland, Knox, Licking, Fairfield, Hocking and Vinton Counties. The present southern extremity of these connected pools is in Richland Township, Vinton County. A vertical section of the formations penetrated here by the drill may be constructed from the accompanying table.

FORMATIONS AT THE CLINTON POOLS

| | |
|---|-----------------------|
| "Big Injun" and Waverly shales | In surface outcrops |
| Berea Sandstone | 20 to 80 ft. thick |
| Bedford (Carboniferous) and Ohio (Devonian) | 750 to 900 ft. thick |
| "Big Lime" (Corniferous and Niagara) | 570 to 675 ft. thick |
| Interval "Big Lime" to "Clinton" | 175 to 210 ft. |
| Interval "Clinton" to Trenton | 1,350 ft. (estimated) |

Spirit-level elevations at the mouth of the various wells drilled, and the elevation of the sand calculated from the logs of the wells demonstrate the monotonous monoclinical structure of the "Clinton" sand. Its development has shown few pronounced anticlines, but there remains a great deal of unstudied territory where the pools may be associated with some sort of folding. Work is now under way in another section of the state, where anticlinical structure is expected.

Oil and gas have been struck in various geologic horizons, the first of which is the Berea sandstone which contains water in this territory. Some gas has been encountered in the Ohio shales, and one or two wells produce a little oil from the top of the "Big Lime," but so far no commercial pool has been developed between the Berea sandstone and the "Clinton."

South of Richland Township but two wells are producing gas from the "Clinton" and they are in the immediate vicinity of the southern township line. Numerous tests have been drilled in a southerly direction as far as the Ohio River, but without encouraging results.

*An abstract of a paper to be presented at the St. Louis meeting of the American Institute of Mining Engineers in October, 1917.

The gas pools in the township are described by the driller as very "spotted." All observed conditions indicate lenticular sand bodies, and differential cementation has been a great factor in the accumulation of gas along this monocline. Another important element under consideration is the fact that connate water is rarely met. The stratum is considered free from water by the driller. No doubt where the "Clinton" lies at a greater depth below sea level, connate water will be encountered, when, of course, structural conditions will be of great importance.

In following up "wildcat" wells, tests located along the strike of the formation have been more successful than those located otherwise. The initial open-flow volume of wells is about two to four million cu.ft. per day. The largest open-flow measurements showed eight to nine million cu.ft. of gas per day when they were drilled in. The rock (or closed) pressure of the wells is between 650 and 750 lb. per square inch.

No producing horizon below the "Clinton" has yet been found in this township. In the wells nearest to this locality that have reached the Trenton limestone, which is the producing horizon of northwestern Ohio, it was found barren of oil or gas. The chemical analyses of this limestone in these wells are not known to the writer, but it is doubtful whether the magnesium contents were large enough to create a sufficiently porous rock which might serve as a reservoir for petroleum. In a well drilled north of Mount Vernon, Ohio, analyses of the Trenton limestone showed magnesium carbonate varying from 3.81% to 5.19%. Comparing this with the analyses of the Trenton limestone at Lima, Ohio, where it is a prolific source of oil and gas, and the magnesium contents range from 25 to 45%, the prospects for a Trenton pool in this territory appear to be very slight.

Lake Superior Iron Ore

THE selling prices of Lake Superior iron ores for the present season are the highest recorded for a number of years. These prices are for ore delivered at docks on Lake Erie ports and are for hard Old Range bessemer ores, \$5.95; for Mesabi bessemer, \$5.70; for Old Range nonbessemers, \$5.20, and for Mesabi nonbessemers, \$5.05 per gross ton. The selling basis is, as it has been for several years past, 55% iron and under 0.45% phosphorus for bessemer ores; 51.5% iron for nonbessemer ores. These prices apply to all the ores supplied to furnaces which buy their ores, that is, to about 30% of the total output; to those companies which own or lease their own mines the actual cost is the real price which they pay for their raw material. It is probable, however, that this actual cost in most cases approximates nearly the selling prices and it is not unfair to accept them as a standard.

These prices or costs are for delivery at Lake Erie ports, and from them must be deducted the cost of transportation. Under the order of the Interstate Commerce Commission made two years ago, the maximum charge from the mines to shipping ports on the upper Lakes is 60c. per ton. Vessel freight rates, which in recent seasons have been as low as 55c. and even 45c., advanced this season to \$1 per ton, at which a number of charters were made; and dock charges are from 5 to 10c. De-

ducting these transportation charges leaves the amount realized at the mines from \$3.35 to \$4.25 per ton, which must cover the cost of mining and loading and the value of ore in the ground, or the royalty which is paid to fee-owners in many cases, especially on the Mesabi Range. These amounts are from \$1.50 to \$2 per ton higher than have been realized for several seasons, and in some years they have been little more than sufficient to cover the cost of mining, leaving hardly anything to cover royalties or depreciation of property.

On the Old Ranges the greater part of the mines are owned by the operating companies. On the Mesabi a large part is leased from fee-owners on royalty payments, and most of these contracts include a minimum clause. The operators are thus impelled to mine at least the minimum quantity for the year, no matter what the prices, so as to avoid an actual loss.

In addition to the cost at Lake ports, the furnaces using these ores must pay the freight to the point of consumption. For the larger part of these furnaces the railroad rate will vary from \$0.50 to \$1.50 per ton, the average being not far from \$1. For furnaces anywhere east of the Pittsburgh district the cost would be higher, in many cases high enough to limit the use of the ores. For the larger part of the furnaces supplied from the Lake Superior district the cost of ore will average—according to the quality used—from \$6.05 to \$6.95 per ton, or from 11.73 to 12.04c. per unit of iron. With costs of \$12 to \$14 per ton of iron for ore and \$8 to \$10 for fuel, the present prices of pig iron do not seem as high as a comparison with those of a few years ago might indicate.

Scientific Meetings in War Times

A number of our scientific societies have deemed it advisable, "on account of the war," to either cancel or postpone their future meetings and conventions. The American Electrochemical Society, writes Colin G. Fink, the president, disapproves of this action, and at its recent board meeting adopted resolutions encouraging rather than discouraging the holding of meetings.

In order to expedite the solution of many of the new problems, he says, that have arisen as a direct consequence of our martial state, unrestricted discussion of the problems (with but few exceptions) at scientific meetings is bound to give a clearer understanding of the real points at issue. Meetings of scientific and technical societies have ever served as a great stimulus for their members and have been a "clearing house" for many of the best thoughts and ideas of our professional men.

Let us follow the good example set us by England. When England found herself confronted with a serious shortage of sulphuric acid, glass, dyes, electrodes, brass, furnaces, etc., the scientific societies arranged symposiums on these subjects and invited not only all the members to attend, but further, urged those factory men who were not members to come to the meetings to give their views and experiences and to learn all they could in return.

Quicksilver production in Italy in 1916 amounted to 1,093,851.5 kg., according to "Rassegna Mineraria." In 1915 the production was 985,514 kg.

Mining at Juneau, Alaska

BY FLOYD W. PARSONS

The condition of the Alaskan gold-mining industry is not particularly good at present, but there is hope that conscientious and skillful management may considerably improve its status. Alaska Juneau is improving steadily.

ALASKA, in a mining way, was once a name to conjure with. Some time it may again come into its own, but today there is much gloom in Uncle Sam's northwestern territory. The United States paid \$7,000,000 for this near-arctic empire and has been repaid a hundred-fold for its trouble. King Gold was once monarch, now King Salmon seems to hold sway. The fish run in good form and in regular season. The men who catch them play a fairly sure bet; but not so with the miner who tunnels for the elusive quartz—science and knowledge count, but chance counts also, and there is the lure. It's the gamble that charms the seeker and leads him to suffer much to attain his goal.

Some succeed—many fail. They all go away saying good-bye and promising never to return, but they come back—it's in the blood.

The Government is pushing ahead with the railroad from Anchorage to Fairbanks. Here Uncle Sam has an

In the Juneau district the gloom has been increased by the Treadwell disaster. Even the fact that but one life was lost when more than a hundred might have perished, has not dispelled the deep sorrow. The Treadwell management deserves great credit for its carefully arranged patrol system that made it possible to get 150 men out of the workings in 90 minutes from the time the trouble was first noted. At 1:10 a.m., 40 minutes after the last man was out, the ground let go and the whole mine was flooded.

The Mexican and Treadwell mines were entirely lost. The Ready Bullion mine, which was connected underground with the Mexican, was saved by a heavy concrete bulkhead built in the connecting tunnel. When the ocean first came in, the water squirted out of the Mexican shaft to a height of 200 ft. This was probably the moment of maximum pressure on the bulkhead. This barrier has been further strengthened. The Ready Bullion is still operating, but is short of labor. It is likely that many miners are afraid to work in this mine.

To show how completely the mines are lost it is only necessary to say that in the Treadwell shaft, which was 1800 ft. deep, soundings indicate that it is now full of waste up to 800 ft. from the collar. The central shaft, which was 2800 ft. deep, is full up to 1400 ft. The Mexican shaft, 2100 ft. deep, is full up to 1100 ft.



THE ALASKA JUNEAU MILL



THE PERSEVERANCE MILL

opportunity to study the labor situation first-hand. The Government has had to enter the market and bid for men, and it has outbid many of the private companies. Still the supply is insufficient. The complexity of the labor problem and certain helpful relief measures may appeal more forcibly to Washington lawmakers because of this Federal railroad building in Alaska. At least let us hope so.

The blueness of Alaskans just now is perhaps more due to the labor outlook than it is to a slowing up in the number of important new discoveries. No district has enough men. Certain localities can pay no higher wages, and in cases where companies are running company boarding houses, such institutions just now are showing net losses, due to high food costs. Mining labor generally in Alaska is not unionized.

It is quite certain that but a very small area remained unworked. The Treadwell plants have a large salvage value, and the company is realizing high prices for its extensive equipment.

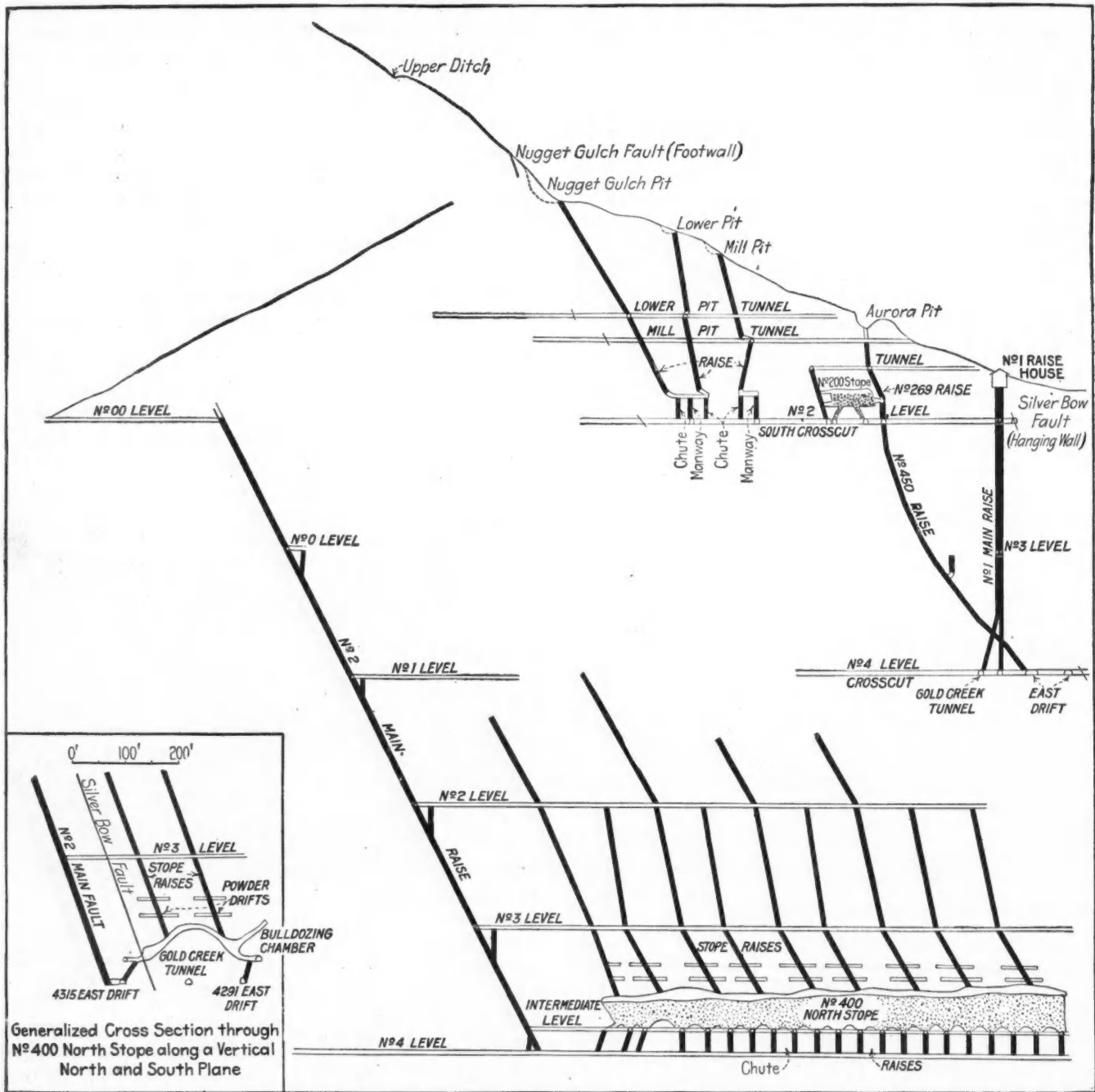
There is hope in the hearts of many in Juneau that the new Alaska Juneau mine will redeem the situation, and there is some foundation for the hope. Juneau will never be a high-grade mine. The ore will likely not average more than a dollar a ton in the mill run. This is without question a disappointment to many. However, Juneau will certainly average a lower cost than was ever thought possible. If luck has been against the company in the matter of ore values, it has been with the management in other ways.

Here are two bodies of ore separated by a fault known as the Silver Bow fault. The slip has separated the

bodies a distance of 2000 ft. The north orebody has been developed; the south orebody has only been tunneled and crosscut in several places. The surface of this south zone shows values rather above the average, and a raise has been driven to daylight through which a small tonnage of this ore will be immediately obtained; in fact, it is being secured now. It is likely that this surface ore, however, will only be available as a summer proposition. However, there is no reason for pushing the development of the south orebody, because the north

The ore is brought to the mill in 10-ton steel cars equipped with air-brakes. These cars are pulled by electric locomotives, the equipment consisting of three Westinghouse 9-ton, two Westinghouse 18-ton and one Jeffrey 10-ton locomotive. From 30 to 50 loaded cars are hauled each trip. Four cars are dumped at a time by a huge cylindrical tippie.

The main haulway extends into the mountain running along the Silver Bow fault and is known as the Gold Creek Tunnel. This tunnel (No. A level on section)



CROSS-SECTIONS THROUGH ALASKA JUNEAU MINE, SHOWING CONNECTIONS THROUGH STOPE AND LEVELS

zone is wholly prepared and has easily available enough ore to feed the mill at maximum capacity for some years.

The mill is on the side of the mountain facing the channel. The portal to the mine is on the opposite side of this mountain. Mine and mill are connected by a substantial double track haulway equipped with 50-lb. rails on loaded track and 40-lb. on track for empties.

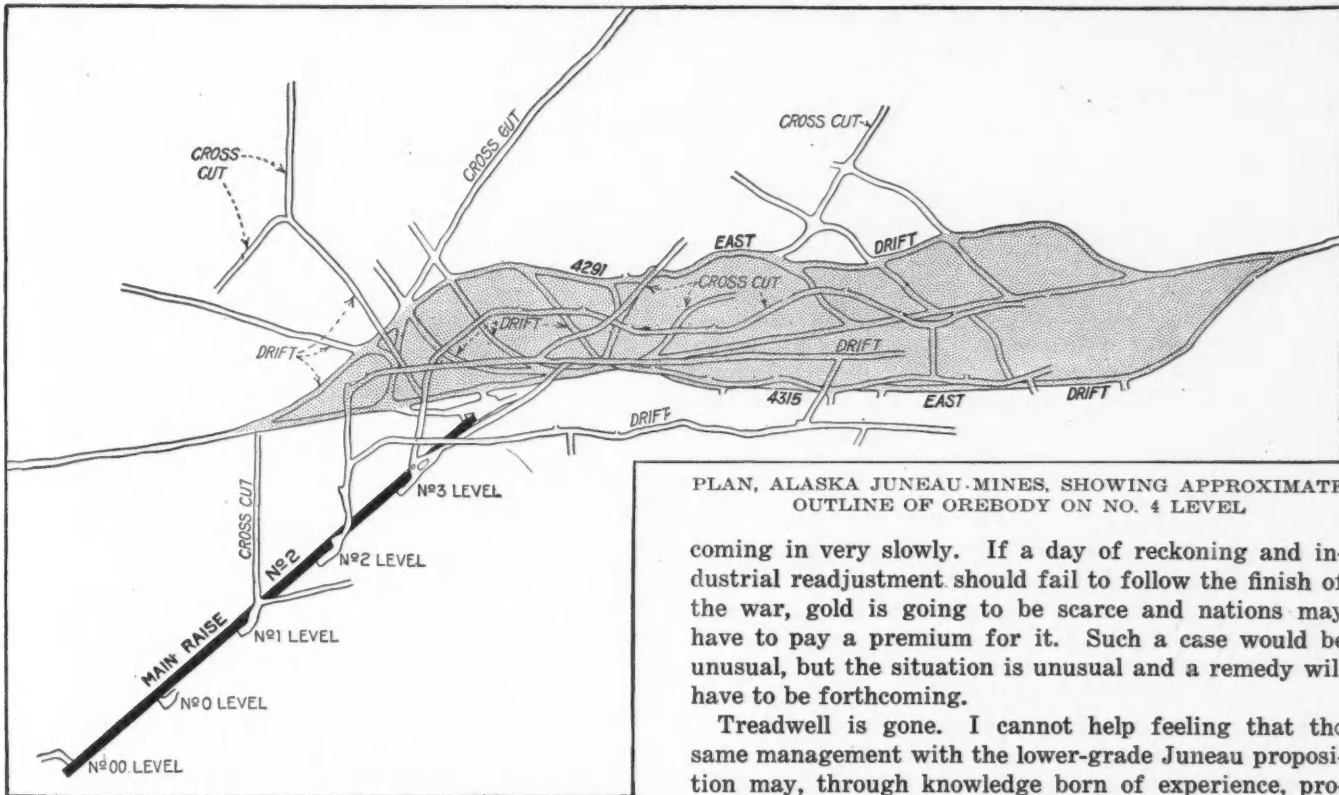
traverses the ore zone running east to west. Drifts 4315 and 4291 branch off this tunnel and traverse the limits of the orebody, as well as constitute the main haulage roads for the fourth level. Ore from the upper levels is sent down through raises, 40 in number, to the bulldozing chambers, where unusually large pieces are shot and reduced to a proper size. Heavy T-iron grates

spaced about 3 ft. apart from the bottom or screen for the bulldozing chambers.

Levels in this north orebody are 250 ft. apart. The scheme of driving the raises is clearly shown in the accompanying illustrations. No more simple method could possibly have been devised. In addition, the ore has lent itself so readily to this system of working that it has actually mined itself. Much of it requires no shooting at all, so that it is only a matter of drawing it out. I do not see how the cost of mining and milling can be over 40c. a ton when the production gets up to anywhere near a normal tonnage. Tailings should not

all the necessary power for the drills. Various types of Ingersoll-Rand and Sullivan drills are used. Piston drills are employed in the open pits and jackhammers are used for plugging. Battery blasting is employed in all the opencuts; Du Pont 40 per cent. ammonia powder is used.

Alaska Juneau is starting operation at an inauspicious moment. The value of gold was never so low. An ounce of the precious metal today has barely half the purchasing power it had several years ago; however, Asia is hoarding the metal, a large part of the present production is going into the arts and new mines are



PLAN, ALASKA JUNEAU MINES, SHOWING APPROXIMATE OUTLINE OF OREBODY ON NO. 4 LEVEL

exceed 20c., so that any mill run above 60c. a ton ought to be profit. These are the figures of F. W. Bradley, president of the company.

The mill is a remarkably fine steel structure equipped up to the minute. The ore goes first to a jaw crusher, then to the gyratory crushers, from here to the ball mills and then part to roughers and oversize to the tube mills. From the tube mills the fines go to the finishing tables, the iron concentrates to the ball mills and the galena concentrates to re-treatment.

The ball mills were designed by the management, and some experimenting has been necessary to get a satisfactory liner. The difficulty has now been overcome, and August should see a material increase in the mill output. Not more than 70 men will be required to operate the mill.

In summer, the power plant uses water power, fuel oil when water is not available. There are four Babcock & Wilcox boilers. There is also a 6000-kw. Curtiss steam turbine, installed by the General Electric Co. Room has been provided and the foundation is ready for a second turbine, should one ever be needed.

Compressed air is carried into the mines at 90 lb. One Ingersoll-Rand, Rogler valve type 4750 cu.ft. and two small Imperial-type Ingersoll-Rand compressors supply

coming in very slowly. If a day of reckoning and industrial readjustment should fail to follow the finish of the war, gold is going to be scarce and nations may have to pay a premium for it. Such a case would be unusual, but the situation is unusual and a remedy will have to be forthcoming.

Treadwell is gone. I cannot help feeling that the same management with the lower-grade Juneau proposition may, through knowledge born of experience, produce a property that will be as profitable eventually as was the famous old mine across the channel.

Increased Production of Lead

WASHINGTON CORRESPONDENCE

It is to Idaho, Utah and Missouri that the United States must look for the greater portion of the increase in lead production during the remainder of the war, according to C. E. Siebenthal, of the Geological Survey. He points out that Idaho has averaged 46,000 tons more of refined lead yearly during the war than for the four years preceding it. Utah has averaged over 40,000 tons more and Missouri 38,000 tons more. Under the stimulus of the unprecedented high prices of lead, all the lead-producing states should show gains. Oklahoma should make a much larger gain in 1917 than in 1916.

With internal conditions in Mexico reaching a state which will permit of smelting operations, increased imports of lead are expected from the southern republic. Before the war, the only lead bullion exported from the United States was that refined from the Mexican ore, which had the benefit of the customs drawback. From January to March of 1917, 14,970 tons of domestic lead was exported.

Mining Expansion

BY HOMER A. GUCK*

During the life of every great mining corporation, with the exception of a few in isolated districts, there comes the time when the management must decide as to whether it is going to confine future operations entirely to the limitations of its properties or to expand, either by the purchase of adjoining properties or by exploration in the same or other districts. Some prominent and successful mining organizations take the stand that when a mine is worked out the organization goes to pot, the machinery ought to be scrapped and the affairs wound up.

Ten years ago the Calumet & Hecla corporation, for many years the largest copper-producing property in the world, decided upon a policy of expansion. A survey of the results are at this time interesting. The company had a wonderfully efficient organization; it had great quantities of copper conglomerate rock still unmined; it had the Osceola amygdaloid, right parallel, showing fairly good results; it had millions invested in its enormous mining, milling and smelting plants; some of the conglomerate shafts were at the end of their usefulness. The management determined that its organization should not only be maintained, but should be improved and brought up to a state of higher efficiency. It likewise determined that its great surface plant should be utilized to the benefit of numerous smaller mines in the immediate vicinity. This determination resulted in the purchase of interests in other properties in the Lake Superior district. At the time of the purchase only two of the properties were making a profitable showing.

PURCHASES OF THE CALUMET & HECLA

The Calumet & Hecla paid over \$20,000,000 to secure part interests in Ahmeek, Allouez, Centennial, Cliff, Gratiot, Isle Royale, La Salle, Laurium, Osceola, Seneca, Superior, Tamarack and White Pine, and a complete interest in other properties, none of which is returning anything to the company, and has paid off every dollar of the indebtedness contracted to secure its varied subsidiary interests. Provided that during the second half of 1917 the copper industry maintains the average price already contracted for for the first six months, the treasury should receive in earnings from its subsidiaries alone a sum of \$5,500,000. The actual earnings of the subsidiaries of the company for the year 1916 were \$4,200,000. This is not the total earning of these subsidiaries, nor the dividends, but the earnings on the stock held by the Calumet & Hecla company. Two years' actual earnings of the profitable subsidiary stock is equal to one-half of the total amount invested in these same subsidiaries.

By the payment of the last of four large notes given to the Bigelow interests in exchange for their stock in what are now profitable subsidiaries of the company, the entire indebtedness is cleaned up. The books show that, with the exception of two years, the dividends on subsidiary stock held, more than paid the interest charges on these notes. In 1909 the dividends overcame the interest by \$7830. In 1910 the interest

charge overcame the dividends by \$56,800. In 1911 the interest overcame the dividends by \$90,355. In 1912 the dividends overcame the interest by \$468,540, in 1913 by \$716,379, in 1914 by \$78,962, in 1915 by \$737,816. In 1916 the dividends received were approximately, \$2,500,000, so that the total received in dividends to date, over and above interest, is \$4,362,372.

The Bigelow notes represented in total \$8,519,000. They were paid off out of the earnings and subsidiary earnings much sooner than originally planned. There was one five-year note for \$1,700,000, two 10-year notes for \$1,000,000 and \$1,685,000 respectively, all at 5%, which have been paid; also one note due two years hence and for \$4,134,000 at 4%, which has been called for payment. This total did not represent, by any means, the total outlay of the company in its stock ownership. The Bigelow syndicate, which at that time controlled the Osceola Consolidated, really owned a very small amount of Osceola stock, and the Calumet & Hecla company was compelled to buy on the open market more stock than it secured from Bigelow. The Centennial and Allouez, secured from other interests entirely, were paid for out of the Calumet & Hecla treasury, at the time when few of these properties were paying dividends, most of them being exploratory.

Today the market value of these stocks is approximately \$22,000,000, the Bigelow group totaling at least \$15,930,000, figuring Ahmeek at \$10,000,000, Osceola at \$3,000,000, Isle Royale \$1,155,000, the dividend on Tamarack as \$1,000,000, the sale of Seneca and the payment of the outstanding indebtedness carried on the company's books as money loaned for exploring that property at \$775,000. Besides these there are the Cliff, Laurium, Frontenac, including the old Central, Manitou and a number of others which have a substantial taxable and actual value, but no market values.

The interest which the company owns in Allouez is \$2,800,000, in Centennial \$1,000,000, in La Salle \$600,000, in Superior \$750,000. White Pine and Gratiot can be figured at approximately \$1,000,000, for the Calumet & Hecla is assured of the reimbursement of every dollar spent in the White Pine as well as one-half of the profits.

The Gratiot is optioned to the Lewisohn interests, who have taken over the Seneca, and it is likely that the option will be exercised, so that Gratiot will return to the company the half million expended in the effort to secure commercial copper there.

THE VALUE OF A POLICY OF EXPANSION

Under the circumstances the expansion policy in the case of the company has proved a good thing from every viewpoint. As it now stands, all earnings of subsidiaries are "velvet," and from the viewpoint of the subsidiaries, they have succeeded beyond expectations. Isle Royale, operating under other names before the Calumet & Hecla itself was discovered, never paid a dividend until it became a Calumet & Hecla subsidiary. Three dividends have been paid. Allouez, for 35 years up and down and out with a regularity that made the stock a market figure and little else, is now on a profitable producing basis, good for at least 20 years at at least 10,000,000 lb. a year. These are two brilliant examples. Osceola Consolidated last year earned \$29 per share and is far from going to the wall as anticipated a few years ago. The South Kearsarge, its richest

*Houghton, Mich.

mine, is of course nearing its end, but both the North Kearsarge and the old Osceola have potentialities, both in the quality of and the possibility of handling lower-grade rock. Ahmeek has been the best purchase of all, and Tamarack the biggest disappointment, Ahmeek's production having practically doubled since it came under the Calumet & Hecla domination.

When this policy of expansion was at its most critical point, there were difficulties that for a time made success look a long ways off. When the company proposed a consolidation of all subsidiaries with the main parent company, there resulted long drawn out litigation from shareholders of subsidiaries who did not like the conditions and terms. Ultimately the consolidation was dropped. Then came the Moyer strike with its year of terror and difficulties. But to offset these unfavorable difficulties came the unusual price for the metal, which continues to prevail.

Mining Manganese Ore with Cableway Excavator

A dragline excavator used at the Crimora mines at Crimora, Va., for excavating manganese ore from the pit is described in *Engineering and Contracting*. The excavator has a $1\frac{1}{2}$ -cu.yd. bucket of the Schofield-Burkett type. This bucket dumps the material into a revolving bin having a capacity of 50 tons. From this bin the material is transported to the washer by means of an incline gravity railway, two 4-cu.yd. side-dump cars being used. From these cars it is dumped into the main storage bin at the head of the mill. The material leaving the bin passes over stationary grizzlies, spaced 3 in. apart. The fines or under size go back into a 25-ft. McLanahan stone washer, the oversize passing on to a moving grizzly (also spaced 3 in. apart) and are deposited upon a drag conveyor. This conveyor carries the large lumps to a slugger roll crusher. Here the material is crushed to 3 in. and sent into the log washers, making a uniform feed of 3 in. and under; leaving the log washers, the material passes into a revolving screen, perforations, 2-in.; the undersize passes into screen No. 2, perforations $\frac{3}{4}$ -in. and 1-in. The oversize of No. 1 screen is elevated to a picking belt, where the silica and iron are removed and the clean ore goes over the belt into the ore bin. The oversize from No. 2 screen is elevated to a picking belt No. 2, following the same process as No. 1; undersize passing into screen No. 3, perforations, $\frac{3}{8}$ -in. This screen acts as a slime screen, removing all the slimes before the material is elevated to two sets of four-compartment McLanahan stone jigs.

The mill is built in two units. It has been found through recent operations that a considerable loss of ore is entailed in No. 3 screen, therefore, the management is planning an additional unit for further recovery. In connection with this unit it is proposed to install a Dorr thickener, by means of which approximately 60% of the water may be reclaimed for further use. The solids made by the thickener will be further treated in the additional unit.

The mill as designed and installed has a capacity for treating 1000 tons of material per 10 hours. The plant as designed can handle over 100 tons of washed

ore daily. A recent laboratory test of the material as shown up in the excavator gave an average manganese yield of 5.42. This yield has also been borne out by recent drillings covering the area tested of the known Crimora basin.

The main milling plant consists of buildings and bins, in three sections, 66 x 150 ft., in which the ore-bearing material is received at a 100-ft. elevation. The entire equipment is of the most modern and substantial character, all automatic, with individual electric drives. In the power house there has been installed 500-hp. boiler capacity, Corliss engine, generator, dynamos and auxiliary machinery. This is housed in a building 35 x 100 ft. In addition there has been equipped a modern machine shop, 30 x 60 ft., and other buildings.

A reservoir has been made in the mountains having a storage capacity of 27,000,000 gal. of water. The water from this reservoir is conducted to the mill through a 6000-ft. flume line under a 40-ft. head. In addition, another reservoir is now under construction for impounding about 17,000,000 gal. of water. The mill as designed and when operating full capacity requires about 1,000,000 gal. of water per day, which, if no recovery of water were made, would insure maximum operations for nearly two months; this would extend through the most prolonged period of drought ever experienced in the district.

The refuse from the mill is conducted to the sedimentation basin, which can handle 1,500,000 gal. of water per day.

Determining Copper Costs

WASHINGTON CORRESPONDENCE

Actual work of calculating copper costs has been begun by the Federal Trade Commission. The work is under the direction of Dr. L. H. Haney. Two groups of accountants already are at work. One group is in Utah and another is in New York.

The trade commission feels that it has been particularly fortunate in obtaining the services of several accountants who have had long experience in copper-mine accounting. The speed with which this work will be accomplished will depend upon the ability of the commission to secure the services of men having sufficient experience and ability to undertake the highly technical problem presented. Dr. Haney also is in charge of the investigation to determine the production costs of lead, zinc and aluminum.

British Metal Imports

Imports of metals other than iron and steel in Great Britain for the five months ended May 31, are reported as follows, in gross tons:

| | 1916 | 1917 | Changes |
|-----------------------------------|--------|--------|-----------|
| Copper, metal..... | 48,250 | 38,460 | D. 9,790 |
| Copper matte and precipitate..... | 17,727 | 10,404 | D. 7,323 |
| Total copper..... | 57,114 | 43,662 | D. 13,452 |
| Tin..... | 15,172 | 12,847 | D. 2,325 |
| Lead..... | 76,378 | 50,715 | D. 25,663 |
| Zinc..... | 16,665 | 26,095 | I. 10,030 |

Zinc is the only metal showing an increase this year. There were decreases of 23.6% in copper, 18.6% in tin and 33.6% in lead; an increase of 60.3% in zinc.

Dangers Accompanying Use of Carbide*

The carbide lamp has largely displaced the crude, spouted oil lamp as an illuminator in mines. The handling of the carbide has, however, brought its own problems and dangers. The substance employed is chemically unstable and possesses a strong affinity for water. If placed in contact with any explosive, fulminate, dynamite or powder, provided that explosive carries moisture, grave possibilities are at once developed.

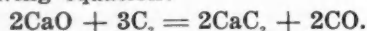
NOBODY regrets the passing of the spout oil lamp. It was a dirty, unsanitary makeshift at best. The marvel is that it remained so long without a rival. Here and there, where naked lights are permitted, isolated individuals still hang on to it, in spite of the scorn of their more progressive neighbors. But their numbers are steadily shrinking, and the day is not far distant when it will have gone the way of the tallow dip and the hemp rope, with none to mourn its mature demise.

"Carbide" has come to stay. It is a convenient, clean and dependable source of an efficient illuminant. The clear penetrating light from the combustion of its acetylene product has wrought a great improvement in mining conditions. More efficient work, greater safety and a cleaner product are among some of the results to its credit. Furthermore, a careful counting of costs, as compared with oil, strikes the balance decidedly in favor of the use of carbide.

SHOULD BE HANDLED WITH REASONABLE CARE

After we have conceded all these advantages to carbide, there are, however, other features to be considered. The product has been introduced and distributed widely throughout the mines of the country as a substitute for oil. In most cases it has been accepted too literally as such. It is handled with the same familiarity, and is stored away in the tool chest, in the niches previously occupied by the lard pail or the oil can. This is usually done with complete disregard of the fact that its introduction to the "collection," which comprises dynamite, blasting powder and detonating caps, may be the last link in a vicious circle that one day may be disturbed with disastrous consequences.

Calcium carbide is produced by the fusion of a mixture of lime and coke, under the tremendous temperature of the electric furnace. The metal calcium in the lime parts with its oxygen and combines with a portion of the carbon present to form the calcium carbide of commerce. The oxygen liberated unites with another part of the carbon to form carbon monoxide, as shown in the following equation:



The union of the metal with carbon is abnormal, and its affinity for oxygen is unimpaired. When opportunity is afforded, therefore, carbide attacks water in any form, tears its constituents apart and unites itself forcibly with the oxygen. The hydrogen and carbon

liberated by this action combine to form the acetylene which is burned in the miner's lamp.

The tremendous chemical activity of calcium carbide may be partly realized in the statement that, in the decomposition of water, it accomplishes a task which can only be accomplished ordinarily with much difficulty.

This article is not intended to alarm, or to discourage the use of carbide, but to direct attention to the fact that some real dangers attend its careless handling.

Put a little calcium carbide into a wine glass, and add as much dynamite as will cover a dime. Cover the glass for a few minutes, then uncover, and apply a light. You will find that a gas has been evolved which takes fire on the application of the light. Before burning itself out the gas ignites the dynamite, which burns fiercely until exhausted.

Again put some calcium carbide into a wine glass, and add a few grains of blasting powder that has been exposed to the air for some time. Cover for a few minutes. Uncover, and apply a light. You will find that a gas has been evolved which takes fire and ignites the powder.

Take the lid off a carbide can at any time, and apply a light. You will usually find that there is enough gas within the can for ignition and temporary combustion.

Now miners are much the same the country over. Familiarity with the handling of high explosives has bred a contempt for conditions that would raise the hair and stagger the equanimity of the intelligent tyro.

MIXING CALCIUM CARBIDE WITH DYNAMITE

Conceive the situation. A miner goes to prime a dynamite charge. He seizes a stick of dynamite, drills a hole through it with the tang of a file, pulls one end of the fuse through the hole, and pushes the fuse into a detonator which he takes from a carbide tin.

Let us see what we have in that detonator now. We have fulminate of mercury, calcium carbide, dynamite adhering to the fuse (this comprises nitroglycerin, moisture, sawdust and, possibly some free acid) also the various ingredients of the fuse—comprising carbon, sulphur and potassium nitrate or sodium nitrate.

I am ready to admit that the mixture may be quite innocuous until the intrusion of the carbide. But the soberest chemical imagination must be profoundly stirred on the entry of that disturbing factor into such a shaky mixture of explosive material.

I am not acquainted with the actual temperature resulting from the slaking of calcium carbide with water. But, from experience in handling the lamp in which the operation is effected, I should not be surprised to learn that it exceeds the temperature of boiling water.

There appear to be two stages in the evolution of the heat. The first is that in which the decomposition of water takes place, accompanied by the union of the calcium with the oxygen of the water, and the carbon with the hydrogen, as represented in the following simple equation:



*From an article in "Coal Age," by J. R. Allardyce, Saginaw, Mich.

This reaction being completed, diminution of the supply of acetylene in the miner's lamp at once takes place, with reduction of temperature. The miner, finding the light failing, instinctively increases the supply of water, an act which is rapidly followed by the steady extinction of the flame and a great increase in the evolution of heat. The temperature at this stage is often so high that it is impossible to hold the lamp in the hand.

What takes place in this second stage may be represented by the equation, $\text{CaO} + \text{H}_2\text{O} = \text{Ca}(\text{OH})_2$, which signifies that after the completion of the first reaction, in which acetylene is liberated, what remains as solid residue in the lamp is simply unslaked lime. The addition of water to this, as is well known, results in the liberation of much heat.

This is the real danger point in the contact of calcium carbide with such irritable bodies as fulminate of mercury and nitroglycerin. The slaking of quick lime in contact with easily combustible bodies, such as wood, has often resulted in fire.

It is not beyond the compass of probability that the frequent assembling of the nervously active chemical bodies, already enumerated, may one day, or any day, result in a combination whose reaction will precipitate a disastrous explosion.

Not being in possession of facilities for conducting the experiments necessary to justify or disprove the theory of a possible explosion from such a cause as outlined above, I submitted the matter to the Bureau of Mines. The officials of that department, in their reply, said that they had applied calcium carbide to the fulminate in the shell of the detonator, in 12 separate instances. No explosion, they stated, had resulted. In an oracular postscript, however, they expressed the view that "it does not seem impossible that, under some circumstances, an explosion would occur."

The courtesy of the bureau officials was unmistakable. But in view of the fact that Thomas A. Edison conducted a series of 1400 different experiments in pursuit of a principle, I hope I may be pardoned for remarking that the bureau's dozen odd ventures assume somewhat modest proportions.

The suggestion from me that the bureau include the action of calcium carbide on dynamite and blasting powder in their investigations was ignored entirely. This was possibly due to a lack of knowledge of the habits of miners, many of whom, as I have already stated, stow dynamite, carbide, powder and detonators all in the same box.

One will run in a hurry to that box and grab a handful of carbide, spilling a quantity over an exposed broken stick of dynamite, and close the lid again. Returning, on a similar errand, he opens the lid and jabs his head into the box, with his lamp burning on his cap. Acetylene gas has been accumulating around the dynamite in the interval.

Or, with the powder keg open beside him, another may suspend his labors on cartridge making and hurriedly restock his lamp with carbide, spilling part of it into the keg, where it starts the generation of acetylene.

The average miner is ignorant of the nature of the simplest chemical reaction, even that involved in the case of burning coal. But if he were to understand that in bringing water into contact with carbide he is

performing an act similar to blowing air into a coal fire, and that the carbide is then burning exactly as coal does, he might be more careful in handling it.

The resulting temperature, of course, is much lower than in the combustion of coal, but it may be sufficiently high to ignite fulminate of mercury.

Extending Nickel Production

The British America Nickel Corporation is pushing work on the mines which it has acquired in the Sudbury district in Ontario and is preparing to begin work on the smeltery and refining plant which it expects to build near its most important mine. This plant will be under the charge of E. P. Matthewson, recently with the Anaconda Copper Co. The nickel to be made there will be refined by the Hybinette electrolytic process. The Christiansand Nickel Refining Co. in Norway, using the process, has taken an interest in the concern.

The British America Corporation has a capital stock of \$20,000,000 and will issue \$9,000,000 in bonds. The stock, it is understood, is controlled by the British government. That government will take the nickel made by the company up to the limit of its requirements and will control the sale of any surplus. The company was first organized and promoted by the late Dr. S. F. Pearson, and its operations were delayed by his death.

The company has two distinguished technical men on its staff. One is E. P. Matthewson, already mentioned, whose career at the Anaconda is well known. The other is W. A. Carlyle, who was at one time provincial mineralogist and deputy minister of mines of British Columbia, and later manager of the Rio Tinto Copper mines in Spain. He is one vice president of the company. The president is James H. Dunn, of London; the other vice president is J. Frater Taylor. The directors are: A. G. Anderson and H. M. Hubbard, of London; S. Eyde, V. N. Hybinette and Admiral Borresen, of Norway; Robert Gowan, J. S. Lovell, R. H. Smith and E. R. Wood of Toronto.

Under its present technical and financial management there is no doubt that the new company will become a large and important producer of nickel. The production from the Sudbury district has heretofore been entirely in the hands of the International Nickel Co., with the exception of a small part controlled by the Mond Nickel Co. The Mond process, though technically almost perfect, has never seemed able to compete commercially with the refining plants controlled by the International Nickel Co. here and the Société Le Nickel in France and New Caledonia. Meantime the International Nickel Co. is going on actively with the construction of its refining plant at Port Colborne, Ont. This plant, which will cost in all about \$4,000,000, is built in accordance with the company's agreement, made with the Ontario government, that part of the nickel from Sudbury should be refined in Canada. Up to the present time, as is well known, all the nickel matte from the Sudbury mines and furnaces has been refined at the company's works at Constable Hook, N. J.

It does not follow that there will be any sharp commercial competition between the British America and the International companies. The demand for nickel is growing, and there will probably be business enough for both—to say nothing of a possible agreement.

Details of Practical Mining

Large Map Roller

A sturdy cheap and easily constructed table for working on large drawings or maps is shown in the accompanying sketch. The size of the table depends of course on the size of the work in question, but the main features, namely, the map roller and the noncreasing device, may be worthy of mention. By having a wooden roller under each side of the table, fitted with a crank

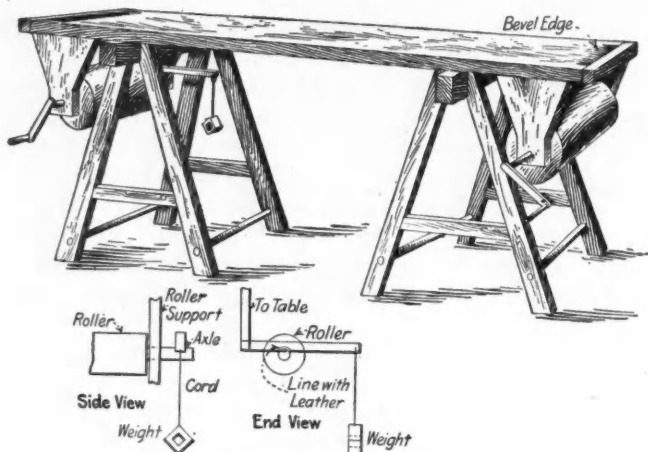


TABLE FOR LARGE MAPS OR PLANS

for turning and also a gravity brake that works automatically, the map may be shifted backward or forward at will and will retain the position at which it is set.

The noncreasing device consists of a slot in each edge of the table about three inches wide and extending the full length of the table, the inside edge of which is beveled as shown in the sketch. The map or drawing is inserted in this slot and then back to the roller. The draftsman's weight is then on the edge of the table instead of on the map or drawing.

It is advisable to cover the rollers at both ends of the table, as the face of the map or plan is always out or exposed to the dust which is likely to accumulate in the "V" between roller and paper.

Plans may be kept on rollers which may be made in such a manner as to be easily changed, thus reducing the dangers of having them crushed.

Care should be exercised that the brake is not set too tight, as continually stretching the paper, particularly in wet weather, destroys the scale of the drawing.

Record Drift for the Franklin Mines

By H. H. HODGKINSON*

The five-hole cut method is used exclusively in drifting at the Franklin mines of the New Jersey Zinc Co., as it has proved to be the most reliable and practical cut for both the rock and ore at this mine. A great many different types of cuts, such as draw cuts, V-cuts,

pyramid cuts and side cuts, have been tried without success. These cuts require more holes to break the ground than does the five-hole cut, without giving near the same advance in feet. The holes, when fired, either leave a long bootleg (bottom) or else merely blow off the collars, burning the bottoms. Besides, the size at which the drifts are driven does not permit the use of the previously mentioned cuts, as there is not sufficient space to give the cut holes the proper spread. Furthermore, the dimensions of the drifts are ample for the purpose for which they are intended, and the ore, which is a granular mixture of franklinite, willemite, zincite and calcite, is extremely tough and does not shatter readily, and can be mined a great deal cheaper by stoping than by drifting. The rock is a crystalline white limestone that is very resilient and equally as hard to break as the ore.

Better results are obtained with the dynamite uniformly distributed over the partial length of the drill holes than with it concentrated in their bottoms as is usually practiced in other methods of placing and loading drill holes. The method of loading drill holes provides sufficient space to permit the placing of enough tamping material to prevent any "windy shots." The holes are drilled of as small a diameter as is possible to accommodate the 1 x 8-in. dynamite cartridges. This not only allows the distribution of the dynamite over the partial length of the hole, but also increases the drilling speed of the machines because of the small gage of bit used.

The record drift was driven in October, 1915, on the 750-ft. level, when an advance in ore of 122 ft. was made by one man in 25 shifts of eight hours each. A round was drilled up and fired each shift which drew an average of 4.88 ft., the size of the drift being 7 x 5½ ft. The drilling labor rated at 0.205 runner shift per foot advance. The drill used was an automatic rotating hammer drill with water tube sending water through the drill steel and with the pneumatic feed mounting attached to the column arm. No repairs whatever were made on the drill, even the replacing of a broken water tube being unnecessary. This was due largely to the faultless steel turned out by the blacksmith and the care the drill received at the hands of the drill runner. There were 19½ drill shifts (eight hours) in which 460 holes were drilled, making a total footage of 2319 ft. The drill averaging 14.9 ft. per hour and 0.159 drill shift per foot advance. An average of 18.4 holes were drilled per round, to a depth of 5½ feet.

The drill steel used was ⅞ in. quarter octagon hollow with a shank of the same section sharpened with six corner or rose bits ranging in gage from a 1½-in. starter to 1¼-in., at which the holes were bottomed. There were 139 drill steels dulled for the entire drift; in other words, each steel drilled 16.68 ft. before being dulled.

The drilling and blasting was all done on the day shift, the night shift mucking out the heading; there

*Box 1536, Jerome, Ariz.

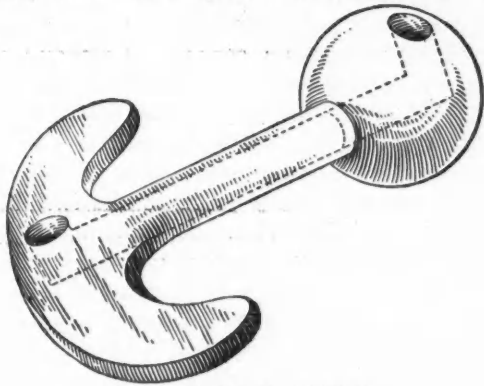
being 63 shifts and 3 hours muckers' and trammers' total, or 0.517 muckers and trammers per ft. advance. There were used 2920 sticks of (1 x 8-in.) 50% low-freezing gelatine dynamite, or an average of 6.35 sticks per hole, making 9.06 lb. of dynamite per ft. advance.

Ear Protector for Millmen

By S. H. BROCKUNIER*

Those of us who have had to work for any length of time in the noise of the stamp mill have seen the ill effects of the deafening roar, and the curious phases of the adjustment of the ear to its unusual surroundings. Many millmen, who have become quite deaf to ordinary conversation in the open air, can hear quite distinctly amid the roar of the stamps, if the voice is only slightly raised and the speaker is quite close. They can also differentiate between the usual crash and pound of the stamps and the slightly different noises resulting from too close feeding of the stamps or a loose stem. The ear adjusts itself to the vibration, and is rather uncomfortable when away from it.

Many millmen protect their ears by stuffing them full of cotton and soap, or even waste. For a number of years I have used the ordinary naval big gun ear protectors, when working in a mill, and find the form



THE EAR PROTECTOR

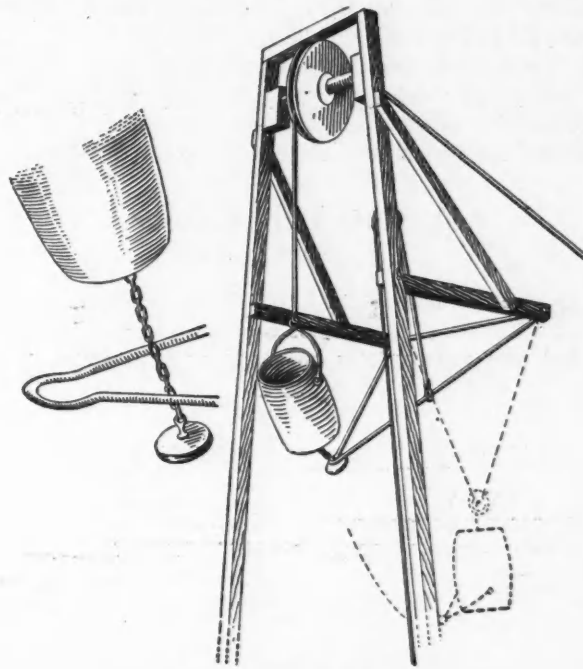
herein illustrated the safest and most comfortable; and while they do not prevent one's ears from ringing for awhile after removing the protectors they do furnish a great relief, especially for those who are not continuously in the mill, and whose ears therefore do not get adjusted to the vibration.

The protector is made of celluloid, and consists essentially of a ball containing a round hole on one side, and a small duct leading from the bottom of the hole through the stem to another smaller hole in the anchor shaped terminus of the stem. The ball is inserted in the ear, the hole next to the ear drum, and the anchor shaped stem is braced against the lobe of the ear, thus holding the protector in place. The sound now has to enter the small hole in the stem, traverse the narrow passage or duct to the hole in the ball, and thence pass to the drum of the ear. The sound therefore has to pass through a decreased aperture and make two sharp bends before reaching the ear; the effect is to reduce the shock and vibration to the ear drum without preventing one from hearing entirely.

There is nothing in the shape or method of insertion of this protector to injure the ear in any way, which is more than can be said of some of the protectors or remedies adopted by millmen.

Ore-Bucket Dumping Device

Economy and efficiency, many times obtained only at a comparatively large capital investment, was practiced by the prospector in Colorado many years ago, poverty being the prime factor. Many shafts sunk in the early days of Cripple Creek and other Colorado camps were sunk by four or six "pardners" who put in long and varied shifts. It was not infrequent that one man fired the boiler, ran the hoist, dumped the buckets, trammed the dirt and sharpened the steel, and in case no dirt was to be hoisted, even climbed down the ladder and helped drill or timber. A bucket-dumping device was installed at many prospects. Who devised it is not known, but its efficiency is great and its cost low. The



GRAVITY-DUMPING ORE BUCKET

illustration shows how it is constructed and works.

The bucket has, attached to the ring in the bottom, a piece of chain six to eight inches in length to which is attached a large cast-iron washer. A bar of 1-in. iron is bent into a V, the point being rounded off so as to allow the chain to engage therein without pinching. Eyes and eye-bolts are welded into the ends of the rod, each leg of which must be as long as the radius of the circle described by the dumping of the bucket; that is, according to the distance from shaft center to the point where the material is to be deposited. Eye-bolts are fastened to stiff legs of headframe or to substantial posts, to carry the weight of the dumping bucket, the V-iron is counterbalanced so as to be moved freely by the lever, and gravity does the rest.

BROKEN HILL SOUTH SILVER MINING Co., of Broken Hill, New South Wales, Australia, in its report for the half-year ended Dec. 31, 1916, shows that the first unit of the lead section of the selective flotation slime plant ran continuously during the period; 1924 tons of concentrates were produced, assaying 58.7% Pb, 44.7 oz. Au and 9.3% Zn, effecting a recovery of 82.8% Pb, 88.8% Au and 10.1% Zn, the latter metal being recovered separately. The zinc section of the plant has been completed.

Details of Milling and Smelting

Recovery of Potash from Alunite

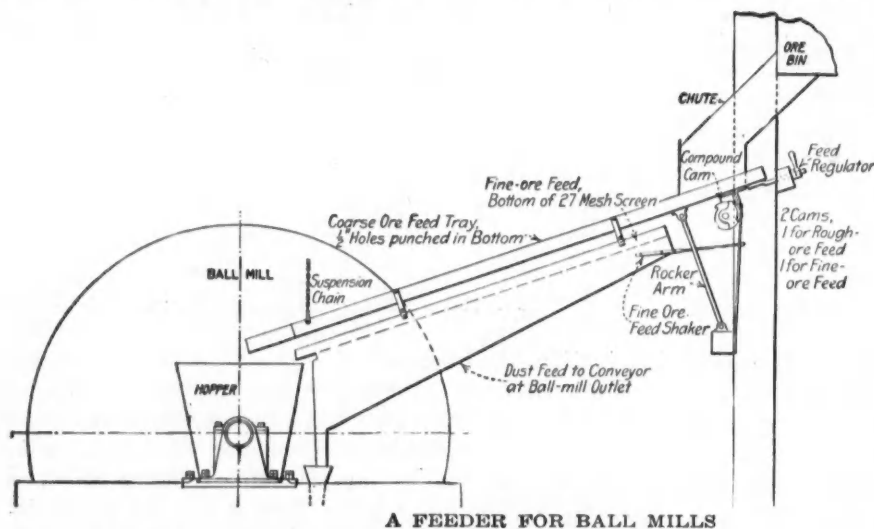
In experimenting on alunite from Marysvale, Utah, W. H. Waggaman and J. A. Cullen have found that the best results were obtained for potash extraction if the calcination was conducted at from 750° to 800° C. Above 800° fixation of potash took place, particularly in the presence of much silica. No gain was shown by grinding the material finer than would pass a 60-mesh sieve (U. S. Dept. Agr. Bull. 415, 1916).

It is suggested that it might prove the most economical method of working to ship the raw material East, since alunite takes a low freight rate and the finished products are practically all consumed in the East.

A Ball-Mill Feeder

BY A. W. ALLEN*

The present activity in ball-milling practice suggests the publication of details of a type of feeder that was erected and successfully operated at Kalgoorlie, West-



A FEEDER FOR BALL MILLS

ern Australia, about 15 years ago. The design may not be widely known, but it possesses several interesting features, and although used in connection with dry crushing in this instance, it would be equally applicable under many other conditions. At the South Kalgurli mine, where this feeder was in operation, it was found that from 10 to 15% of ore was bypassed to the ball-mill outlet, thus effecting a considerable increase in milling efficiency. The upper tray consists of steel plate perforated with $\frac{1}{2}$ -in. holes. The fine screen below corresponds in aperture width to the one used in the mill (Krupp type), in this case 27 mesh. A compound cam gives the necessary jar to both screens and provides for a greater frequency in the vibration of the finer screen than in the punched plate. The details and drawings are taken from R. Allen's "West Australian Metallurgical Practice."

*300 Broadway, New York

Device for Filling Air Chambers with Air

BY W. A. McCURDY*

Following is a description of a scheme which is simple and inexpensive, but which works wonders on pumps operating against high heads by filling the air chambers with air at a pressure equal to that due to the hydraulic head. This device is not new, but is of value.

When we stop to think that a cylindrical air chamber 30 in. long, filled with air at atmospheric pressure, will have but the top one inch of its length full of air when working under a 1000-ft. head, it is evident that the air chamber is of no use, while with this same chamber full of air at the proper pressure, there is a perfect cushion to absorb the shock due to the sudden thrust of the pump plunger against the end of a long, heavy column of incompressible liquid.

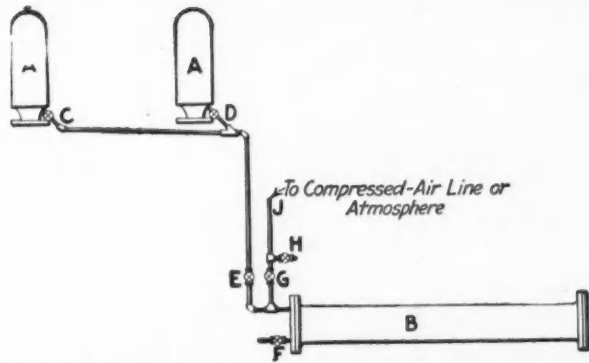
There are in the mines of the Oliver Iron Mining Co. on the Vermilion Range several crank and flywheel pumps of about 1000 gal. per min. capacity, operating against a head of approximately 1000 ft. A speed of 38 to 40 r.p.m. was about the limit of safety prior to the installation of this device. On account of the heavy water-hammer, it was impossible at higher speeds to prevent gaskets from blowing out, fittings from breaking and undue wear and tear due to the excessive vibration of everything connected with the pumping plant. With this device in use, the same pumps can now be operated at 55 to 60 r.p.m. as noiselessly and smoothly as a new sewing machine. In other words, the pumps may be run right up to capacity without difficulties of any sort.

Referring to the attached sketch, the device consists of a length of heavy pipe *B* which may be 8, 10 or 12 in. in diameter and 16 or 18 ft. long, the ends being closed with blind flanges. One flange is drilled and tapped near the bottom for a $1\frac{1}{2}$ -in. pipe which will drain the large pipe, and near the top for a 1-in. pipe. From the 1-in. opening pipes lead to the air chambers *AA* and to the compressed air line or atmosphere through *J*. There are 1-in. globe valves suitable for the high pressure at *C*, *D*, *E*, *G*, *H* and *I*. At *F* is a $1\frac{1}{2}$ -in. valve. The pipe *B* should be level and the 1-in. pipe *CDE* should be continuously up-grade from *B*. There should be no point in this pipe as high as the point *C*, otherwise the air will be trapped and cause the device to operate slowly or not at all.

Operation is as follows: Valves *C*, *D* and *H* are open. Valves *E*, *G*, *F* and *I* are closed. Now open *F*, *G* and *H*

*Ely, Minn.

or *F*, *G* and *I*. This will drain or blow all water out of *B*. When *B* is empty, close *F* and *H*, leaving *G* and *I* open till *B* is filled with compressed air at 60 to 75 lb. pressure or with atmospheric air if there is no compressed air handy. Now close *G* and *I* and open *E*. Water will now flow from *AA* to *B* compressing the air in *B* to pump pressure, after which this air will bubble up through pipe *EDC* to the air chambers *AA*. After a few minutes close *E*, open *F* and *G* and repeat operation till air chambers are full of air. This will be



PIPING ARRANGEMENT FOR DEVICE FOR FILLING AIR CHAMBERS

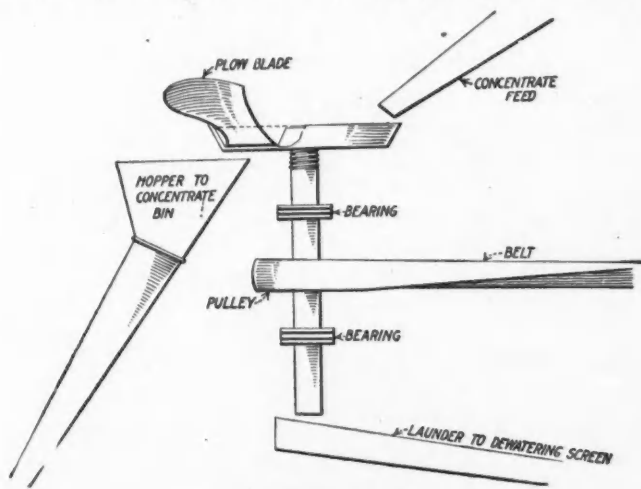
known when the valve *F* discharges air instead of water. Two of these operations are sufficient for the pump previously mentioned. It might be well to have a try-cock in one air chamber just above where *C* or *D* enters.

The valves *H* and *I* are not necessary when air is taken from the atmosphere. They are merely a safeguard against water entering the compressed-air system when the device is idle. To prevent this *H* is left open to drain off any water leaking by *G*. Doubtless the device can be still further simplified and improved.

Concentrates Dewatering Pan

A very simple, but effective dewatering pan for mixed concentrates may be put in ahead of the regular dewatering screens, saving much wear and tear.

The device consists of a boiler-plate pan 3 ft. in diameter, made in the shape of a gold pan, with flat



CONCENTRATES DEWATERING PAN

bottom and sloping sides. A central cone 1 ft. in diameter and 4 in. high is fixed in the center of the pan. The top of this cone and the bottom of the pan are bored

and tapped for a 4-in. pipe so that the pipe, when threaded, may extend above the top of the cone.

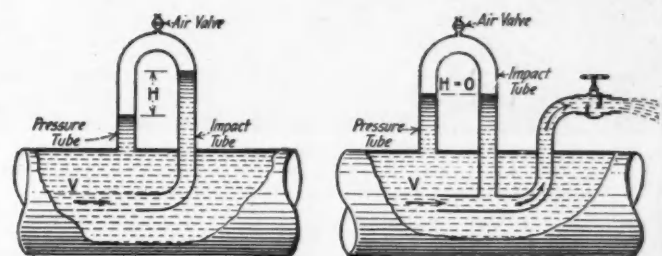
This pipe has a long thread cut on it, and since it is also used as a shaft, it is well to cut out short sections of the thread so that a wedge may be placed between the pipe and the top of the cone to prevent unscrewing or screwing up the pipe, thus changing the height. This pipe is the water discharge from the pan. At some points on the pipe about 1 ft. and 3 ft. below the pan, pipe flanges are keyed and faced to give bearings.

Above the pan an arm is arranged to carry a plow blade, which is made to fit in the pan and is to be set above its bottom, the distance depending upon the size of the concentrates. The pipe and pan are then made to revolve, using a rope, a belt or gear drive. The plow blade will remove the concentrates from the pan at an elevation greater than that of the water discharge or overflow. The water will naturally carry some fines, which can be taken to a screen or other dewaterer.

The pan will take all sizes of material from the bull-jig product to table concentrates. The wear and tear on both pan and blade is nominal.

Modified Pitot Tube

The pitot tube has long been used as a device for measuring the flow of liquids and gases, but only when used with the utmost care have the results proved uniform. Many experimenters have worked with modified forms in the endeavor to reduce the variation in



Common Pitot Tube
FIG. 1

Formula:
 $V = c\sqrt{2gH}$
H = Pitot Head
c = Coefficient
g = Acceleration of Gravity

Hydraulic Shunt
(Modification of the Pitot Tube)
FIG. 2

Formula:
 $V = \frac{Q}{cA}$
Q = Flow from Tube
A = Area of Tip Opening
c = Tip Coefficient

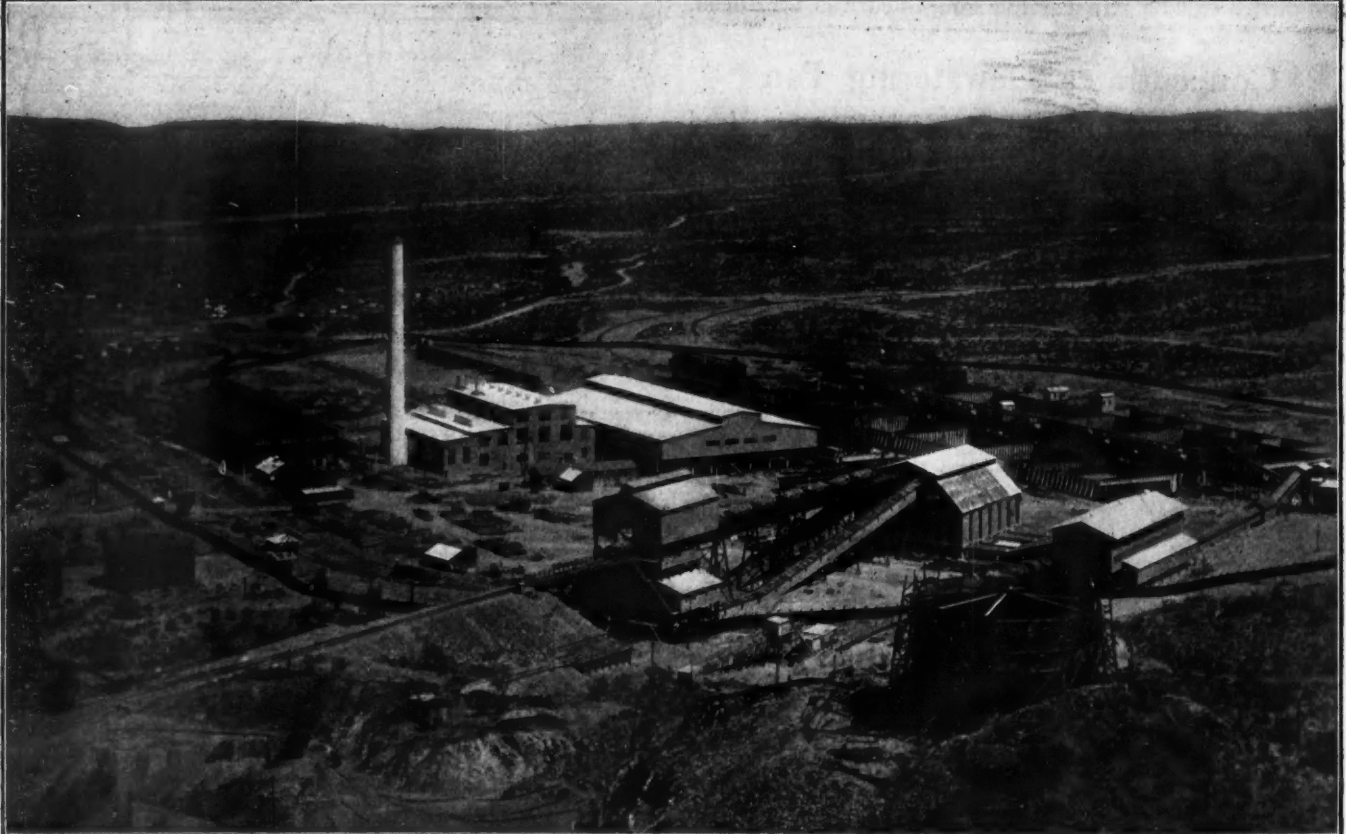
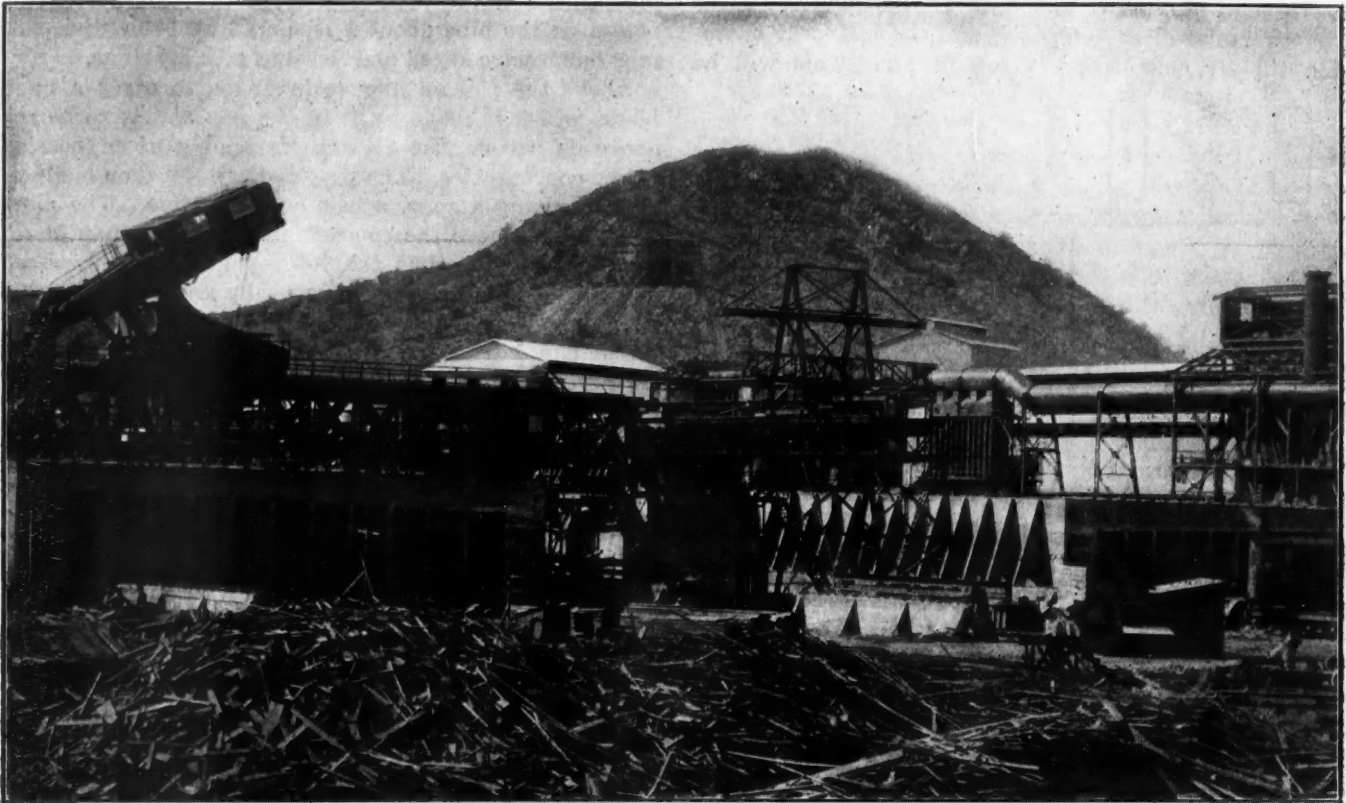
ALMOST AS SIMPLE AS A PITOT TUBE

results, but it is evident not only that the data obtained are variable, but that the same tube may have different coefficients, says *Engineering News-Record*.

In order to correct this latter defect, Prof. H. A. Thomas has devised the "Hydraulic Shunt-Flow Tube," described in the *March Rose Technic*, p. 176. This is a tube so arranged that it may be introduced into the stream with the tip directed against the flow and yet maintain at the tip the same pressure that existed before the introduction of the tube. The water flows into this tube and may be shunted into a small container and weighed, leaving the velocity undisturbed.

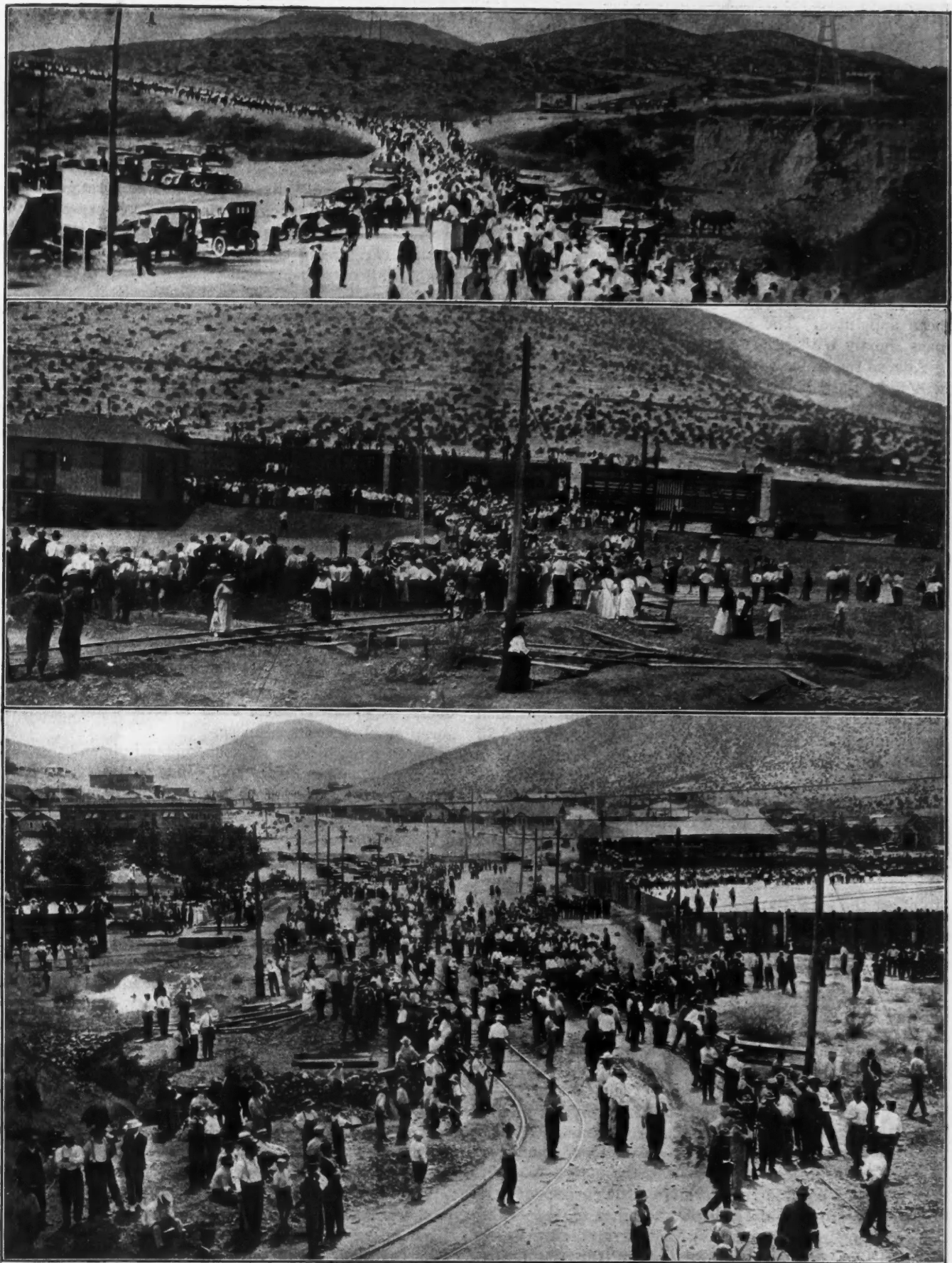
The velocity of flow at the tip of the tube will be equal to the quantity of water collected in the measuring tank, in a measured time, divided by the top area. It is possible to demonstrate mathematically that turbulent flow should not affect the coefficient of the tip. The tip coefficient should be unity under all conditions, but experiments show that it varies less than 1%.

Photographs from the Field



VIEWS OF THE NEW PLANT OF THE NEW CORNELIA COPPER CO., AT AJO, ARIZ.

The upper view is of a corner of the leaching plant shortly after completion, while the lower includes the tank house



VIEWS OF THE EXPULSION OF THE I. W. W. FROM BISBEE, ARIZ.

The upper view shows the exiles on their way from Bisbee to Warren, where they embarked. The central view is loading the men on cattle cars at Warren. In the lower view is shown Warren ball grounds, where the men were held pending deportation

Events and Economics of the War

It has been impressed upon us during the week that war is expensive. Secretary McAdoo has requested 5 billions more. \$2,500,000,000 is wanted for coast defense. The year's war cost, it is said, will be over 11 billions and may reach 14 billions with loans included.

Hurley and Capps succeed Denman and Goethals. The long rumored Central Purchasing Committee has at last been appointed. The Food Control bill is expected to pass shortly with Hoover as administrator.

Abroad the Allies have once more proclaimed that they will fight until their object is attained. The Russian retreat continues but the Rumanians gain. Kerensky is now dictator. Peace seems to interest the Germans more than it does the Allies.

Practices that Tie Up Cars

Relative to further increase in transportation efficiency, J. F. Porterfield, general superintendent of transportation of the Illinois Central Railroad, recently said:

"A saving equal to the present car shortage can be made by eliminating the delay incident to holding cars for reconsignment and surrender of bills of lading.

"After years of effort the railroads have finally agreed on filing tariffs covering uniform reconsigning rules and charges, and while these rules will not prohibit such reconsigning, they make a reconsigning charge of \$5 where the movement of the car is interrupted and a nominal charge of \$2 where the car is reconsigned without being delayed or diverted from the current of traffic. It is thought the \$3 difference in the charge will greatly reduce the reconsigning in hold-yards and increase the placing of reconsigning instructions with the railroads sufficiently in advance of arrival of cars to effect the reconsignment without diverting cars from the current of traffic to hold-tracks. It is probable that the National Industrial Traffic League and the Commission on National Defense can prevail upon the Interstate Commerce Commission to permit these reconsigning tariffs, now under suspension, to go into effect at once.

"The practice of moving freight on 'Shippers Order Notify Billing,' always a source of serious loss in car efficiency, is causing additional car delay owing to the present banking system requiring the handling of bills of lading through several banks, resulting in a large number of cars being delayed awaiting surrender of bills of lading; although, of course, the most serious delay is caused by diverting cars from the current of traffic to hold-yards while the party named in the billing is receiving notice, obtaining and surrendering bill of lading. An order should be issued by the commission, having authority, to prohibit this practice during the present car shortage."

Speaking of sight draft shipments, W. F. Bode, vice president of Reid, Murdoch & Co., of Chicago, says:

"These are at the present time subject to surrender of bill of lading before delivery of car. It is suggested that a bond of indemnity to railroads be arranged for in advance, thereby insuring immediate delivery of car on arrival, saving from one to four days in the release of such car. Bond can be a six months' or an annual bond. This arrangement now prevails with a number of institutions."

Products Requiring Licenses for Export

An export license is required at present for any article on the following list of mineral, metal and chemical products:

Coal, coke, fuel-oils, lubricating oil, benzol, head-lantern oil, toluol, naphtha, benzine, red oil, kerosene and gasoline, including bunkers.

Pig iron, steel billets, steel sheet bars, steel blooms, steel slabs, ship plates and structural shapes, iron plates, I-beams, mild-steel plates, rolled-steel plates, steel channels, steel angles, mild-steel plates (ordinary tank quality), steel beams, steel plates one-eighth of an inch thick or heavier (steel sheets one-eighth inch thick or heavier are classed as steel plates), steel tees and zeels, structural steel shapes, boiler plates, tank plates, steel doors, steel-car frames, steel towers, scrap iron and scrap steel, ferromanganese.

Fertilizers, nitrate of soda, potassium salts, potash, cyanamide, phosphoric acid, phosphate rock, superphosphate, chlorate potash, ammonia and ammonia salts, acid phosphate, anhydrous ammonia.

Explosives, nitrate of potash, rosin, sulphur, saltpeter, turpentine.

Hoover's Six Requests

To bring about concerted action every organization member of the Chamber of Commerce of the United States is asked, in a war bulletin issued by the National Chamber committee cooperating with the Council of National Defense, to get behind Herbert Hoover's six big requests. These are to eat one wheatless meal a day; to eat beef, mutton or pork not more than once a day; to economize in the use of butter; to cut the daily allowance of sugar in tea or coffee and in other ways; to eat more vegetables, fruit and fish; and to urge in the home or the restaurants frequented the necessity of economy.

However good may be the individual intention, the bulletin declares, these requests are not going to be lived up to on any large scale unless men and women take concerted action. To assist in bringing this about about every organization member of the Chamber has been asked to make and to follow up among its members, lest they forget, the three requests made below of individual members.

Each individual member is requested: To undertake himself to live up to the six requests and to ask his friends and employees to do so; to ask clubs and associations of which he is a member to appoint committees to assist in making general the observance of the six requests; to put into effect other ways and means of making general in his community the observance of the six requests, advising the National Chamber Committee of anything he is able to do in this respect which might be of assistance in other communities.

"The important problem of food conservation will not be solved without the concerted and continued cooperation of business men," the bulletin concludes. "The National Chamber is bringing this fact to the attention of members at the request of Mr. Hoover, and relies on them for a prompt response. Men who stay at home must help win the war. Here is a chance for every man in the true spirit of American energy to put his individual shoulder to the wheel."

Workmen's Compensation Acts

This summary presents a brief survey of a report issued by the National Industrial Conference Board, which shows the general tendencies of workmen's compensation legislation in this country. The legislation varies widely in form, but its fundamental principle is universal. The basis of compensation is no longer a fault actually proved against the employer, but simply the fact that the injury was received by an employee while at work.

A narrow view still regards the new system as a modification of the former employer's liability system based upon negligence. The broader conception is that workmen's compensation definitely supplants the old liability of the employer and becomes a vital part of the labor contract. This view rests upon the assumption that the circumstances out of which work injuries arise are only to a limited extent within the control of employer or employee; and that accident originates, broadly speaking, in conditions of production rather than in conduct of persons. Under this view, compensation acts aim to meet a public necessity, not to redress a private wrong. Relief is afforded in terms of wage loss. The worker, in return for certainty of limited relief, loses his former rights of action; the employer forfeits his old rights of defense and becomes a limited insurer for work injuries occurring in the industry which he controls and operates.

Decisions of state courts on the constitutionality of workmen's compensation acts have often conflicted. Very recently, however, appeals to the Supreme Court of the United States from decisions of state courts have afforded a basis for a searching legal test of the constitutional questions involved, which have greatly clarified them. The general power of a state to enact compensation legislation in the public interest is no longer open to question. It is admitted that the industry should bear the burden of relief rather than the particular employer in whose plant an accident may happen.

More than 67% of the employees of this country are included under compensation laws of one sort or another. There is, however, no uniform basis for determining just what employees or classes of employees shall be included. In numerous industries, compensa-

tion acts do not apply to the small employer. The effect of this is, of course, to exclude a considerable proportion of the country's workers from the benefits of workmen's compensation.

In some states the acts are compulsory upon the employer; in others he has an election. In some the employer affected by compensation acts must either insure his liability or demonstrate his financial capacity for self-insurance. In certain states contribution to a state insurance fund is obligatory. In all cases the employer is primarily liable for the payment of compensation unless he either is required or elects to pay a fixed premium into a state insurance fund. His personal liability is not relieved by insurance with private underwriters.

In this country "occupational diseases" are not, as a rule, included under the term "accident" in compensation acts, but in the administration of these acts an increasing tendency by administrative boards and by courts to include many forms of disease contracted during employment is evident. Another source of conflict lies in the significance given to the term "accident." Many of these inconsistencies are due to the absence of adequate and standardized information in the reports of the various boards upon whom the practical administration of these acts devolves.

To secure greater uniformity an organized effort toward concert of action is essential. It is therefore suggested that the states should promptly undertake, under expert guidance, the establishment of a permanent, scientific, uniform system of compensation statistics, providing for separate publication of judicial decisions relating to the compensation principle. This would be a great step toward the establishment of definite insurable standards of liability and of equitable premium rates. It would exercise a powerful influence on legislative ideas of the relative hazard of occupations and permit the extension of the compensation principle to many workers now excluded.

It is further suggested that clear discrimination, in legal definition, between the terms "occupational disease," "accident," and "injury" would greatly tend to clarify liability and minimize the number of contested claims; that experience endorses direct settlement between employer and employee of all claims; that inasmuch as the compensation system is intended to be substitutional for and not supplemental to employer's liability, an exclusively compulsory compensation system is advocated, as tending to eliminate many technical questions relating to whether or not employer or employee made an election.

Light Motors for the Air

The United States is clearly passing through the formative stage of airplane development, says the *Boston News Bureau*. Nothing distinctly American has so far been done mechanically toward perfection of a military airplane. The United States has copied French and is preparing to copy English and possibly German models of military engines.

The story comes from Washington that an all-American airplane engine has been produced. It is asserted that this engine has been perfected with the sensational weight of a shade under two pounds per horsepower.

It is a fact that a group of engineers have been working on what they call an international or universal type of airplane engine. The thought in doing this was to develop a standard motor which could be then adopted as the American engine and built in a large number of factories throughout the country and in immense quantities.

But in making this universal motor the engineers and designers have simply taken parts of four or five of the leading fighting engines used on both sides, have cleverly combined them and produced a sort of hybrid, which is now in process of being worked out. In all fairness it must be admitted that this motor is far from tested out, and far from proved a perfected fighting engine.

The notion of the universal engine, however, is a thoroughly American idea. It may be that this engine really does weigh only two pounds per horsepower, based on the same standard of weight-testing that airplane companies regularly use. If this is actually the case, it is the lightest motor in the world and the airplane sensation of the war. It would give America immediate air supremacy, and if adaptable to automobile companies, might easily be turned out in thousands per month. But until some of these points are established airplane engineers and authorities will go slow in accepting the finality of the universal motor as proclaimed in the preliminary accounts from Washington.

Open Mind of the War Department

Ever since the United States entered the present war it has been the policy of the War Department to bring its executive personnel as much as possible into contact with the sort of people who come to Washington with original ideas. This receptive attitude has been very aptly nicknamed the "open-mind" policy, and although it gets the bureau heads and executive officers in for a great deal of extra work, anybody who carries with him the seed of a useful idea is welcomed and his plan given thoughtful consideration. In a word, the War Department wants to make use of the brains of the American people and is willing to comb out a great mass of fanciful schemes, knowing as they do that the thousand-and-first idea might contain the germ of radical improvement in our method of carrying out our end of the world conflict.

Every day men of importance and responsibility come in to offer suggestions. Also men, hitherto obscure, frequently submit ideas and inventions of importance. In fact, the War Department has already profited by its policy of the "open mind."

Delivering Household Supplies

Coöperative deliveries of supplies are urged in a bulletin written by Ida M. Tarbell, concerning the activities of the Commercial Economy Board. She says in part:

The board is now calling on women to coöperate in another saving which comes through reform in one of the everyday practices of life—the way we get our daily groceries, meat, vegetables. All we do is to ask for them—at any hour of the day—a dozen times a day—in any quantity—and presto! it is on the kitchen table.

The thing, which takes no forethought on our part, is pretty sure to be expensive. The Bureau of Commerce estimates that the gross delivery expense of retail grocers in the country is over \$75,000,000 a year. What is this sum used for? For the hire of men to put up packages, to run wagons and trucks, to go to your house, often half a dozen times a day.

How is the delivery system to be put on a rational basis? There are towns in the country where it has been done by coöperative deliveries. Wherever well managed, the average saving has been around 50%. Of course this means reform in the method of ordering. One delivery a day is all that ought to be expected under present conditions.

The Women's Committee of the Council of National Defense urges women everywhere to aid. They can encourage their merchants to establish central deliveries. They can discipline themselves to thoughtful ordering. They can carry small packages and discontinue the practice of having goods sent home on approval. We shall see men freed from useless service.

To Avoid Rail Congestion

With the building of army cantonments requiring vast shipments of lumber and equipment, railroad men and the American Railway Association's special committee on national defense are doing much figuring to avoid serious congestion of railroad traffic after October 1.

The association's commission on car service estimates that from 100,000 to 120,000 cars of lumber will be required in the construction of cantonments. To protect the shipments of lumber at least 61,000 cars will be needed.

To move one field army of 80,000 men, according to the latest bulletin issued by the association, 6229 cars made up into 366 trains, with as many locomotives, will be required. These cars will be made up of 2115 passenger, 1055 box, 1899 stock and 775 flat cars.

This represents 0.7% of the locomotives owned by American railroads, 4.2% of their passenger cars and 0.2% of their freight equipment.

Daylight Economy

In view of the fact that the bill for saving daylight has already passed the Senate, it may be interesting to note one effect of light-saving legislation in England. In *Commerce Reports* is given the statement of the Leeds Corporation Electricity Committee for the year ended Mar. 31, 1917, which states that the number of units sold for all purposes showed an increase of 22.7%. For power purposes the sales of energy had increased rapidly, owing to war requirements, the number of units sold having advanced by 46.6%.

The police lighting regulations and daylight saving during the summer of 1916 caused the sales of energy to private lighting consumers to remain practically stationary, while the sales for street lighting had practically disappeared, being only \$1713, as compared with \$5781 in the previous year, and \$17,179 in the last pre-war year. It is pointed out that the war prices of materials and labor caused the working expenses to increase in greater ratio than the income.

Editorials

Tampering with the Machinery

THE controversy respecting prices seems to be abating somewhat. The Federal Trade Commission, upon orders of the Administration, is investigating the cost of producing steel, iron, copper, lead, zinc, coal, etc. Nobody in the possession of his senses and any expert knowledge expects anything useful to come of this. The undertaking is in magnitude analogous to the physical valuation of the railways. In many branches, the determination of the cost of producing copper, for example, the problem is insolvable, impossible. In the meanwhile the executive departments are continuing to consider the question on their own account. There are rays of hope and indications, if we read correctly between the lines, that Washington is obtaining a clearer perception of economic conditions.

Let us concede that the officials in the departments are animated by the sincerest motives to do the best that they can for the country. Let us concede, moreover, that in previous wars, even so recently as the Spanish War, there were scandals between the Government and business interests, in which the latter did not appear in the best light. Let us concede further, that the plan of the Advisory Council of National Defense in organizing subcommittees in the respective industries was not the best thing.

On the other hand, Washington should not have been so slow in awaking to the fact that the business interests of the country are just as patriotic as anybody else. In the talk about the poor being conscripted for their services, wherefore the rich must do their share by submitting to the conscription of their money, there has been a good deal of perversion of thought, even of nonsense. In the first place, the services of the rich are just as much subject to conscription as are those of the poor. In the second place, the rich have never demurred to the conscription of their wealth. On the contrary, they have subscribed with wonderful liberality to the Red Cross Fund, have assumed the bulk of the Liberty Loan and have faced the prospect of the enormous taxation with the utmost cheerfulness. All that business has asked of Washington is that its organization be not so tampered with that it will fail to run smoothly and will fail to produce the earnings out of which taxes are expected.

The organization of business is a delicate thing. There are relationships spreading over the entire world that are in perfect accord. Let some alteration be ignorantly and suddenly made in New York, there may ensue disasters in remote parts of the country. We have already had an example of this in the labor troubles that have spread through the West, which are directly attributable to the Government's threats to reduce

prices for commodities, and have already had the effect of restricting the production of such necessary things as copper and lead at a time when the maximum production is needed.

All the talk about suspending the law of supply and demand has been foolish. That law is going to continue to operate, just as it always has. The determinative factor as to price is how much production is needed. The price will be what will induce the last part of that production to be made. In every industry there will be differences in the costs, and consequently in the profits of the producers. In the case of copper, for example, costs will range from 10 to 25c. The system of taxing excess profits is an automatic equalizer that takes care of such differences.

(The reader will note that we say nothing about 5 or 6c. costs for copper. We do not believe there is any such thing, the official reports of several companies to the contrary, notwithstanding. Such figures are but partial costs, useful for comparative purposes so long as other producers figure in approximately the same way, but they are not true costs. The reader will recollect that we have expressed these views for many years back.)

It does not matter particularly what negotiations are consummated between the Government and the producers. The Government may make an arbitrarily low price for itself, and the producers may consent to it. The result would be that the profits of the producers would be diminished, and therefore they would pay less taxes to the Government; or else the supply of the commodity having been diminished by the Government's subtraction, other users would have to pay more. In either case there would be no great difference to the Government nor to the producers.

It was not that which gave the shock to the markets and the industries, but it was the vague ukase that the prices of commodities to everybody must be reduced. This was like a threat to throw a crowbar into the machinery. If the economics of the great war has shown one thing more clearly than another, it has been the innate stubbornness and selfishness of labor. The labor leaders said that prices for copper and iron, coal, etc., might be reduced, but they were not going to stand for any reduction of wages. There was, too, some reason in their talk, inasmuch as there was no prospect of the cost of living being reduced. On the contrary, Congress at this very time was inserting in the Food Bill a provision of \$2 as the minimum price for wheat, although previous to the war dollar-wheat was the acme of agrarian hopes.

Washington is now beginning to see the inconsistency of shuddering over 25c. for copper and being enthusias-

tic about \$2 for wheat. It begins to see, moreover, how tampering with the machinery is having bad results, such as the fomenting of labor troubles, which was one of the things that business men warned about in the early days of the price controversy. Washington is, perhaps, finally coming to see, also, that business men are patriots, not hogs, and anxious to serve their country. Probably it is being perceived, moreover, that this war should be fought with a spirit of domestic optimism, rather than pessimism. We look, therefore, for a change in the attitude of Washington and the passage into oblivion of the cost-of-production theory and many others.

The prices for commodities are going to be governed by the law of supply and demand, simply for the reason that nothing else will work. The Government will probably so organize itself that it will be able to buy intelligently and without disturbance of the markets. This last thing is really the goal toward which it is laboring, although it has so far failed to appreciate it.

Iron and Steel Conditions

THE strong and active condition which marked the iron and steel markets during the earlier months of the year has developed since June opened into considerable excitement, with rapid advances in prices. These have been especially marked in pig iron, the basic commodity. Bessemer pig, which sold in June, 1916, at \$22 per ton in Pittsburgh, but rose to \$36 in January last and \$47 in May, has taken a further jump and is quoted this week at \$55, a price far above any on record. Since July, basic pig has advanced from \$19 a year ago to \$35, to \$43 and now to \$51 per ton, and No. 2 foundry from \$19.50 to \$31 and now to \$50. These, of course, are the figures for iron sold by the merchant financier, which furnish about 30% of the total. The steel companies which make their own pig iron get it at cost, but that cost has advanced materially, owing to the higher wages and the advanced cost of ore, fuel and supplies. On the basis of Lake freights and figures, ore is from 20 to 30% higher than a year ago; coke is rather more than double last year's price; while labor has gone up about 35 or 40%. The ton of pig iron must cost from one-third to one-half more than a year ago. Steel scrap, which is an important item in openhearth steel manufacture, has advanced in close parallel to pig iron.

Finished steel, which is dependent upon the prices of basic material and which at present absorbs nearly all of it, has of course advanced on parallel lines. Steel billets are quoted at over \$100 per ton, while tank plates are \$140@150, ship plates and angles \$180@140, with other products in proportion. These are decidedly what would have been called "famine" prices a year or two ago, and are so high that a serious limitation of industrial demand would certainly have followed. Whether such a result is now threatened is not yet certain, owing to the unusual conditions which prevail. The uncertain condition which most affects the markets at present is the extent of export and government demands. Very large orders of both classes have been placed and more

are expected, but the quantities are altogether uncertain. These orders will necessarily have preference, so that buyers of iron and steel for consumption and manufacture are faced by the conditions that not only will they have to pay high prices, but also there will be difficulty in placing orders at all, or in securing deliveries.

There is no immediate probability of any material increase of supplies in the immediate future. On June 1 there were in blast 340 coke and anthracite stacks out of the 404 on the list of the American Iron and Steel Association. Of the idle furnaces a few were permanently disabled and the rest were undergoing absolutely necessary repairs. The pig-iron production in May was approximately 3,455,000 tons. An increase to 3,500,000 tons monthly is probably the best that can be expected. Repaired furnaces blowing in must be nearly balanced by those which must be stopped, and of the new furnace capacity building hardly any will be ready until toward the close of the year. The charcoal-furnace capacity cannot be much enlarged; at any rate it furnishes but a trifling proportion of the total. We have spoken chiefly so far of pig iron because that is necessarily the basis of the business. Capacity for conversion into steel can be furnished as quickly as it is required. Rolling and forging machinery is again a slower matter, but will probably be ready when it can be used.

Zinc-Smelting Conditions

STATISTICS relating to the zinc industry were published in the *Journal* of July 7 disclose many interesting things. Among others is the great reduction in the average duty per retort. Whereas, in times preceding the war an output of 4.2 tons of spelter per retort per annum was reckoned, the yield in the latter part of 1916 was only about 3.6 tons, or six-sevenths of what it used to be.

To a certain extent this is attributable to the smelting of a lower grade of ore, it being reckoned that the average grade of ore smelted in 1916 was about 47%, compared with about 50% in 1914 and 1915. It was but natural that the enormous demand for ore, the smelters having required about 1,700,000 tons in 1916 against about 1,200,000 in 1915, should have led to the acceptance of lower grades. Ore production was not checked by contraction in the price for spelter, the latter having been chiefly at the expense of the smelters. In 1914 and 1915 there was a deficiency of smelting capacity, and consequently there was a premium upon the use of what existed, which expressed itself in the form of wide smelting margins. In 1916 the smelting capacity began to approach and even exceed what was required, and competition among the smelters trimmed down the smelting margin, which was, of course, to the advantage of the ore producer.

However, although the average grade of the ore smelted in 1916 was lower than in 1915, the chief factor in the reduced yield of spelter per retort was undoubtedly the lower extraction of the zinc from a given grade of ore, due to the rushed work and to the carelessness of labor in many respects.

BY THE WAY



HERBERT CLARK HOOVER

The cartoon of Mr. Hoover by Cesare that we present this week appeared in the *New York Evening Post* of July 21, 1917, by the courtesy of which publication we reproduce it.

"Because of the character of the ore, which is of volcanic origin and has never been affected by the action of frost as have ore deposits in more northerly latitudes," according to a publication that is promoting the sale of stock in this interesting mine, "the ore caves in easily and can be taken down with a minimum of labor. Even the expense of hauling the ore from the tunnels to the mill is eliminated, as by reason of the abundant water it is possible to convey the ore by a system of sluices, which make possible a still further economy, as in the course of transit the coarser particles of gold are automatically separated from the finer."

A newspaper of Grass Valley, Calif., has a report about a mule in the Empire mine, which is said to have kicked a man by mistake. The mule is known to every employee of the mine, 450 in all, and while there is no affection for her among 449 of them, they all have a wholesome respect for her in spite of her contrary disposition. It is a mine classic that she kicks the air pipe 2 ft. above her head for exercise. With Fred Wales, however, it is different. He has worked with Bessie for 14 years and has become attached to the animal. He excuses her vagaries as an indulgent mother condones the actions of a spoiled child. It is merely a matter of temperament, he says, and the other men do not understand her. Yesterday, however, his faith was

shaken temporarily, but not for long. In the physician's office he took offense at a suggestion that the mule should be killed on account of her viciousness, and rushed to her defense. "It was perhaps my fault, it certainly was not hers. Bessie either did not know who it was when she kicked, or I had forgotten to give her the usual chew of tobacco. I am willing to take all the blame."

Price fixing is the most vicious blunder conceivable, says the *New York Sun*; not because of the injustice to producers and venders, but because of its inevitable effect in stopping production and checking the marketing of commodities. The fixing of minimum prices strangles trade and industry for psychological reasons. The minimum price becomes the maximum that any one will pay willingly and that the producer can count on getting. Fixed maximum prices are not only psychologic but economic barriers to production. In face of them no new capital will be embarked and no new effort put forth. The stimulus to industry and investment is the hope of profit. Lock the door on this opportunity, and capital and labor alike soon take to the subcellar and the roadside. An aim of the Government might well be the sane limitation of consumption, or at least the control of waste. In this direction, by far the most potent agency is the price current. Artificially low rates are an inevitable invitation to lavish and wasteful consumption, while high figures mean frugality and restraint, and the substitution of abundant foods for those of which there is a scarcity. We had the working of the law demonstrated most perfectly in the recent food agitation in this city. Man cannot beat the laws of the universe. When he fights them, they punish him relentlessly.

A correspondent in Arizona writes that, lest we might not see *Dunbar's Weekly*, which he characterizes as the "personal organ of Ex-Governor Hunt," he sends us a copy containing a few remarks that may be of interest to us. The remarks to which he refers are the following:

The honest law-abiding people of Arizona had better be on their guard, as there is no right, law or business ethics these hounds respect. As an illustration of their tactics we cite this fact, the *Engineering and Mining Journal* of New York, the greatest paper of its kind in the world, recognized as the authority on the price of copper and other valuable metals, was adopted by the miners and the mining companies of Arizona as the guide that should regulate the prevailing prices of copper that was to be made the base of the sliding wage scale. The big publication could not be corrupted and became a source of annoyance to these companies, and six months ago, under cover, the Copper Queen purchased that great journal out and out and all for the purpose of using it as a decoy to rob the miners of Arizona, and yet we are told that this company is just in its dealings. What a condition of rottenness and pelf dear old Arizona is in today.

On another page the same journal asks:

Why, we ask the fair-minded people of Arizona, was it necessary for the Copper Queen to purchase the *Engineering and Mining Journal* of New York at a price upward of one million dollars?

We are indeed interested in this news, which we might not have heard in the ordinary course of events. We have interviewed Phelps, Dodge & Co. on the subject and they said that they had not heard about it either.

July Mining Dividends

Disbursements to stockholders in July, by 55 United States mining and metallurgical companies making public reports amounted to \$16,531,242. Of this amount, \$5,026,450 represented special dividends in favor of the American Red Cross, paid by 13 companies. The regular payments, therefore, amounted to \$11,504,792 distributed by 46 companies, as compared with \$13,278,377, by 41 concerns in July, 1916. Canadian and Central American companies paid \$1,055,807 as compared with \$1,201,912 a year ago.

The only holding company which paid a dividend in July, 1917, was the St. Mary's Mineral Land Co., which disbursed \$2 a share, or \$320,000.

The record of United States mining and metallurgical companies for last month, showing a decrease, is a change

| United States Mining and Metallurgical Companies | | Situation | Per Share | Total |
|--|------------|-----------|-----------|-------|
| Ahmeek, c. | Mich. | \$4.00 | \$800,000 | |
| Allouez, c. | Mich. | 3.00 | 300,000 | |
| Am. Smelters, pfd., A. | U. S.-Mex. | 1.50 | 246,882 | |
| Am. Smelters, pfd., B. | U. S.-Mex. | 1.25 | 375,000 | |
| *Am. Smelt. & Ref. | U. S.-Mex. | 1.00 | 609,980 | |
| *Anaconda, c. | Mont. | .50 | 1,165,625 | |
| Aris. Commercial, c. | Ariz. | .50 | 132,500 | |
| *Aris. Commercial, c. | Ariz. | .10 | 26,500 | |
| Aris. United, c. | Ariz. | .01 | 25,000 | |
| Bingham Mines, l. s. | Utah | .50 | 75,000 | |
| *Bingham Mines, l. s. | Utah | .25 | 37,500 | |
| Bunker Hill & Sullivan, l. s. | Ida. | .50 | 165,500 | |
| *Butte & Superior, s. | Mont. | .40 | 116,079 | |
| Caledonia, l. s. | Ida. | .03 | 78,150 | |
| Camp Bird, pfd., g. s. | Colo. | .18 | 110,501 | |
| Cerro Gordo, l. s. | Calif. | .07½ | 75,000 | |
| Champion, c. | Mich. | 6.40 | 640,000 | |
| *Chino, c. | N. M. | .40 | 347,992 | |
| Cresson, g. s. | Colo. | .10 | 122,000 | |
| Daly | Utah | .10 | 15,000 | |
| Dragon Cons. | Utah | .01 | 18,750 | |
| Empire Copper | Ida. | .05 | 50,000 | |
| Golden Cycle, g. | Colo. | .03 | 45,000 | |
| Granite, g. | Colo. | .01 | 16,500 | |
| Hecla, l. s. | Ida. | .15 | 150,000 | |
| Homestake, g. | S. D. | .65 | 163,254 | |
| Horn Silver, l. s. | Utah | .20 | 20,000 | |
| Inspiration, c. | Ariz. | 2.00 | 2,363,934 | |
| *Inspiration, c. | Ariz. | .25 | 295,492 | |
| *Internat. Nickel | U. S.-Can. | .25 | 418,346 | |
| Iron Blossom, s., l. g. | Utah | .05 | 50,000 | |
| Iron Cap, c. | Ariz. | 1.00 | 102,510 | |
| Iron Cap, pfd., c. | Ariz. | .35 | 15,685 | |
| Ile Royale, c. | Mich. | 1.50 | 225,000 | |
| Judge Min. and Smelt., s., l. s. | Utah | .25 | 120,000 | |
| *Kennecott, c. | Alaska | .20 | 557,336 | |
| Loon Lake, c. | Wash. | .01 | 14,404 | |
| *Macma, c. | Ariz. | .10 | 10,000 | |
| *Nevada Cons., c. | Nev. | .15 | 299,919 | |
| Nevada Hills, g. s. | Nev. | .10 | 106,569 | |
| New Jersey Zinc | U. S. | 4.00 | 1,400,000 | |
| North Butte, c. | Mont. | .50 | 215,000 | |
| Osceola, c. | Mich. | 6.00 | 576,900 | |
| Portland, g. | Colo. | .03 | 90,000 | |
| Prince Cons., l. s. | Utah | .05 | 50,000 | |
| *Ray Cons., c. | Ariz. | .20 | 315,436 | |
| Richmond, l. s. | Ida. | .02 | 16,800 | |
| Shattuck Arizona, c. | Ariz. | 1.25 | 437,500 | |
| Silver King Coalition, s., l. s. | Utah | .15 | 187,500 | |
| Topopah Belmont, g. s. | Nev. | 12½ | 187,504 | |
| Topopah Min., s. | Nev. | .15 | 150,000 | |
| United Copper | Wash. | .01 | 10,000 | |
| United Eastern, g. | Ariz. | .05 | 68,000 | |
| U. S. Smelting, com. | U. S.-Mex. | 1.25 | 438,894 | |
| U. S. Smelting, pfd. | U. S.-Mex. | .87½ | 425,555 | |
| United Verde, c. | Ariz. | 1.50 | 450,000 | |
| *Utah Copper, c. | Utah | .50 | 812,245 | |
| Uvada Copper | Nev. | .01 | 6,000 | |
| Vindicator, g. | Colo. | .03 | 45,000 | |
| Wellington, s. g. | Colo. | .10 | 100,000 | |
| Yellow Pine, s. l. | Nev. | .03 | 30,000 | |
| Canadian and Central American Companies | | Situation | Per Share | Total |
| Cons. Min. & Sm. Co., c. z. | B. C. | \$0.62½ | \$260,445 | |
| La Rose, s. | Ont. | .05 | 74,931 | |
| McKinley-Darragh-Savage, s. | Ont. | .03 | 67,431 | |
| N. Y. & Hond. Rosario | C. A. | .50 | 100,000 | |
| Nipissing, s. | Ont. | .25 | 300,000 | |
| Porcupine Crown, s. | Ont. | .03 | 60,000 | |
| Standard Silver Lead | B. C. | .05 | 100,000 | |
| Temiskaming, s. | Ont. | .03 | 75,000 | |
| Townsite Extension, s. | Ont. | .12 | 18,000 | |

* Red Cross.

from that of the earlier months of the year, during each of which amounts paid were in excess of the dividends of the corresponding period in 1916. Although there were a number of new dividend-payers on this month's list, several companies which paid in July, 1916, found it necessary to reduce their payments or discontinue, and

the New Jersey Zinc Co., which paid an "extra" of \$10 in July, 1916, distributed only \$4 in July, 1917.

Empire Copper Co. paid its regular quarterly dividend of 5c. a share, but instead of paying an extra of the same amount as was done in the preceding quarter, voted to invest \$50,000 in Liberty Bonds, which will be distributed to the stockholders later.

Nevada Hills made two payments of 5c. each, which are understood to be in liquidation.

Initial payments were made in July, 1917, by Bingham Mines, Loon Lake and United Eastern.

The totals for the first seven months of the year are as follows: Mining and metallurgical companies, \$121,348,231; holding companies, \$3,867,789; Canadian, Central American, South American and Mexican companies, \$11,230,666.

Strike Conditions in Arizona

My communication published in the *Journal* of July 21, 1917, suffered some pruning, I suppose owing to the exigencies of the "make-up." Yet, there was an excision of matter that I think ought to be of record. On page 137, column 1, clause beginning "Such occurrences" had direct reference to the attempts which had been made to burn our mines, which read as follows:

"On three occasions within the past few months attempts have been made to burn the mines in this district. On Sept. 23 of last year two mines, a mile apart, were set fire to and one of these fires being set in such a place and in such a manner that it was most difficult to fight, and had the efforts undertaken and continued during months at a heavy outlay not been successful, the largest producing mine in the district would have been forced to close down; while in the other case the mine affected, and which in that time was outputting 300 tons a day, had to be bulkheaded off and has not since operated. The third attempt was less successful in doing material damage, owing to the early discovery of the fire, and prompt means of handling it.

"Such occurrences cannot be reasonably laid to the charge of any of the old employees in this district, but probably to some of the I.W.W. floaters whose activities have become so pronounced since the commencement of the European War."

NORMAN CARMICHAEL,
Gen. Mgr., Arizona & New Mexico Railway Co.
Clifton, Ariz., July 25, 1917.

Wheat versus Steel

Here is Wall Street's great metaphysical problem, says the *Evening Post*: If in the words of Mr. Wilson, profits are never to be mentioned in the same sentence with patriotism, why does the Government consider a minimum price of \$2 a bushel for wheat?

The reply may be that the crops must be stimulated at all costs and that fixing a minimum price is a necessary evil. But must not the output of steel be stimulated? Must not the output of ships be stimulated? Must not the output of copper be stimulated? If the word incentive is to be treated with contempt when mentioned in connection with steel manufacturers, why must it be treated with reverence when mentioned in connection with farmers? The truth is that what

The Administration knows is this: though it could condemn the mention of profits and patriotism in immediate proximity to each other, though it could tell the farmer that with men giving their blood and their lives on the battlefield it would be a very sordid thing for him not to work at his hardest and increase his acreage to the greatest possible extent—though it could tell him all this, and though it would be right, yet it knows that if it depended on him to do it, and gave him no assurance of profit and no assurance against loss, wheat would not be grown in sufficient quantity; the progress of the war would be hindered and bedeviled—all because the Administration expected a higher code of morals and sacrifice from the farmers than it had any reasonable ground of expecting.

But this is how it treats the manufacturers. The Federal Trade Commission has made no investigation, and has not been ordered to make any investigation, of the cost of producing wheat. Yet Washington now considers guaranteeing a minimum price of \$2, which means that the farmer is allowed to sell his wheat for more than that if he can get it in the market, but that if the market will not take all his wheat at more than \$2, the Government will buy it at that price. Two dollars is more than twice the normal pre-war price. Now suppose that the steel manufacturers asked for exactly the same treatment as the farmers? Suppose they went to Washington and said: "We feel a little nervous about whether the market for steel is going to hold. The market price of steel before the war was \$30. Couldn't you guarantee us that if by any chance the market broke, you would take all the steel from us that we couldn't sell at \$60? Otherwise we will not have enough incentive." Washington would think only one thing: that the steel manufacturers had gone violently insane.

Manganese Production in Brazil

Exports of manganese ore from Brazil in 1914, says *Commerce Reports*, were 183,630 tons, valued at \$1,380,453. In 1915, 288,671 tons were exported, to the value of \$2,632,427. The consular export returns for 1916 show a very large increase over the figures for the preceding two years, reaching 503,120 tons, valued at \$7,080,954. This exceptional development is due to the greatly increased demand for manganese in the United States, where 80% or more of the supply is now of Brazilian origin, because of the almost complete closure of other sources by the war.

Certain new Brazilian mines have been opened under the stress of the increased demand. These operations have been chiefly in the state of Minas Geraes; but the state of Bahia seems also likely to become a large producer of manganese ore.

A newly formed American company, which claims to have recently purchased four mines in the state of Bahia, is exporting manganese ore from the City of Bahia. The largest of these mines is in the municipality of Bom-Fim, northwest of the City of Bahia. It is reached by the Central Ry. of Brazil but has not been explored to any extent. Three other mines are near the town of Nazareth, southwest of Bahia. They have no railway outlets, and the ore now mined is taken

by lighters to the Bay of Bahia and there loaded on ships. These properties are said to be smaller than the one at Bom-Fim.

Only two ships have been loaded at Bahia with ore from these mines, the amount shipped being 8300 tons. It is claimed that a large tonnage is in sight and that American engineers have reported very favorably upon the properties.

The local agents of the company estimate that with better railway facilities from 15,000 to 20,000 tons of manganese ore could be shipped monthly via Bahia. They claim, however, that the lack of sufficient railway facilities to carry the ore to tidewater is the big drawback. This is a general condition and applies to the state of Minas Geraes as well. In fact, it is the prevailing belief among technical men that the entire manganese problem of Brazil and, even further, the problem of disposing of its vast natural resources, is one of communications by highway in many interior districts and from the commercial centers of those districts by rail to tidewater.

Melting Point of Glucinum

In determining the melting point of glucinum and its heat of fusion, a review in the *Journal of the Society of Chemical Industry*, Mar. 31, 1917, of some German experiments, points out that glucinum prepared electrolytically from sodium glucinum fluoride, was pressed into pastilles and fused in a magnesia tube in hydrogen. The product contained 99.5% Gl, the principal impurity being the carbide. Heating and cooling curves gave the value $1278^{\circ} \pm 5^{\circ}$ C. for the melting point.

An approximate determination of the heat of fusion by comparing the duration of the arrests when equal volumes of gold and glucinum were cooled under similar conditions, gave 277 calories per gram, while Crompton's rule, atomic weight \times heat of fusion \div absolute temperature of fusion = 2, gave the value 341. Glucinum has the largest heat of fusion of any metal corresponding with its high melting point and low atomic weight.

Spalling of Magnesite Bricks

Spalling of magnesite brick, says J. W. Mellor, in an article in the "Transactions Ceramics Society," 1916-17, is attributed to shrinkage on heating caused by conversion of α - into β -magnesia, and to shrinkage caused by the closing of the pores in highly porous brick. Lightly calcined or α -magnesia has a specific gravity of 3.2 or 3.3, but the crystalline or fully shrunk β -magnesia has one of 3.65, that of the natural mineral, periclase, being 3.5 to 3.75.

The speed of conversion of α - into β -magnesia at 1300° C. is relatively slow, but is more rapid at high temperatures. To prevent spalling, the material must be maintained at a suitable temperature until a sufficient amount of conversion has occurred, and the porosity of the brick must be kept reasonably low. Bricks with a sufficiently high specific gravity do not spall, as the change in volume on further heating is too small to set up serious strains.

Personal

Francis Church Lincoln, director of the Mackay School of Mines at Reno, has been appointed State Assayer for Nevada.

G. E. Postma, a chemist in the service of the Bureau of Mines, has been transferred from Pittsburgh to the station at Tucson.

E. Gybbon Spillsbury sailed from New York on July 26 for Central America and expects to be absent until the end of August.

Charles M. Coats is now in the land department of the Kansas and Kentucky Oil Co. His address is Box 209, Chanute, Kansas.

Frank Oliver has severed his connection with the Mogul Mining Co., due to the closing down of the North Carolina property.

B. R. Hornor, of the Bureau of Mines staff, is engaged in an inspection of the metalliferous mines of northeastern Washington.

Howland Bancroft has returned to New York and is at the Engineers' Club. He will return to Denver about the middle of August.

John Hunt, underground superintendent at No. 1 mine of the Western Fuel Co. at Nanaimo, B. C., has been appointed general superintendent.

W. Sampson, superintendent of the Nickel Plate mine at Hedley, B. C., has resigned after 10 years' service, and has gone to Salt Lake City.

B. W. Knowles has been appointed superintendent of the Nickel Plate mine, at Hedley, B. C., with L. S. Morrison and W. Trezona, assistants.

Lawrence Martin, of the University of Wisconsin, gave instruction in topography at the Officers Training Camp, Fort Sheridan, Ill., during June and July.

Elliot Blackwelder, of the University of Illinois, is in California as member of a commission appointed to investigate the petroleum resources of the state.

A. E. Wells, superintendent of the Salt Lake City station of the Bureau of Mines, has been spending a few days in Washington conferring with Bureau officials.

Frank L. Stack, superintendent of the Davison Sulphur & Phosphate Co., at Cumanayagua, Cuba, is returning to the United States to offer his services to the army.

Charles T. Williams, recently with the Cananea Consolidated Copper Co., at Chivatera, Sonora, is now with the Tonopah Belmont Development Co., Tonopah, Nevada.

Lapsley W. Hope, superintendent of the Yankee Girl mine at Ymir, B. C., has resigned to become superintendent of the Eureka-Holly Mining Co., at Eureka, Nevada.

Clifton Cooper, at one time with the Bon Air Coal & Iron Co., Nashville, Tenn., is secretary-treasurer of the new Suwanee Iron Co., with offices at Nashville, Tenn., which recently acquired the furnaces at Grand Rivers, Kentucky.

Fred W. Padgett, for the past four years research fellow in oil, gas and gasoline in the University of Pittsburgh, has been appointed associate professor of chemistry in the University of Oklahoma, where he will develop a research department in oil, gas and gasoline.

Charles Camself is in charge of the field work of the Geological Survey of Canada in British Columbia this summer. He has his office at Vancouver and field headquarters at D'Arcy. He has parties at work in the Slocan, in East Kootenay and in the Omineca mining division.

Lionel S. Marks, professor of mechanical engineering at Harvard and Massachusetts Institute of Technology, has been assigned by the national advisory committee on aeronautics to take charge of investigations relating to airplane-engine design now being made at the Bureau of Standards.

W. H. Coghill, of the Bureau of Mines, will assist Thomas Varley, superintendent of the Seattle station, in the investigation of ore dressing, which is to be one of the principal lines of work at the Seattle station. Mr. Coghill will continue his work on the molecular physics of flotation as applied to Oregon ores.

Mrs. W. Koenig warns the public, especially the mining public, against a man representing himself to be the son of Dr. George A. Koenig, late Professor at the Michigan College of Mines. This man has asked assistance from graduates of the Michigan College of Mines on the score of their friendship for their former professor. He is not the son of Dr. Koenig. The latter has one son only, Augustus Koenig, M. D., a practicing physician in Philadelphia.

Obituary

D. G. Scofield, ex-President of the Standard Oil Co. of California and more recently chairman of the board of directors, killed himself at his home in Oakland on July 30. Dependency, due to grief over the death of his wife five years ago, is believed to have been responsible. He was 74 years old. Mr. Scofield was one of the oil operators who laid the foundation for the Standard Oil Co. in Pennsylvania many years ago with John D. Rockefeller. A year ago he retired.

Clarence Hobart McDougall was killed in action in the battle of Arras in May. A graduate of McGill in 1905, he was employed as surveyor at the Snowshoe mine in the Boundary district, in British Columbia. Later he joined the staff of the Consolidated Mining and Smelting Co. of Canada, rising to be superintendent of the Sullivan and St. Eugene mines. He was a member of the Canadian Mining Institute. He was commissioned a lieutenant in the Canadian Engineers about a year ago.

William Bullock Clark died on July 27 at North Haven, Me., aged 57 years. He was born in Brattleboro, Vt., and entered Amherst in 1880, graduating in 1884. He pursued geological studies at the University of Munich, 1884-97 and studied at Berlin and London, making geological surveys of Prussia and Great Britain. He was instructor in Johns Hopkins University, 1887-89; associate, 1889-92; associate professor, 1892-94. He became professor of geology in 1894. In 1888, he was appointed assistant geologist, United States Geological Survey, working on Cretaceous and Tertiary formations of the Atlantic coastal plain. At this time he was requested to prepare the Correlation Bulletin on the Eocene, one of a series of similar reports presented to the International Geological Congress in Washington, in 1891. In 1889, he made study of Eocene deposits of the Far West and investigated the Eocene formation of the Atlantic border. He was geologist on the staff of the Survey, 1894-1907, after which he acted as cooperating geologist. In 1892 he organized the Maryland State Weather Service and became Director. In 1896, he organized the Maryland Geological Survey, since becoming State Geologist. In 1900, he was appointed commissioner for Maryland. In 1906, he was made a member of the Maryland State Board of Forestry and elected as its executive officer, which position he held until his death. Since 1901, he was president of the Children's Aid Society of Baltimore, a member of the executive committee of the State Tuberculosis Association and vice president of the Federated Charities of Baltimore. He was a member of many clubs: The Maryland University, Baltimore Country, Johns Hopkins and city clubs of Baltimore and the Cosmos Club of Washington.

Societies

National Association of Purchasing Agents will hold its annual congress on Oct. 9, 10 and 11 next, in Pittsburgh, Pennsylvania.

American Institute of Metals will meet in Boston on Sept. 25-28. Separate sessions will be devoted to the discussion of crucibles and furnaces, the melting and casting of nonferrous metals, casting in connection with munitions making and the testing of nonferrous metals and metallography. The tentative list of papers includes 32 titles.

Industrial News

Homestead Valve Manufacturing Co., of Pittsburgh, Penn., has appointed the National Mill Supply Co., of Fort Wayne, Ind., as its sole representative for Fort Wayne and vicinity.

Sullivan Machinery Co. announces the removal of its San Francisco office from the Sheldon Building, No. 461 Market St. to the Hobart Building, No. 582 Market St. Ray P. McGrath is manager at San Francisco.

Cleveland-Cliffs Iron Co., has had plans prepared for a new hospital building at its mining headquarters, Ishpeming, Mich. The building, which will cost about \$85,000, will be of brick, three stories high, 50 x 150 ft., and will be completely equipped.

Dodge Sales and Engineering Co. has discontinued its Salt Lake office probably for the duration of the war. Requests for

information, bids or material should be taken up with the company's many Dodge, Oneida, or Keystone dealers or with the Mishawaka, Ind., office.

Asbestos Protected Metal Co., of Pittsburgh, has closed its Cincinnati office temporarily, due to the fact that E. G. Irwin, Cincinnati manager, has entered the Ohio National Guard. Communications should be addressed to the home office, First National Bank Building, Pittsburgh, Pennsylvania.

Ingersoll-Rand Co. announces the election of J. H. Jowett, formerly general sales manager, as vice president of the company. L. D. Albin, formerly assistant general sales manager, was appointed general sales manager. Mr. Jowett and Mr. Albin will continue to make their headquarters at the company's New York office, at 11 Broadway.

Wisconsin Electric Co., Racine, Wis., has on the market the Dumore Portable Grinder for making repairs on hammer and drill parts, for resharpening drill bits, and for regrinding cylinders, deep drawing dies, large gages, etc. It is equipped with a Universal motor, using direct or alternating current, is light and convenient, can be quickly set up in a lathe, milling machine or shaper, and attached to an ordinary lamp socket. Weight 17 pounds.

Western Electric Co. announces the opening of electrical-supply warehouses at the following points: New Haven, Conn., 135 Wood St., representative, Tyler L. Holmes; Baltimore, Md., 425 E. Oliver St., representative, S. Greenfield; Charlotte, N. C., 238 W. First St., representative, R. H. Bouigny. The Seattle office and warehouse has moved into new quarters at 84 Marion St. W. H. Quirk has been appointed manager of the Cincinnati warehouse. W. L. Sioussat will succeed Mr. Quirk as stores manager in the Cleveland house.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alkali Silicates—Process of Decomposing Silicates and Manufacturing Potassium Chloride. Harry Williams Charlton, Jones Point, N. Y., assignor to Kaolin Products Corporation, Va. (U. S. No. 1,234,626; July 24, 1917.)

Blast-Furnace. George L. Colford, Sharpville, Penn., assignor to Blast Furnace Appliances Co., Cleveland, Ohio. (U. S. No. 1,234,630; July 24, 1917.)

Drafting—Blueprinting Machine. Ferdinand F. Metzger, Philadelphia, Penn. (U. S. No. 1,234,554; July 24, 1917.)

Excavating Machine. George Henry Dunlop, Auburn, Victoria, Australia. (U. S. No. 1,234,147; July 24, 1917.)

Iron-Ore Briquettes—Binding Material and the Method of Preparing. Walther Mathesius, Berlin, Germany. (U. S. No. 1,233,384; July 17, 1917.)

Lead—Process of Treating Lead Ores, by sulphidizing surface of minerals. Alfred L. Pelegrin, Tucson, Ariz. (U. S. No. 1,233,398; July 17, 1917.)

Mine-Protection System. Nils D. Levin, Columbus, Ohio. (U. S. No. 1,234,185; July 24, 1917.)

Mining System and Means. John S. Bartlett, Kalamazoo Township, Kalamazoo County, Mich. (U. S. No. 1,233,301; July 17, 1917.)

Ore Concentration. George Albert Chapman, Anaconda, Mont., assignor, by mesne assignments, to Minerals Separation North American Corporation. (U. S. No. 1,234,288; July 24, 1917.)

Pyrometer. Edwin F. Northrup, Princeton, N. J., assignor to Pyroelectric Instrument Co., Trenton, N. J. (U. S. No. 1,234,203; July 24, 1917.)

Rabble-Tooth. Harry H. Stout, New York, N. Y., assignor to General Chemical Co., New York, N. Y. (U. S. No. 1,234,408; July 24, 1917.)

Refractory Ores—Process of Treating Refractory Ores. Stafanus Johannes Vermaes, Delft, Netherlands, assignor to Mijnbouwmaatschappij Aequator, The Hague, Netherlands. (U. S. No. 1,234,426; July 24, 1917.)

Rock-Drill—George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,234,097; July 17, 1917.)

Titanium Oxide—Method for Producing Composite Titanic-Oxid Products. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,234,260; July 24, 1917.)

Editorial Correspondence

BUTTE—July 26

Labor Situation has cleared with respect to the mechanical unions, but the week has passed without any definite conclusion having been reached as to the stand the striking miners' unions are going to take. There were endless meetings between the individual unions, between delegates of such unions with officers of the various mining companies, meetings on which votes were to be cast for or against accepting the proposals of the employing companies, but no general agreement was reached. On July 24 the 14 principal mining companies announced a schedule of wages which they proposed to pay and will probably continue to employ the men as they return without reference to union affiliations.

(By Telegraph—July 31)

Strike Situation Greatly Improved in Butte and with failure of metal trades to endorse the I. W. W. mine strikers, the latter are beginning to realize that they are beaten. The most vicious of their leaders, alleged to be under German pay, have left the district, and the strike is now in the hands of local leaders. A final attempt was made to have the electricians strike again in order to give encouragement to the striking miners, but only a few obeyed the order to walk out and when they saw that all did not quit, they returned to work. Ever since the strike has been on, the operating companies worked only on day shift, but recently night shifts have been added at half a dozen mines, and it is anticipated that in another week practically all miners now in Butte will be back at work. However, several thousand of the best miners left the district, not desiring to become involved in the labor troubles, some going to other camps and many to harvest and hay fields. As there is a scarcity of labor everywhere, it will be months before normal crews can be secured for the mines.

I. W. W. Agitator Hanged in Butte early in morning of Aug. 1.—According to dispatches, six masked men drove in an automobile to Frank Little's boarding house and took him from his room. His body was later found hanging from a railroad trestle. On the body was found a card bearing the old vigilante "3-7-77," with additional inscription as follows:

Others Take Notice. First and Last
Warning

3-7-77. L D C S S W T

City, county and national officers have denounced the lynching and are taking steps to apprehend the perpetrators. Little was a member of the executive board of the I. W. W. and had only recently recovered from an automobile accident in Arizona where he had been engaged in I. W. W. strike work. His conduct was already under investigation by Federal officials, and the report of his reference to United States soldiers as "Uncle Sam's scabs in uniform" in a speech to a miners' mass meeting on July 13 had not increased his popularity in Butte.

DENVER—July 27

New Leadville Tunnel is projected. Leadville is a district in which the benefit of a large drainage and transportation tunnel has been demonstrated, the Yak Tunnel having proved wonderfully successful both productively and financially. Feeling that the large territory lying to the north of the main part of the developed district deserves similar recognition, persons have for years given more or less thought to the inauguration of a similar tunnel project, the portal to be well down along the eastern side of the Arkansas River Valley and the bore to be driven easterly or southeasterly. Last spring, the matter was taken up seriously by Arthur A. Barrett, who caused field surveys to be made and geological maps constructed to show the formations along several proposed routes. The result of this investigation was the conclusion that the project was altogether warrantable but that the tunnel could not be driven straight, it being found that the introduction of several curves or angles will enable the exploration to be maintained in ground that is recognized as favorable for orebodies. He proposes a particular route with a length of 7000 ft. which will bring the breast well into Breese Hill after traversing Canterbury Hill, Evans Gulch and a por-

tion of Yankee Hill. According to his early plans, Prospect Mountain was to receive special attention but it is now evident that it is impracticable to accomplish the deep development of this great mountain and the proposed area on its south with a single tunnel. The site selected for the mouth is about 1½ miles north of the Denver & Rio Grande Ry. station in Leadville, immediately below the abandoned track of the Blue River branch to Breckenridge. The first 600 to 1000 ft. will be driven through wash.

SALT LAKE CITY—July 27

Increased Tonnages are being brought to market from the distant and less accessible camps. An evidence of this is the unusually large number of cars released by the Utah Ore Sampling Co. on July 23 when the number amounted to 32 cars. Twenty cars came from Utah; six from Nevada; three from California; two from Colorado; and one from Idaho.

Federal Copper Investigation as to the cost of production is now under way in this state. Copper mining, milling and smelting, and in particular the operations of the Utah Copper as the largest producer of the state, will be looked into. The men in charge of the work—W. A. Moore, H. A. Steinmetz and A. S. Christian—are in this city. They are being given free access to books, etc. The present investigation is antedated by a similar study made some months before the entrance of the United States into the war under the direction of W. C. Ebaugh of this city for navy and army inventory. Labor conditions also will be gone into. In this connection it is interesting to note that while labor has been more difficult to obtain and less efficient than ever before in this section, there has been little serious trouble and all difficulties arising between employers and employees have been speedily adjusted. In the matter of costs, there are of course to be considered, as well as the high wages prevailing, the supply and quality of labor obtainable.

Shipping from the Cottonwoods—two camps, from which steep grades and heavy snowfall make the matter of transportation more or less of a problem—is now in full force. Shipments from Alta in Little Cottonwood have increased to about 700 tons weekly over the Salt Lake & Alta R.R. running from Wasatch to Midvale, with more ore coming down in trucks. The railroad is replacing its lighter equipment as rapidly as possible with 65-lb. rails to be able to carry a larger tonnage, and it is expected that this work will be completed by September. Properties shipping are the South Hecla, Michigan-Utah, Sells, Emma, etc. Improved haulage conditions in Big Cottonwood are marked by the recently declared dividend of \$125,000 by the Cardiff, the largest shipper there. For many months this property has been seriously hampered by the haulage question—partly owing to bad roads, etc., and partly to the failure of a transportation company, which had contracted to haul the output of this mine. The Cardiff is now bringing down its own ores, using trucks. The daily output has been brought up to 125 tons. Since paying its first dividend in 1915, after developing a large orebody, the company will including the present payment, have paid \$625,000 in dividends.

OATMAN, ARIZ.—July 26

Tom Reed Gold Mines Co. is undertaking to prospect and explore an interesting portion of their property, which consists of the faulted portion of the Aztec vein. This is really the easterly extension of the main Tom Reed vein system, which has been opened up for a distance of over 1500 ft. from the Aztec and Black Eagle shafts. Extending parallel to this vein and several hundred feet south of it, is another vein, which is held by eminent geologists who have made extensive and minute examinations of the Tom Reed property, to be the upper portion of the main vein. The vein opened up from the Aztec shaft does not outcrop at surface. The faulted vein can be traced on the surface for about 4000 ft. and already it has been opened up by cross cuts to a depth of between 400 and 500 ft. It is proposed to use diamond drills from the Aztec workings to complete the pre-

liminary exploration and thus determine extent and contents of the orebodies, if such exist. At the top of the Aztec vein where the fault occurred, the vein is wider than where explored on the 400-ft. level from the Aztec shaft. A raise from the 400-ft. level reached top of the ore at 250 ft. So far as explored by shallow shafts and cuts, the upper portion of the vein appears to be in place and unbroken by the movement that wrenched it from its original position.

AJO, ARIZ.—July 26

Plans for Cooperative Store have been approved by the Board of Directors of the New Cornelia Copper Co. for the benefit of the corporation's employees, according to General Manager Greenway. Local Manager Curley has been turned over the use of a large and substantial store building now ready, and given a credit of \$50,000 for initial stock of goods. He is to employ a capable store manager and start the business at as early a date as possible, charging prices comparable with those known in other Arizona mining camps. No employee will be forced to trade at the store. At the end of each year, after deduction of the actual operating cost, which shall include interest to the mining company for its advances, at 6%, the balance is to be divided among the employees of the mine and railroad in the proportion in which they have made purchases, no participation to be enjoyed in the profits by men of less than 4 months' employment. Dividends of men who have quit during the year will be divided among those who remain. The mining company will make no money whatever from the enterprise. In the event it proves unsatisfactory, the company reserves the right to withdraw at any time. Suggestion is made that the Board of Directors of the store company invite the election of a committee of seven from the employees, to advise monthly with the store manager. It is hoped that the plan will actually lower the cost of living, attach good and steady workmen to the camp and will avoid the charge, made in other camps, that the mining companies, in mercantile profits, are returning to themselves a material part of the wages paid.

HIBBING, MINN.—July 27

State Mine Shipments, according to reports given out by F. A. Wildes, State Mine Inspector, at Hibbing, for the week ended July 15, exceeded all previous records in output for this season. The total of 179,777 tons of ore was shipped to the head of the Lakes. The shipments were as follows: Shiras mine, Buhl, 12,006 tons; Leonidas mine, Eveleth, 28,985 tons; Mesa-be Mountain mine, Virginia, 13,296 tons; Smith mine, Hibbing, 10,800 tons; Philbin mine, Hibbing, 4746 tons; Wanless, Buhl, 3680 tons; Woodbridge mine, Buhl, 14,190 tons; Frantz mine, Buhl, 3150 tons; Hanna mine, Mountain Iron, 9675 tons; Helmer mine, Kenney, 8178 tons; Deacon mine, Kenney, 4674 tons; Pool mine, Hibbing, 44,350 tons; Hill Annex mine, Marble, 15,075.

HOUGHTON—July 28

Two Militia Companies, part of the Michigan battalion of engineers, will go into camp at Houghton for two months' training, although their equipment is not expected for another week, and they probably will be called upon in the event of serious trouble with an I. W. W. outbreak. The mining companies are preparing to meet the labor issue and men who can be thoroughly trusted have been selected tentatively to help guard property and lives.

JOPLIN—July 28

First Aid Contest, held here July 4 has produced good results almost immediately. W. A. Lynott, who has work in charge, reports that 21 mining companies have ordered stretchers for their plants, while a total of 43 first-aid cabinets have been purchased.

Development of New Field is being attempted by Joplin operators, in what is known as the Elk Valley region, about 18 miles south of Springfield, Mo. There has been shallow mining in this region for a number of years, but in recent months it has been shown that there also are deeper runs. Gillis & Fink, who went there about

a year ago and have been operating a small mill, have been doing so well that a modern concentrating plant has now been ordered. In part, the production is a high-grade carbonate of zinc.

Increase in Oklahoma Output is the most important feature of the recent operations in the Joplin district. Turn-in for last week amounted to over 8,000,000 lb. of blende and 1,700,000 lb. of lead concentrates. A few years ago there were numerous weeks when Joplin's total output did not exceed this amount. Besides, a number of companies in the Oklahoma field are holding ore, one mine alone having 2500 tons in its bins. This big increase in output is having a bad effect on market, particularly on the sheet-ground mines of the Webb City-Carterville section. A number of these have been closed down and more will have to close. While there are many rich producers in the Oklahoma field, it is also true that a number are little richer than mines of the older camp.

WASHINGTON—July 30

Arkansas Manganese Production has grown in a recent month than the entire output of the United States in a year before the war, so the domestic manganese situation is regarded as far from hopeless by W. C. Phelan, of the U. S. Bureau of Mines, who is making a personal visit to most of the manganese deposits of the country. While many manganese districts have failed to respond to prices which are from double to four times higher than they were when imports were unrestricted, this is not true of the Arkansas region which lies in Independence and Izard Counties of that state. These deposits have been known for many years and their development is entirely a result of the increase in price.

Oil-Land Leasing Bill is being delayed by hearings almost wholly devoted to proposed relief and remedial provisions. Max Ball, formerly chairman of the oil board of the Geological Survey, but now with the Roxana Petroleum Co., urges that additional hearings be granted. He claims that the general provisions of the bill were lost sight of in former hearings. These general provisions, he says, apply to an area so much greater than the relief provisions and are of so much greater importance to the public and to America's supremacy in the petroleum industry that those best qualified regarding the terms and conditions of fu-

ture leases should be heard. Senator Henry L. Myers, the chairman of the committee on Public Lands, is opposed to additional hearings, but Senator Reed Smoot urged that Mr. Ball's request be granted.

Sources of the Rarer Metals have been investigated lately by Frank L. Hess, of the U. S. Geological Survey. He reports that there has been a marked increase in the general interest, and especially in the prospecting for, the rarer metals. As to the little-developed metals, such as antimony, he concluded that the United States can rely on domestic sources for one-half of its present needs of antimony. The largest portion of domestic antimony comes from the antimonial lead ores. The great bulk of imported antimony comes from China, but the United States has nearer sources in South America and Mexico, from which increasing imports are coming. In case of necessity, Mr. Hess believes that satisfactory substitutes for hardening lead, one of the chief uses of antimony, may be found in using calcium, barium, strontium, magnesium and copper. The United States could produce 3000 tons of nickel ore from domestic deposits, provided the necessity existed and the matter of costs were a secondary consideration. With regard to tungsten, Mr. Hess says: "High-water mark in the production of tungsten ores in this country may have been reached, but it is not impossible that under the incentive of prices reaching, say, \$35 a unit, and the added zest of patriotism, the figures for 1916 might be exceeded."

Inventory of War Minerals is being made by the Committee on War Minerals, of which William Y. Westervelt, of New York, is chairman. The committee hopes to be able to ascertain whether necessary supplies of war minerals can be developed commercially by private capital, or whether the development should be fostered by the Government and if sufficient shipping for imports must be provided. One of the chief aims of the committee is to convert generalities into exact statement of fact. If it is advisable, for example, to use a part of the shipping for the pyrites trade, the committee hopes to point out the fact with a definiteness that may be the basis of intelligent action. Again, it is believed that manganese and pyrites sufficient for urgent needs can be developed domestically if necessity should arise, yet the committee wants more information before accepting

that belief. It is therefore making a careful inventory of American resources of pyrite, sulphur, manganese, manganiferous iron ore, lead, nitrate, chromite, tin, nickel, platinum, flake graphite, sheet mica and high-grade refractory clay. Through cooperation of mining engineers and geologists in all parts of the country, the committee expects to amass in a few weeks the up-to-date economical information, which, linked with the data already in the hands of the American Institute of Mining Engineers, the Geological Survey and the Bureau of Mines, will enable it to reach definite conclusions that will permit the Government to outline a definite policy as to war minerals.

TORONTO—July 28

Manganese Deposits have been opened in the Cypress Hills in southeastern Alberta. Operations have been progressing for some time in charge of James F. Reilly, of Montreal, who is stated to represent the Hersey and allied interests. It is reported that 800,000 tons have been indicated by the work done during the last few months. The ore is of good grade and is disposed of to the British War Office. Shipments of the ore are being made as rapidly as transportation facilities permit.

Steel Company of Canada, the headquarters of which is at Hamilton, Ont., is the only large Canadian steel-making company which does not control the sources of its raw material. At a meeting of the directors on July 12, an important change of policy was decided upon. The company in association with American interests proposes to acquire iron ore and coal properties located in the Eastern States, from which they can draw supplies, and to establish a large coke-producing plant in Hamilton of a capacity of about 800 tons per day.

Spectacular Gold Find has started a rush of prospectors into Rickard Township, about four miles south of the Abitibi River and 12 miles east of Iroquois Falls. It was made by two Swedes, who were cruising for pulp-wood timber. Three veins, ranging from 4 to 20 ft. in width, have been uncovered, the gold occurring in white quartz, which shows little other mineralization. The rock outcrop covering about one square mile has already been staked, and as the surrounding area comprises a number of veteran claims which are not open for mining locations there is little opportunity for prospectors.

The Mining News

ALASKA

ALASKA UNITED (Treadwell)—Ready Bullion mine produced in May, 24,346 tons ore yielding \$44,413, or about \$1.84 per ton; operating expense, \$42,456; operating profit, \$1956; construction expense, \$4193; net loss, \$2236; sundry income, \$1340. The 700-ft. claim mine recovered from earth and around mill 44 tons concentrate yielding \$4869; operating expenses, \$2254; operating profit, \$2614; construction expenses, \$1187; net profit \$1187; other income, \$1340. No ore crushed at 700-claim.

ALASKA GASTINEAU (Juneau)—This mine and the mill at Thane, about mile south of Juneau, having difficulty getting labor to bring production up to anticipated tonnage. At present some ore being obtained from open pits back on mountain. Bartlett Thane, who developed property, is no longer actively connected with management. Is working extension of Alaska Juneau ore zone. Physical conditions seem to be more favorable to low costs at Juneau. Latter mine is protected on practically all sides from caves bringing in barren wall and surface rock.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—Report for quarter ended June 30 showed metal production as follows: Copper, 3,824,297 lb.; lead, 588,491 lb.; silver, 52,587 oz.; gold, 483 oz. Gross operating cost per pound of copper, 14.724c.; less operating credits, 2.485c.; net cost, 12.239c. Dry tons copper ore mined, 39,591; lead ore, 1412 tons. Production in April and May about normal, but June output was cut off June 27 when I. W. W. miners' union called strike. Low-grade manganese ores opened on 100, 200 and 300 levels.

Mohave County

I. W. W. PROBLEM in Chloride solved by mine operators and International Union of Mine, Mill and Smelter Workers reaching agreement as to wages and conditions, in return for which union agrees to support operators in efforts to eradicate turbulent element. All is peaceful in district, with every reason to believe condition will continue.

RATTLESNAKE (Chloride)—Stopping carload gold-silver-lead ore for shipment to Selby smelter. F. E. Braly, superintendent.

KEYSTONE (Chloride)—Mill being re-modeled by F. W. Sherman to treat dump ores. If results of experimental work are satisfactory, the mine will be reopened.

WEST STAR (Chloride)—Leased and bonded to E. J. Carter and associates of Chloride. G. R. Harkness, superintendent. Sinking operations begun July 10. Shaft down 60 feet.

UNION METALS CO. (Chloride)—Sinking shaft on Fredonia group sideling the Golconda. At 40 ft. cut oreshoot carrying silver and copper. J. P. Ryan, general manager.

WESTERN ORE CONCENTRATION CO. (Chloride)—The Steffy custom mill now complete, ready to run when the 1000-ft. wooden pipe line is completed to provide reserve water supply. F. E. Steffy, general manager.

MINNESOTA-CONNOR (Chloride)—P. S. Virgin, superintendent. Hauling 200 tons dump ore to Steffy mill for test run. Mine workings unwatered. Further development depends on result of mill run.

NEW TENNESSEE MINING CO. (Chloride)—Opened up 4 to 5 ft. gold-lead ore at 235-ft. point in shaft. Top of shoot

struck at 210-ft. point improving except few feet where vein pinched. Has widened again to 5 ft. G. J. Ridenour, superintendent.

UNION BASIN MINING (Chloride)—Operating Golconda mine, John Wanvig, Jr., superintendent, met with International Union officials, raised wages to Chloride scale. Union agreed to furnish miners in any numbers. I. W. W. element ordered out of camp. Evidently band sent into this region for purpose of tying up mines has been scattered and thoroughly defeated by harmonious efforts of operators and union miners.

UNITED EASTERN (Oatman)—First semi-annual report by Gen. Supt. J. A. Burgess shows total of 37,565 tons of ore treated; gross value, \$793,497 or \$21.12 per ton; extraction was 96% and net profits for period, \$491,130. Developments on the 665-ft. level of the mine have opened orebody for 650 ft. On the 400-ft. level of the Sunnyside, orebody 15 ft. wide has been opened for 340 ft. west from shaft. The Sunnyside lies south and west of the Telluride where an important orebody was opened 10 days ago. It is controlled by the same interests as United Eastern. This discovery is at a point three miles from the United Eastern shaft.

Pinal County

ARIZONA & BUTTE (Ray)—Station completed at 200 level and 90 ft. of crosscut driven.

MCCALLUM (Ray)—Property north of Ray Lead Development Co. leased by James Pollard. Shipping ore to El Paso.

RAY LEAD (Ray)—Shipping four cars a week. Doing considerable development work. Shipments limited by transport facilities.

ARKANSAS

Baxter County

LOST JACK (Cotter)—Work started by Owan and Wood of Yellville, who will develop.

OHIO-REYNOLDS (Cotter) — The Ohio mine owned by Dr. Drennon at Rush, and Reynolds mine owned by R. R. Reynolds of Buffalo, have been consolidated. Both are situated in the Hall Mountain camp near this place.

Roone County

MARGUERITE (Everton)—Sold by Potts & Hoye, to Oklahoma men, who will build mill.

Marion County

NORTH STAR (Yellville)—New 50-ton mill ready.

BEN CARNEY (Rush) — Leased by Capt. George Chase, who has started tunnel.

WHITE EAGLE (Rush)—Operated by Yellow Rose Mining Co.; mining and milling with three eight-hour shifts.

MONTA VISTA (Buffalo)—Under lease to W. N. Anderson. Development work showing heavy deposits of jack and carbonate.

ARKANSAS-SOUTH CAROLINA (Rush) — This company installing development plant at Hawkey mine, on Clabber Creek. May build small mill this fall.

PRODUCTION from the northern Arkansas zinc and lead field for the month of June was: 5,475,000 lb. zinc and lead ore; 190,000 lead, balance zinc. Field produced for first six months this year, 24,362,000 lb.; 3,000,000 in mine bins. Increase of 33 1/2 per cent. over same six months last year.

Newton County

LOST MOUNTAIN (Cavecreek)—This lead-zinc mine leased by W. O. Krueger, formerly with Old Confederate.

ELEVENTH HOUR (Ponca)—Producing carbonate of zinc. Sold by H. J. Vancil to Victor Primrose and associates who will continue operations.

CALIFORNIA

Calaveras County

CALAVERAS COPPER CO. (Copperopolis)—Damage by recent burning of transformer house repaired and mine in operation. Old dumps are also being treated. Employ 125 men. S. M. Levy, manager.

SHEEPRANCH (Sheepranch) — W. B. Thompson, C. S. Jennison and H. Robinson Plate, of New York, have formed a syndicate to unwater and explore this old mine, with idea of equipping same with 200- to 250-ton milling plant if developments warrant. The Sheepranch mine was formerly operated by the Haggin-Hearst-Tevis interests and is reputed to have made a production of about \$4,000,000. Since then, it has had a checkered career, having been in hands of several companies of limited financial means. Mine had 1350-ft. shaft with winze from 1300 level to the 1550-ft. point. Fissure vein, about 5 ft. wide, in Calaveras slate, is estimated to contain about \$6.30 in gold. In former mining ore was sorted underground and as some of the quartz is dark, it is assumed that considerable loss arose from inability to distinguish this quartz from the black slate; there was also considerable loss from "high-grading." Ore-shoots were about 1500 ft. in length. H. Robinson Plate, in charge of new work.

Del Norte County

CHROME MINING CLAIMS on French Hill, Crescent City, being developed by G. S. Barton, R. J. Rowen and M. E. Young, of Grants Pass. One working developed 5000 tons of ore. Shipments will be made by auto-trucks to Crescent City, then by water to San Francisco. Ore runs 50% and over.

Mariposa County

QUARTZBURG MINING CO. (Mariposa) — Permitted to issue 60,000 shares common stock for mining claims in Quartzburg district and to sell 40,000 preferred shares for additional equipment.

COLORADO

Chaffee County

PARAMOUNT REDUCTION CO. (St. Elmo)—Mill being overhauled following test run on ore from Flora Belle mine. Capacity will be 75 tons daily.

Dolores County

RICO-ARGENTINE (Rico) — Block of ground leased to Marmatite Mining and Milling Co., which is working 20 men.

BERTHA S. (Rico) — Good-grade lead carbonate ore assaying well in silver opened

in development work. Work temporarily suspended on account of water flow.

Gilpin County

FRANCIS (Central City)—Telluride of gold ore opened recently, similar to that produced by War Dance mine, of which Francis is probably extension.

POWERS (Central City) — Unwatered; lessees to resume work at once.

EUREKA (Central City) — Shaft down 700 ft. and will be sunk to 1000-ft. level. Remodeled mill making satisfactory recovery.

Lake County

MINES CLOSED as result of strike called July 21, but pumps are being kept going. Situation growing more serious and pumps may be pulled at certain mines.

TWIN LAKES DISTRICT slow in opening this year on account of late spring. Fidelity mine being reopened; shipped high-grade ore last autumn. Work on Miller and Lincoln Highway mines resumed. Latter being developed by Colorado Springs men. Lincoln Highway (automobile road) will be completed to Everett this autumn, and will help in opening Twin Lakes.

Mineral County

EQUITY CREEDE MINING CO. (Creede)—Being developed by Pueblo, Colo. men. Plant and machinery will be installed this summer.

Ouray County

U. S. SMELTING, REFINING AND MINING CO. is making canvass of possible production from Ouray and Red Mountain districts to determine advisability of reopening the smelting plant at Ouray.

BARSTOW (Ouray)—This Red Mountain mine being operated by lessees; mill to resume at once.

MOUNTAIN TOP (Ouray)—Underground mill now treating 25 tons daily. Expected to increase capacity by changes in equipment.

VERNON (Ironton)—Grading for new 60-ton mill under way. Good-grade copper-silver ore opened in development work in 4 parallel shoots. Mine work temporarily suspended until mill construction finished.

Pitkin County

NEWMAN TUNNEL (Aspen)—Local stock company formed and 10-year lease secured on old Newman mine, formerly heavy silver-lead producer. Tunnel will be driven to open and unwater property at depth.

San Juan County

BANDORA (Silverton)—In Ice Lake Basin sold recently to Eastern men.

ELK (Silverton)—Compressor and transformer being installed. Gold-silver-copper ore opened in 1200-ft. tunnel.

Summit County

JUNE GOLD OUTPUT of dredges in Breckenridge district was \$175,000. No. 1 dredge of Tonopah Placers Co. operating near Colorado & Southern R.R. tracks, which cross valley just south of ground being dredged. As drilling in upper Blue River district, south of the ground now being dredged, proved gravel to be good grade, railroad right of way may be changed to let dredge past. Cleanups now made on dredges every 10 days, as they have been working in richer gravel lately.

PIONEER CONSOLIDATED (Breckenridge)—Mill running full capacity and making good extraction.

JUNE BUG (Breckenridge) — Lessees mining ore assaying 240 oz. silver in this Gibson Gulch property.

JESSIE (Breckenridge) — Additions to milling equipment will be made. Mine crew being increased. Sufficient ore developed to keep mill operating full capacity.

Teller County

SEMIMONTHLY PAY DAY will be established in Cripple Creek district in near future.

KOMAC (Cripple Creek)—New leasing company organized to work Victor mine; operations under way.

ECLIPSE LEASING (Cripple Creek)—Operating Jo Dandy mine under long-term lease; shipping good-grade ore. Shaft sunk from 500- to 800-ft. level, and development work on 600- and 700-ft. levels.

BEACON & RAVEN HILL GOLD MINING CO. (Cripple Creek)—Driving 250 ft. by contract from Roosevelt tunnel to cut extension of oreshoot worked to depth of 700 ft. in Elkton mine adjoining. This lateral will cut vein at considerably greater depth than worked formerly.

MICHIGAN

Copper

SOUTH LAKE (Houghton)—July shipments expected to average nearly 200 tons daily.

SENECA (Calumet)—Preparing for installation of second-hand 4000-ft. hoist recently purchased. Will also install second-hand compressor. Shaft sinking will begin in a few weeks.

Iron

STRIKE OF MINERS on Gogebic Range began July 30. Colby and Ironton mines of Corrigan-McKinney Co. among those affected. I. W. W. agitators arrested, and state constabulary is assisting in preserving order.

MINNESOTA

Cuyuna Range

DOCKS AT ST. PAUL for Cuyuna Range ore are being discussed. Ore may be transported down Mississippi River. Proposed use of bridge of St. Paul Bridge and Terminal Co. approved.

CONGDON-ADAMS (Riverton)—Drilling on 240 acres by Tod-Stambaugh Co. discontinued. Showed important manganese ore deposit.

JOAN MINING (Duluth)—Sank shaft 60 ft. to rock in 14 days. Shipments will begin as soon as spur track is completed to property in NE 1/4, SE 1/4, Sec. 32-47-29. Mine electrically equipped. Owned and operated by M. L. Fay of Duluth.

Mesabi Range

DUNCAN (Chisholm)—This State lease, held by the Oliver company, made its first shipment recently. Not more than 5000 tons will be shipped from this property this season. Shipments also started from the Glen openpit; one steam shovel loading ore.

HULL-RUST (Hibbing)—Range loading records were broken at this Oliver operation recently when 200 forty-five-ton cars were loaded by one crew in a 10-hour shift. There are 18 shovels working at this pit and 16 locomotives hauling ore and overburden.

WARREN (Hibbing)—Leased from the Great Northern by Todd-Stambaugh interests. Shipped its first ore July 26. Mine is west of the Leetonia and was stripped by Winston Dear Co. with a 350-ton Marion dragline excavator, the first to be used on the Mesabi range. The cleanup work was done by an ordinary light-weight shovel.

MIDGET (Hibbing) — This new mine, west of Hibbing and owned by G. G. Hartley of Duluth, Carver Richards, range superintendent, shipped its first ore from its pit via the Duluth, Mesabe & Northern to the docks last week. Expects to ship about 75,000 tons this season.

MARGARET (Buhl)—New Butler Bros.' property near the Wanless mine, is to be developed as an openpit by using one of the large 350-ton shovels which the Butlers were first to introduce on the range. Mine will not develop into large property; its total ore reserve less than 1,000,000 tons.

MISSOURI

Joplin District

ARISTA (Racine)—Opening promising silicate mine at depth of from 20 to 40 ft. Small mill completed.

BIG EIGHT (Galena, Kan.)—Plans to erect mill on new lease south of Baxter Springs, Kan., where 13 drill holes have been put down.

U. S. PAYMASTER (Joplin)—Planning second mill in Bell Center, Mo., camp. Ore giving 6% blende recovery. J. W. Martin, Newport, Ark., president.

LUCKY SEVEN (Afton, Okla.)—Preparing to build 300-ton mill, Baxter Springs, Kan. Shaft sinking now under way. J. C. Tucker, Afton, manager.

E. & N. (Duenweg)—With new 150-ton mill, making four to six car loads of blende concentrates monthly. A 16-ft. face being mined. W. P. Eberlein one of owners.

WHITE (Picher, Okla.)—Now handling 3500 tons of ore weekly; when fourth shaft is down, will increase to 4500 tons. Averaging 4% recovery. Adjoins Picher-Netta tract.

OLD CHIEF (Commerce, Okla.) — Fire destroyed mill, July 8. Worley & Co., owners, believe it of incendiary origin. Valued at \$30,000 with \$11,000 insurance. Not known if plant will be rebuilt.

LUCKY TIGER (Neck City)—Purchased 96-acre lease east of Picher, Okla., from J. W. Barnes, Baxter Springs, Kan., for reported consideration \$40,000. Only slight development on tract, but surrounded by good mineralized land.

MONTANA**Deer Lodge County**

CABLE MINING CORPORATION (Cable)—Purchased entire assets of Cable Consolidated. Fund of \$125,000 for exploration to be obtained by assessment.

Lewis and Clark County

COFFEE (Helena)—Made shipment of rich silver-lead ore to smeltery.

TRUE FRIEND (Helena)—New hoist in place; sinking below 150-ft. station.

CRUSE CONSOLIDATED (Helena)—Drifting on ore at 150-ft. level. Crosscutting to foot wall from shaft at 150 level.

SCRATCH GRAVEL (Helena)—New 200-gal. pump in place. Rich gold ore coming from 300-ft. level. Winze to be sunk on oreshoot.

ST. LOUIS (Marysville)—Putting 80 tons ore through continuous cyanide plant per day. Ore from old stopes in Drumhomon mine. About 40 men employed.

Madison County

MANGANESE vein, carrying up to 20 oz. silver opened in Ruby Mountains by P. E. Harriman, of Virginia City. Butte men will develop.

MISSOURI (Virginia City)—Moving Easton-Pacific mill to this mine at head of Meadow Creek. About 20 men working. J. H. Panket superintendent.

CHOWNING MANGANESE (Ennis)—J. W. Chowning is employing about 15 men at this Cherry Creek mine. Ore will be hauled by motor truck to Norris.

REVENUE CONSOLIDATED GOLD MINES CO. (Norris)—Revenue group on Richmond Flats employing about 20 men in mine. Mill being remodeled. G. D. B. Turner, superintendent.

MADISONIAN (Norris)—G. D. B. Turner, superintendent of Revenue Consolidated, has acquired control of this property from Leiter Estate, of Chicago, and will unwater 400-ft. shaft, install hoist and electric power.

Silver Bow County

DAVIS-DALY (Butte)—Butte-Detroit mill being remodeled to handle manganese ore recently opened in Hibernia and New Republic mines.

NORTH BUTTE (Butte)—As result of recent fire, suit was brought by John Werta and Y. Johnson to recover \$22,000 and \$27,000 respectively for suffering and impairment of health due to the fire. Both men were rescued after having been imprisoned in the mine for 36 hr. without water or food. They charge the company with not providing proper means of escape.

NEVADA**Esmeralda County**

GOLDFIELD CONSOLIDATED (Goldfield)—Net realization in May was \$10,186 from 23,300 tons; costs per ton total ore, \$5.704. Leasers produced 831 dry tons having gross value of \$12,080, from which company received \$4767 net. Company did 1186 ft. of development at cost of \$6.51 per ft.

Nye County

TONOPAH ORE PRODUCTION for week ended July 21 was 9290 tons, valued at \$167,220, comparing with 8902 tons for previous week. Producers were: Tonopah Belmont, 2723 tons; Tonopah Mining, 2000 tons; Tonopah Extension, 2380 tons; Jim Butler, 800 tons; West End, 1034 tons; Rescue, 192 tons; Montana, 106 tons; Cash Boy, 55 tons.

MANHATTAN MUSTANG (Manhattan)—Train Chase lease preparing 200 tons to be treated at War Eagle mill.

MANHATTAN MORNING GLORY (Manhattan)—No. 3 shaft now 65 ft. deep in ore. Gasoline hoist and Jackhammer drill being installed. Main shaft 175 ft. deep; bottom in limestone.

WHITE CAPS EXTENSION (Manhattan)—The Hendrie Bolthoff No. 4 hoist with 40-hp. motor, formerly at the Booth shaft in Goldfield, will be installed at once. Chicago Pneumatic G C B compressor and five Jackhammer drills also to be used. Shaft 58 ft. deep. Headframe now ready to be erected.

WHITE CAPS (Manhattan)—Station being cut at fifth level. Will be 14 x 13 x 45 ft., with additional pocket for pump—a Platt 7 x 12-in. triplex, gear driven by 50-hp. motor; capacity, 210 gal. per min. under 700-ft. head. Dreadnought drills now being used in cutting station as ground has become harder. Chutes being driven from third to second level for drawing ore from second-level stopes. Preliminary testing of mill now being made.

OREGON**Josephine County**

OSGOOD (Waldo)—Carload of gravel shipped from this placer mine in Allen Gulch for test. J. T. Logan, manager.

PRESTON PEAK (Waldo)—This copper mine using new diamond drill recently purchased. Owned by Chicago stock company. Mr. Hooper, manager.

TURK (Takilma)—Copper mine owned by Grants Pass Hardware Co., Grant Pass, Ore., being prospected under option by M. A. Delano.

QUEEN OF BRONZE (Takilma)—Final payment of \$60,000 made on this copper mine, purchase price being \$150,000. Formerly owned by Chas. F. Tutts of Colo. Spgs. Sold to six men: John Hampshire, John Towhy, R. B. Miller, M. S. Boss, T. F. Ryan and Roy H. Clarke. Corporation will be formed at once and property operated as stock company. Ore shipments in little more than year amounted to \$1,283,000, according to smeltery returns. Low-grade ore is being sorted and put on dump for concentration later. About 700 tons of ore per month shipped for some time. There are 14 team outfits hauling ore to bunkers at Waters Creek. John Hampshire of Grant's Pass is general manager.

SOUTH DAKOTA**Lawrence County**

TWO JOHNS (Trojan)—Supplying from 40 to 50 tons daily of good milling ore. Property under lease to Mogul Company.

GOLD DOLLAR (Trojan)—Leasers making regular shipments to Trojan mill. Ore hauled from mine to railroad by motor trucks.

CUSTER PEAK (Roubaix)—Contract let for sinking shaft additional 200 ft., making total depth of 500 ft. Concentrator being erected.

OPER-MOGUL TUNNEL (Trojan)—Has reached distance of 500 ft. Raises will be driven to upper workings and will afford more economical method of ore transportation.

WASP NO. 2 (Flatiron)—Coarse crushing 500-ton cyanide plant being wrecked. Quartzite ores found with lower depths require fine grinding. Building will be retained and if development warrants, new process will be installed. Development of gold and tungsten deposits will be continued.

Pennington County

GOLDEN SUMMITT (Hill City)—Shaft reached 275 ft. and several hundred feet of lateral work done. Expert main ore-body will be cut soon. Larger hoist installed.

WHITE SWAN (Hill City)—Werlick and Hayes shipped 100 tons tungsten ore to American Tungsten plant and same being concentrated. Reported to have large body of 2½% material. So far ore taken from open cuts.

UTAH**Salt Lake County**

HOWELL (Salt Lake)—Tunnel in 600 ft. showing mineralization. Being driven to set under ore opened in old workings. Near the Cardiff.

CARDIFF (Salt Lake)—Shipping 125 tons daily. Winze following ore downward from main-tunnel level has reached depth of 135 ft. (735 ft. from surface).

GARFIELD CHEMICAL AND MANUFACTURING CORPORATION (Garfield)—Producing 150 tons of sulphuric acid daily, the addition to plant having been completed. Original capacity, 100 tons.

COLUMBUS-REXALL (Salt Lake)—Recent strike—1350 ft. below surface and 500 ft. in from portal of tunnel—has in two weeks produced 60 tons of good-grade ore. Find is 300 ft. below Cardiff main tunnel level and is in "Cardiff" limestone, not far from quartzite contact.

UTAH COPPER (Bingham)—In spite of high costs, earnings first half of 1917 were good. First quarter, \$7,246,819 or \$4.46 per share and second estimated at \$9,607,442, or \$5.89 per share, making for first half of year rate of \$10.35 per share or annual rate of \$20.70, as compared with a little over \$24 a share in 1916. June copper production was 19,909,097 lb., comparing with 17,877,432 lb. in June, last year.

MONTANA-BINGHAM (Bingham)—Concentrates from first unit of new flotation mill at Fortuna workings, amounting to about \$2000 daily. Work on second unit being pushed. Fortuna vein expected to be cut by Montana-Bingham tunnel in week or two. Work in Bingham-Amalgamated—one-fifth interest owned by Montana-Bingham—being resumed on 300 level. Congor, connecting with Bingham-Amalgamated tunnel, making regular shipments.

Summit County

PARK CITY SHIPMENTS for week ended July 20 were 3,626,500 lb. There are nine shippers, among which the California-Comstock was represented, following reopening under new operating conditions.

DALY (Park City)—Increasing shipments. Shipped 160 tons week ended July 20.

PARK CITY KING (Park City)—Two streaks of ore in face of tunnel, which is in 160 feet. Company recently organized to develop large acreage crossed by three fissures.

Utah County

PACIFIC (American Fork)—Fissures Leasing Co. has about completed new mill building. Machinery yet to be installed. Car of high-grade ore being loaded.

WASHINGTON**Stevens County**

NORTHPORT SMELTING AND REFINING (Northport)—A 900-electrode Cottrell precipitation plant is being built at this works. Building will be 150x75 ft. and about 85 ft. high. Present loss said to be \$600 daily.

CANADA**British Columbia**

GRANBY CONSOLIDATED (Grand Forks)—Arranging to resume smelting at this copper works; closed several months on account of coke shortage.

CANADA COPPER (Greenwood)—Making arrangements to blow in its smeltery about Aug. 1. Closed owing to shortage of coke resulting from coal-miners' strike in Crow's Nest Pass district.

CANADA**Ontario**

ORE SHIPMENTS from Cobalt over the Temiskaming & Northern Ontario Ry., as reported by Arthur A. Cole, mining engineer, for June were: Aladdin, 74 tons; Beaver, 37; Coniagas, 79; Dominion Reduction Co., 220; Hudson Bay, 33; Kerr Lake, 42; La Rose, 87; McKinley-Darragh, 172; National, 20; Nipissing, 663; O'Brien, 28; Penn Canadian, 52; Right-of-Way, 43; Temiskaming, 36; Trethewey, 22; total for Cobalt district, proper, 1614 tons; Miller-Lake-O'Brien (Gowganda) 52; total silver ore, 1666 tons; nickel ore, Alexo mine (Porquies Jctn.) 423 tons.

ADANAC (Cobalt)—High-grade ore found on this property which adjoins Temiskaming.

WHITE RESERVE (Maple Mountain)—A 2-in. vein carrying good ore encountered at 140-ft. level.

KIRKLAND LAKE (Kirkland Lake)—Will install mill of 150 tons capacity. Shaft now down 700 ft.

DOME (South Porcupine)—Mill tonnage up to 1500 tons per day, most of which comes from glory hole and is low grade.

BOSTON HOLLINGER (Boston Creek)—Sold to men interested in the Ross Rifle Co., of Quebec, who will install a plant at once.

PLENAURUM (Porcupine)—Diamond drilling begun to ascertain whether ore-bodies of the Jupiter continue on this territory at depth.

VIPOND-NORTH THOMPSON (Timmins)—The orebody cut some weeks since at 600-ft. level, 24 ft. wide, has been drifted on 50 ft., maintaining its width and gold content.

WHELPLEDALE VETERAN (Cobalt)—Trenching on this property, north of Gillies Lake, uncovered four new veins. Shaft being sunk and crosscutting will be done at 100-ft. level.

NIPISSING (Cobalt)—Shareholders' meeting to be held at Augusta, Me., on Aug. 21 to consider proposition to eliminate the American company and continue only the Nipissing Mines Co., Ltd., of Ontario. Surmised that imposition of war taxes in both countries led to the proposal.

LAKE SHORE (Kirkland Lake)—Will sink another 100 ft. and again crosscut under lake to explore veins that have developed so well from 200-ft. level crosscut, where shoot is now over 150 ft. long.

MEXICO

CIE. DU BOLEO (Santa Rosalia, Baja Calif.)—Production for June amounted to 1,740,500 lb. copper. Grade of ore, 3.81%.

GREAT BRITAIN

COMMANDERING OF IRON MINES of the counties of Cumberland and Lancaster, by the British minister of munitions, announced in cable dispatch of July 31 from United States Consul General Skinner, of London.

The Market Report

Metal Markets

| SILVER AND STERLING EXCHANGE | | | | | | | |
|------------------------------|--------------------|-----------------|---------------|--------|--------------------|-----------------|---------------|
| July | Sterling Ex-change | Silver | | July | Sterling Ex-change | Silver | |
| | | New York, Cents | London, Pence | | | New York, Cents | London, Pence |
| 26 | 4.7556 | 78½ | 39½ | 30 | 4.7556 | 78½ | 39½ |
| 27 | 4.7556 | 78½ | 39½ | 31 | 4.7556 | 78½ | 39½ |
| 28 | 4.7556 | 78½ | 39½ | Aug. 1 | 4.7556 | 79 | 40½ |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

| July | Copper | | Tin | | Lead | | Zinc |
|--------|---------------|------|-------|--------|--------|--------|------|
| | Electro-lytic | Spot | N. Y. | St. L. | St. L. | St. L. | |
| 26 | 24½ | 62½ | 10½ | 10½ | 8½ | 8½ | |
| 27 | 25 | 63 | 10½ | 10½ | 8½ | 8½ | |
| 28 | 26½ | 63 | 10½ | 10.50 | 8½ | 8½ | |
| 30 | 27 | 63½ | 10½ | 10.90 | 8½ | 8½ | |
| 31 | 27 | 63½ | 10½ | 10.90 | 8½ | 8½ | |
| Aug. 1 | 27 | 63½ | 10½ | 10.90 | 8½ | 8½ | |

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

| July | Copper | | Tin | | Lead | | Zinc |
|--------|----------|---------------|------|--------|------|------|------|
| | Standard | Electro-lytic | Spot | 3 Mos. | Spot | Spot | |
| 26 | 125 | 124½ | 137 | 241½ | 238½ | 30½ | 54 |
| 27 | 125 | 124½ | 137 | 243½ | 240 | 30½ | 54 |
| 28 | 125 | 124½ | 137 | 246 | 242½ | 30½ | 54 |
| 30 | 125 | 124½ | 137 | 247 | 243 | 30½ | 54 |
| 31 | 125 | 124½ | 137 | 247½ | 243½ | 30½ | 54 |
| Aug. 1 | 125 | 124½ | 137 | 247½ | 243½ | 30½ | 54 |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21c.

NEW YORK—Aug. 1, 1917

All of the markets were stronger this week, this being most noticeably the cases with copper and lead. However, transactions were rather small and there continued to be considerable confusion respecting conditions.

Copper, Tin, Lead and Zinc

Copper—We indicated last week that the decline in copper had apparently bottomed. This proved to be the case, and sundry second-hand lots having been cleaned up, buyers who had to go to first hands found themselves obliged to pay higher prices. The market advanced sharply from day to

day, more on improvement in sentiment than on transactions, the volume of which was small. It is beginning to be foreseen, however, that the curtailment of production, owing to the labor troubles, is going to have a considerable bearing on the market, which during the recent period of dullness and uncertainty has been overlooked.

The big contract with the foreign governments that was negotiated last October has now practically been filled. Some refiners have shipped away all the copper owed by them. The others have completed their deliveries, but some of the copper still remains here, owing to inability of the buyers to get ship capacity to take it away.

The strike situation in Arizona is much improved. At Butte there is a slow but steady return of men to their work.

Not all copper consumers have been deluded by the theory that the government is going to abolish the law of supply and demand and provide copper for everybody at a reduced price. Thus, in the last number of "The Wire Message," published by the Habirshaw Electric Cable Co. and the Electric Cable Co., it is remarked as follows:

One authority on copper is credited with making the following statement: "The price which the government decides to pay for copper will virtually decide the copper market price to consumers for the balance of the year." We believe statements of this kind produce a false impression, as it leads consumers to expect much lower prices, and, perhaps, to hold off supplying their needs only to find that they may later be forced into the market at higher prices than those prevailing today. We repeat a statement we have several times made, that we do not see how the price to the outside consumer can be determined by anything but the law of supply and demand. If it is true, that the production of copper has so materially increased that the present prices are not justified, they will come down no matter what the attitude of the government is. But if published statements are reliable, supply and demand so nearly balance, that it is difficult to see how there can be in the near future be any material drop in price to the average purchaser.

Copper Sheets are quoted at 37@38c. per lb. for hot rolled, and 1c. higher for cold rolled. Wire is quoted nominally at 33c. per lb., f.o.b. mill.

Tin—This market was more active and the improved demand was reflected in a small advance in price. Banca tin was sold during the week at about 3½c. per lb. under the price for Straits.

Lead—There was a sudden reversal of form in this metal. On July 25, it looked as if the market was headed for 10c., but on the following day 11c., New York, was actually paid. This change in form is attributed to a fuller appreciation of what the labor troubles in Missouri mean with respect to production. August lead is already very scarce and is going to continue scarce.

Zinc—There was a firmer tone to this metal and certain sellers withdrew. This was more in sympathy with the strength in the other metals, than for any other reason, for it is well known that the unsold stocks of spelter are large. The bulk of the business during the week was done around 8½c. At the close, 8½c. was realized.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at \$19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market is weaker. Quotations seem to be nominal and there is no interest in the market. Offers are reported as low as 49@51c. per lb. for No. 1 ingots at New York; futures slightly lower.

Antimony—The market was steadier and slightly firmer. We quote spot at 15@15½c. and futures at 14½@15c., c.i.f., in bond.

Bismuth—Quoted at \$3.50 per lb.

Cadmium—Quoted at \$1.45@1.75 per lb.

Cobalt—Quoted at \$1.70 per lb.

Magnesium—Ingot has declined 50c. per lb., and is now quoted at \$2.

Molybdenum—Pure metal wire has dropped to \$60 per lb., which is less than half the former price, the decline being due to improved methods of production.

Nickel—Steady at 50@55c. per lb., with premium of 5c. per lb. for electrolytic.

Tungsten—Pure tungsten rod has declined to \$80 per kg., for export only, the reduction in price being due to improved methods of production. Metal powder, 95%, is quoted at \$2.80 per lb. Ferrotungsten has advanced to \$2.95 in sympathy with the advance in the price for ore.¹

¹As quoted by Foote Mineral Co., Phila.

Quicksilver—The market is about the same as reported last week. The stocks in New York continue light, and quotations are made here at \$115. San Francisco reports by telegraph \$100@107½, market easy.

Gold, Silver and Platinum

Gold—Movement between United States and foreign countries during the year ended June 30, 1917, showed gain here of \$685,254,801 and loss of \$43,276,368. Gold imports were \$977,176,026. From Alaska \$15,409,529 in gold was imported.

Silver—The silver market has ruled dull and steady the past week, closing higher in London at 40½ pence. The demand from India and China for shipment via San Francisco has stopped for the present.

Silver imports into the United States in the fiscal year ended June 30, 1917, were \$35,003,653. From Alaska \$683,824 in silver was imported.

Mexican dollars at New York, July 25, 61½c.; 26, 61½c.; 27, 60½c.; 28, 60½c.; 30, 60½c.; 31, 61c.

Platinum—Steady at \$105.

Palladium—Firm at \$115, which price is bid to producers.

Zinc and Lead Ore Markets

Platteville, Wis., July 28—Blende, basis 60% Zn, \$70 for premium ore down to \$65 for medium grade. Lead ore, basis 80% Pb, \$112@115. Shipments reported for the week are 3026 tons of zinc ore, 118 tons of lead ore, and 555 tons of sulphur ore. For the year to date the figures are: 80,990 tons of zinc ore, 3843 tons of lead ore, and 16,907 tons of sulphur ore. Shipped during the week to separating plants, 3356 tons of zinc ore. Several mines have been closed down due to low prices and unsatisfactory market conditions and prospect work has been curtailed.

Joplin, Mo., July 28—Blende, per ton, high \$76.70; basis 60% Zn, premium ore, \$75, medium to low \$70@65; calamine per ton, 40% Zn, \$42@40; average selling price, all grades of zinc, \$65.22 per ton.

Lead, high \$127.40; basis 80% Pb, \$120@110; average selling price, all grades of lead, \$121.35 per ton.

Shipments the week: Blende, 8348 tons, calamine, 959 tons, lead, 1556 tons. Value, all ores the week, \$795,780.

Many of the sheet ground mines are and have for weeks been engaged in trimming pillars and sides of drifts preparatory to closing down the mines on account of the high cost of explosives and supplies. Three more finished work this week and were closed down, one to be removed at once to another field.

Other Ores

Chrome Ore—Business was done at \$1 per unit, f.o.b., California, for ore containing minimum of 46% chromic oxide.

Fluorspar—Low grade British spar, for reasonably prompt shipment, is offered at \$22 per 2000 lb., f.o.b., New York, for 75% calcium fluoride, plus and minus 50c. per unit above or below 75%.¹

Iron Ore—Prices, delivered lower Lake ports are for old-range bessemer, \$5.95; old-range nonbessemer, \$5.20; Mesabi bessemer, \$5.70; and Mesabi nonbessemer, \$5.05.

Manganese Ore—Metallurgical ore is quoted at \$1.20 per unit for high grade.

¹As quoted by Foote Mineral Co., Phila.

Pyrites—Spanish lump quoted at 15c. per unit on basis of 10s. ocean freight, buyer to pay war risk, excess freight and any duty. Ocean freights are 42s. 6d. from Huelva to southern ports, contracts having been made at that figure lately.
Tungsten Ore—Unchanged at \$25 per unit for wolframite and \$26 for scheelite.

Iron Trade Review

NEW YORK—Aug. 1, 1917
Active buying of iron and steel products by the Government, says "Iron Age," in some cases with prices stipulated, but for the most part at prices to be fixed later, is in contrast with the continued abstention of private buyers from the market. There is little dissent from the view that present conditions are likely to last for some time and that if meantime some of the price peaks come off the steel trade will not suffer.

PITTSBURGH—July 31

Stagnation continues to be practically the only feature of the iron and steel markets, and instead of the condition causing concern or dissatisfaction, the whole trade, producers and consumers, appear to be quite contented. There is a feeling of relief that the readjustment which all realized must come eventually, with a continually rising market, is now not very far distant. The furnaces and mills are well sold up, while buyers with trifling exceptions are covered, for months to come, and there is nothing to do but carry out the business entered on books. The bulk of the high-priced business done in recent months was for comparatively early deliveries and most of the material will probably have been shipped before the readjustment is fully under way. The Steel Corporation, for instance, has sold during the past three months, when it sold at all, only at prices below those currently quoted as the market, and so with the majority of the large interests, the fancy prices having been obtained by the smaller producers. The Steel Corporation's unfilled obligations decreased 500,000 tons during June and predictions of the July decrease run as high as 750,000 tons.

Production has been greatly curtailed by the extremely hot weather of the past few days by an average of 10 to 20%, the curtailment being particularly heavy because there are no extra men to take the places of those who lay off.

Pig Iron—A sale of 1000 tons of basic iron for prompt shipment was made yesterday at \$52, valley, establishing the market at that level, a decline of \$1 from last week's quotation and of \$2 from the top price quoted on the movement, so that in pig-iron readjustment is already under way. The market in general is stagnant, inquiries being few, and limited to prompt deliveries. We quote: Bessemer, \$55; basic, \$52; foundry and malleable, \$53@55, i. o. b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Mills quote same prices as formerly, \$95@100 for billets and \$105@110 for sheet bars, but the few consumers who have been inquiring refuse to pay the price and say they will wait. They do not even make bids. Nominally the market is quotable at the old level but practically there is no market.

Ferroalloys

Ferromanganese—The market has proved fairly firm, when actual purchases are undertaken, and does not reflect conditions suggested by recent bearing reports. Prompt carloads bring \$400 and less than carloads have sold up to \$450. Deliveries over the remainder of the year are quotable at \$375 @400 and first half deliveries at \$350@375.

Ferrosilicon—The 50% material is quoted at \$225@250. Bessemer ferrosilicon, 12%, quoted at \$100.

Speiseleisen—Quoted at \$80@85.

Iron Ore

Iron Ore—Lake shipments have been heavy in July though not entirely up to expectations as many boats lost a few hours' time awaiting unloading. Season prices are based on \$5.05 for Mesabi non-bessemer, at Lake Erie dock.

Coke

Connellsville—After declining for three weeks following Independence Day, which witnessed the usual bulge in prices, the market has stiffened in the past few days, prompt furnace coke being quotable at \$11@12. The stiffening is attributed to car shortage. The railroads had improved the supply but the operators were unable to load all the cars.

STOCK QUOTATIONS

| N. Y. EXCH.† | July 31 | BOSTON EXCH.* | July 31 |
|------------------------|---------|------------------|---------|
| Alaska Gold M. | 5 | Adventure | 2½ |
| Alaska Juneau | 3 | Ahmeek | 99 |
| Am. Sm. & Ref. com. | 102 | Algoma | 60 |
| Am. Sm. & Ref. pf. | 113 | Allouez | 62 |
| Am. Sm. Sec., pt. A | 98 | Aris. Com. cts. | 12½ |
| Am. Sm. Sec., pt. B | 91 | Arnold | 25 |
| Am. Zinc | 25 | Bonanza | 20 |
| Am. Zinc, pf. | 60 | Butte-Ballaklava | 55 |
| Anaconda | 77 | Calumet & Ariz. | 79 |
| Batopilas Min. | 1 | Calumet & Hecla | 535 |
| Bethlehem Steel | 132 | Centennial | 17 |
| Bethlehem Steel, pf. | 115 | Copper Range | 59½ |
| Butte & Superior | 36 | Daly West | 1 |
| Cerro de Pasco | 34 | Davis-Daly | 15 |
| Chile Cop. | 20 | Deer | 11 |
| Chino | 55 | Franklin | 6 |
| Colo. Fuel & Iron | 50 | Granby | 76 |
| Crucible Steel | 81 | Hancock | 14½ |
| Dome Mines | 10 | Hedley | 16 |
| Federal M. & S. | 25 | Helvetia | 25 |
| Federal M. & S., pf. | 53 | Indiana | 2 |
| Great Nor., ore ctf. | 33 | Isle Royale | 29½ |
| Greene Cananea | 43 | Keweenaw | 2 |
| Gulf States Steel | 118 | Lake | 11 |
| Homestake | 161 | La Salle | 34 |
| Inspiration | 56 | Manitou Valley | 7 |
| International Nickel | 38 | Mass. | 13 |
| Kennecott | 43 | Mayflower | 2 |
| Lackawanna Steel | 92 | Michigan | 2 |
| Miami Copper | 41 | Mohawk | 80½ |
| Natl. Lead, com. | 80 | New Adrian | 34 |
| National Lead, pf. | 109 | New Idria | 14 |
| Nev. Consol. | 22 | North Butte | 18 |
| Ontario Min. | 1 | North Lake | 1 |
| Quicksilver | 1 | Ojibway | 1½ |
| Quicksilver, pf. | 1 | Old Dominion | 56 |
| Ray Cop. | 23 | Oreocsa | 84 |
| Republic I. & S., com. | 90 | Quincy | 83½ |
| Republic I. & S., pf. | 103 | St. Mary's M. L. | 77 |
| Sloss-Sheffield | 54 | Santa Fe | 1 |
| Tennessee C. & C. | 174 | Seneca Mines | 10 |
| U. S. Steel, com. | 123 | Shannon | 7 |
| U. S. Steel, pf. | 119 | Shattuck-Aris. | 23½ |
| Utah Copper | 104 | So. Lake | 31 |
| Va. Iron C. & C. | 68 | So. Utah | 15 |

| N. Y. CURB† | July 31 |
|-------------------|---------|
| Big Ledge | 2 |
| Butte C. & Z. | 1 |
| Butte C. & Z. | 8 |
| Caledonia | 70 |
| Calumet & Jerome | 1 |
| Can. Cop. Corp. | 2½ |
| Carlisle | 4 |
| Cashboy | 0.61 |
| Can. Ariz. Sm. | 2 |
| Con. Coppermines | 7½ |
| Con. Nev.-Utah | 7½ |
| Emma Con. | 1.60 |
| Ferber | 1.25 |
| First Nat. Cop. | 2½ |
| Goldfield Con. | 59 |
| Goldfield Merger | 0.51 |
| Greenmonster | 1 |
| Hecla Min. | 81 |
| Howe Sound | 5 |
| Jerry | 5 |
| Kerr Lake | 4 |
| Magma | 52 |
| Majestic | 42 |
| Melchley-Dar-Sa. | 53 |
| Mohican | 63 |
| Mother Lode | 36 |
| N. Y. & Hond | 12½ |
| Nipissing Mines | 7½ |
| Ohio Cop. | 3 |
| Ray Hercules | 3½ |
| Richmond | 55 |
| Rochester Mines | 48 |
| St. Joseph Lead. | 19 |
| Standard S. L. | 1 |
| Stewart | 1 |
| Success | 29 |
| Tonopah | 61 |
| Tonopah Ex. | 21 |
| Tribullion | 1 |
| Troy Arizona | 21 |
| United Cop. | 75 |
| United Verde Ext. | 36 |
| United Zinc | 4 |
| Utica Mines | 22 |
| White Knob, pf. | 11 |
| White Oaks | 12 |
| Yukon Gold | 1 |

| N. Y. CURB* | July 31 |
|--------------------|---------|
| Alaska Mines Corp. | 62 |
| Bingham Mines. | 12½ |
| Boston Fly | 71 |
| Boston Mont. | 15 |
| Butte & Lon'Dev | 15 |
| Calaveras | 4 |
| Calumet-Corbin | 01 |
| Can. Ariz. Com. | 24 |
| Cortez | 24 |
| Clown Reserve | 28 |
| Crystal Cop. | 1 |
| Eagle & Blue Bell | 2½ |
| Houghton Copper | 95 |
| Intermountain | 1 |
| Iron Cap, Com. | 1½ |
| Iron Cap Cop., pf. | 15½ |
| Mexican Metals | 27 |
| Mines of America | 11 |
| Moine Central | 53 |
| Nat. Zinc & Lead | 50 |
| Nevada-Douglas | 1½ |
| New Baltic | 1 |
| New Cornelia | 17½ |
| Oneco | 50 |
| Pacific Mines | 30 |
| Rex Cons. | 24 |

SALT LAKE* July 31

| | |
|--------------------|------|
| Bannack | 55 |
| Big Four | 18 |
| Black Jack | 06 |
| Cardiff | 5.50 |
| Colorado Mining | 17½ |
| Daly-Judge | 8.00 |
| Empire Copper | 1.30 |
| Gold Chain | 1.18 |
| Grand Central | 1.60 |
| Grand Gulch | 1.19 |
| Iron Blossom | 90 |
| Lower Mammoth | 03 |
| May Day | 06 |
| Moscow | 15 |
| Prince Con. | 1.05 |
| Silver-King Coal'n | 2.95 |
| Silver King Con. | 3.75 |
| Sioux Con. | 10 |
| So. Hecla | 1.35 |
| Uncle Sam | 02½ |
| Wilbert | 25 |
| Yankee | 07 |

TORONTO* July 31

| | |
|------------------|------|
| Balloy | 1.03 |
| Beaver Con. | 32 |
| Buffalo Mines | 1.00 |
| Chambers Ferland | 14 |
| Coniagas | 3.40 |
| Hargraves | 11 |
| La Rose | 1.65 |
| Peterson Lake | 10 |
| Right of Way | 05 |
| Temiskaming | 30 |
| Wettlauffer-Lor. | 05 |
| Dome Exten. | 16 |
| Elorec | 18 |
| Foley O'Brien | 60 |
| Hollinger | 4.10 |
| McIntyre | 1.51 |
| Newray | 63 |
| Porcu. Crown | 45 |
| Schumacher | 42 |
| Teck-Hughes | 48 |
| Vipond | 31 |
| WestDome | 19 |

STOCK QUOTATIONS—Continued

| COLO. SPRINGS July 31 | LONDON July 12 |
|-----------------------|----------------|
| Cresson Con. | 6.00 |
| Doctor Jack Pot. | 0.41 |
| Elkton Con. | 0.5 |
| El Paso | 28 |
| Gold Sovereign | 0.5 |
| Golden Cycle | 2.11 |
| Granite | 50 |
| Isabella | 10 |
| Mary McKinney | 15½ |
| Portland | 1.41 |
| United Gold M. | 20 |
| Victor | 70 |
| Alaska Mexican | 20 10s 0d |
| Alaska Tre'dwell | 1 0 0 |
| Burma Corp. | 4 3 9 |
| Cam & Motor | 0 7 9 |
| Camp Bird | 0 6 6 |
| El Oro | 0 10 0 |
| Espiransa | 0 9 6 |
| Mexican Mines | 4 7 6 |
| Neel, ptd. | 0 12 8 |
| Oroville | 0 16 3 |
| Santa Ger't dia. | 0 10 6 |
| Tomboy | 0 18 6 |

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

| | New York | | | London | | |
|-----------|----------|--------|--------|--------|--------|--------|
| | 1915 | 1916 | 1917 | 1915 | 1916 | 1917 |
| January | 48.855 | 56.775 | 75.630 | 22.731 | 26.960 | 36.882 |
| February | 48.477 | 56.755 | 77.585 | 22.753 | 26.975 | 37.742 |
| March | 50.241 | 57.935 | 73.861 | 23.708 | 27.597 | 36.410 |
| April | 50.250 | 64.415 | 73.375 | 23.709 | 30.662 | 36.963 |
| May | 49.917 | 74.289 | 74.745 | 23.570 | 35.477 | 37.940 |
| June | 49.034 | 65.024 | 76.971 | 23.267 | 31.060 | 39.065 |
| July | 47.519 | 62.940 | 79.010 | 22.597 | 30.000 | 40.111 |
| August | 47.163 | 66.083 | 78.283 | 22.780 | 31.498 | 40.111 |
| September | 48.680 | 68.515 | 79.315 | 23.593 | 32.584 | 40.111 |
| October | 49.385 | 67.855 | 78.855 | 23.925 | 32.361 | 40.111 |
| November | 51.714 | 71.604 | 78.604 | 25.094 | 34.192 | 40.111 |
| December | 54.971 | 75.765 | 78.765 | 26.373 | 36.410 | 40.111 |
| Year | 49.684 | 65.661 | 75.661 | 23.675 | 31.315 | 40.111 |

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

| | New York | | London | |
|------|--------------|--------|----------|---------|
| | Electrolytic | | Standard | |
| | 1916 | 1917 | 1916 | 1917 |
| Jan | 24.008 | 28.673 | 88.083 | 131.921 |
| Feb | 26.440 | 31.750 | 102.667 | 137.895 |
| Mar | 26.310 | 31.481 | 107.714 | 136.750 |
| Apr | 27.895 | 27.935 | 124.319 | 133.842 |
| May | 28.625 | 28.788 | 135.457 | 130.000 |
| June | 26.601 | 29.952 | 112.432 | 130.000 |
| July | 23.865 | 26.620 | 95.119 | 125.400 |
| Aug | 26.120 | 26.120 | 110.283 | 126.304 |
| Sept | 26.855 | 26.855 | 113.905 | 134.071 |
| Oct | 27.193 | 27.193 | 122.750 | 142.523 |
| Nov | 30.625 | 30.625 | 134.659 | 155.432 |
| Dec | 31.690 | 31.690 | 145.316 | 162.842 |
| Year | 27.202 | 27.202 | 116.059 | 138.281 |

| | New York | | London | |
|-----------|----------|--------|---------|---------|
| | 1916 | | 1917 | |
| | 1916 | 1917 | 1916 | 1917 |
| January | 41.825 | 44.175 | 175.548 | 185.813 |
| February | 42.717 | 51.420 | 181.107 | 198.974 |
| March | 50.741 | 54.388 | 193.609 | 207.443 |
| April | 51.230 | 55.910 | 199.736 | 220.171 |
| May | 49.125 | 63.173 | 196.511 | 245.114 |
| June | 42.321 | 62.053 | 179.466 | 242.083 |
| July | 38.510 | 62.676 | 168.357 | 242.181 |
| August | 38.565 | 62.676 | 169.870 | 242.181 |
| September | 38.830 | 62.676 | 171.345 | 242.181 |
| October | 41.241 | 62.676 | 179.307 | 242.181 |
| November | 44.109 | 62.676 | 186.932 | 242.181 |
| December | 42.635 | 62.676 | 183.368 | 242.181 |
| Year | 43.480 | 43.480 | 182.096 | 182.096 |

| | New York | | St. Louis | | London | |
|-----------|----------|--------|-----------|--------|--------|------|
| | 1916 | | 1917 | | 1916 | |
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| January | 9.921 | 7.626 | 5.826 | 7.530 | | |
| February | 6.246 | 8.636 | 6.164 | 8.595 | | |
| March | 7.136 | 9.199 | 7.375 | 9.120 | | |
| April | 7.630 | 9.288 | 7.655 | 9.158 | | |
| May | 7.463 | 10.207 | 7.332 | 10.202 | | |
| June | 6.936 | 11.171 | 6.749 | 11.123 | | |
| July | 6.352 | 10.710 | 6.155 | 10.644 | | |
| August | 6.244 | 10.710 | 6.088 | 10.644 | | |
| September | 6.810 | 10.710 | 6.699 | 10.710 | | |
| October | 7.000 | 10.710 | 6.898 | 10.710 | | |
| November | 7.042 | 10.710 | 6.945 | 10.710 | | |
| December | 7.513 | 10.710 | 7.405 | 10.710 | | |
| Year | 6.853 | 6.853 | 6.777 | 6.777 | | |

| | New York | | St. Louis | | London | |
|------|----------|--------|-----------|--------|--------|------|
| | 1916 | | 1917 | | 1916 | |
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| Jan | 16.915 | 9.619 | 16.745 | 9.449 | | |
| Feb | 18.420 | 10.045 | 18.260 | 9.875 | | |
| Mar | 16.846 | 10.300 | 16.676 | 10.130 | | |
| Apr | 16.695 | 9.459 | 16.525 | 9.289 | | |
| May | 14.276 | 9.362 | 14.106 | 9.192 | | |
| June | 11.752 | 9.371 | 11.582 | 9.201 | | |
| July | 8.925 | 8.643 | 8.755 | 8.473 | | |
| Aug | 8.730 | 8.730 | 8.560 | 8.277 | | |
| Sept | 8.990 | 8.990 | 8.820 | 8.595 | | |
| Oct | 9.829 | 9.829 | 9.659 | 9.379 | | |
| Nov | 11.582 | 11.582 | 11.422 | 11.143 | | |
| Dec | 10.685 | 10.685 | 10.495 | 10.212 | | |
| Year | 12.804 | 12.804 | 12.634 | 12.634 | | |

New York and St. Louis quotations, cents per pound; London, pounds sterling per long ton. † Not reported.

| Pig Iron, Pitts. | Bessemer† | | Basic† | | No. 2 Foundry | |
|------------------|-----------|---------|---------|---------|---------------|------|
| | 1916 | | 1917 | | 1916 | |
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| January | \$21.60 | \$35.95 | \$18.78 | \$30.95 | | |
| February | 21.16 | 36.37 | 18.93 | 30.95 | | |
| March | 21.81 | 37.37 | 19.20 | 33.49 | | |
| April | 21.65 | 42.23 | 18.95 | 38.90 | | |
| May | 21.78 | 46.94 | 19.11 | 42.84</ | | |

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