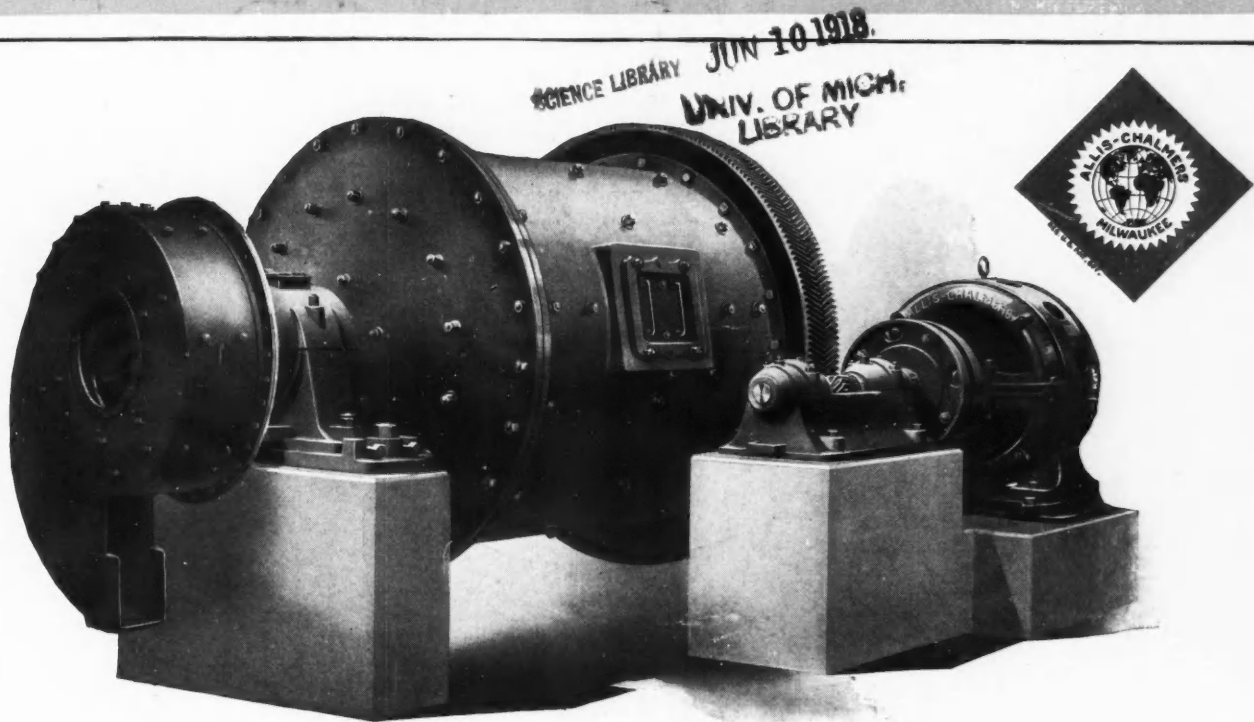


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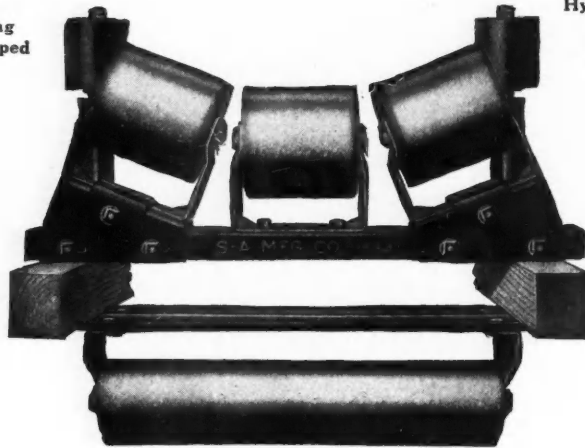
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VIRGINIA CITY AND THE COMSTOCK LODGE VIEWED IN A NORTHWESTERLY DIRECTION FROM THE COMBINATION SHAFT

Mining Lower Levels of the Comstock Lode

By LEWIS H. EDDY*

The reopening of the lower levels of the Comstock Lode is an interesting chapter in the mining history of the West. The evolution in drainage appliances and their use under excep-

tional conditions are important phases of recent work. The development of new orebodies and the completion of drainage facilities have stimulated mining operations on the lower levels.

THE development of new high-grade orebodies in the lower levels of the Northend mines of the Comstock Lode at Virginia City, Nev., as a result of drainage to the 2900-ft. level, establishes proof of the persistence of payable ore at depth. A large area is now drained and reopened for mining.

The complete reopening of the lower levels of the Northend mines, through the Union shaft, after being filled with water for 33 years, was marked by the extraction of payable ore on the 2700-ft. level in July, 1917. In September of that year development was in progress on the 2900-ft. level. Since the middle of July, 1917, new ore has been disclosed and developed from the 2300-ft. down to the 2600-ft. level. In the middle of last September important disclosures were made of ore averaging in excess of \$30 per ton, one on the 2300-ft. level and one in a new winze at a depth of 26 ft. below the 2700-ft. level. The average payable ore mined in other parts of the upper level

ranged from \$12 to \$37 per ton, and has been almost constant during the last three years, with frequent occurrences of ore assaying \$60 to \$70 per ton. Low-grade ore has also been discovered in prospecting.

The active resumption of mining in the lower levels followed close upon the draining of the mines by electrically driven pumps lifting through the C. & C. shaft to the Sutro tunnel. This accomplishment was the result of nine years of patient, arduous labor. The operators controlling the drainage and development of the Northend and the North Middle mines comprise the Sierra Nevada Mining Co., Mexican Gold and Silver Mining Co., Union Consolidated Mining Co., Ophir Silver Mining Co., and the Con. Virginia Mining Co. The United Comstock Pumping Association, with W. G. Morrow as president, Whitman Symmes, mining engineer, and T. F. McCormick, superintendent, is a separate organization, which carries on the drainage work and apportions the expenses among the different mines. The Slossen-Symmes interests control the Union, Mexican, Ophir and Con. Virginia and cooperate with the

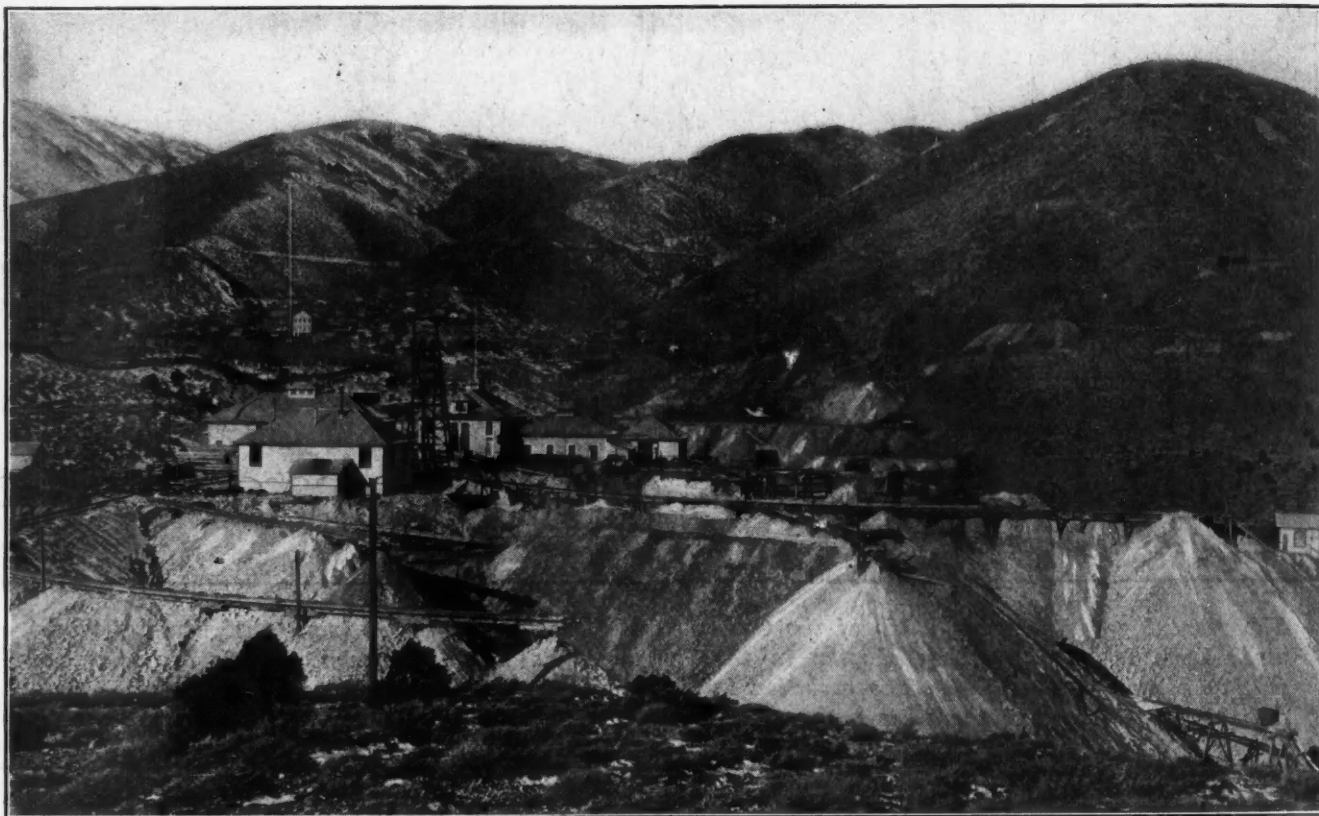
*Associate editor, Eng. and Min. Journ., San Francisco, California

Sierra Nevada, of the Northend mines. The pumping in progress or to be undertaken is handled by the United Comstock Pumping Association.

The Comstock covers an area approximately two miles long and 2000 ft. wide, lying along the eastern flank of the Washoe Range, dipping 35 to 45° east, and embracing the Northend mines, the Middle mines and the Gold Hill mines. The east side of the Comstock includes the mines of Silver City on the south, the Brunswick, Comstock-Phoenix and Scorpion to the north and a number of other mines and mining claims. The East-side mines are on what is generally conceded to be a series of parallel and branching veins, some of which diverge at the north and south from the main lode. The towns of Virginia City and Gold Hill are on the lode, the former extending from the Sierra Nevada to the Potosi and the latter from the Bullion

the relation of orebodies and workings in the Northend and North Middle mines from the surface to the deepest levels. The depth in the old workings is approximately the same in the Mexican as in the Chollar, of the Middle group, about 3300 ft. The approximate east and west dividing line between the Northend and the Middle mines is marked by the Spanish Ravine. This places the Best & Belcher in the Middle district, which extends south to the south line of the Alpha. The present plans for unwatering and development in this district include principally the mines the underground workings of which are tributary to the Combination shaft, and particularly referred to as the North Middle mines.

Unwatering the Northend mines was started in 1898. In the five years following, the mines were drained and the C. & C. and the Union shafts reopened to the



SURFACE PLANT OF THE UNION MINE ON THE COMSTOCK LODGE

to the Overman. Virginia City is on the east slope of the mountains at 6000 ft. elevation, and the Gold Hill is at 500 ft. lower elevation.

The general strike of the Comstock lode is north and south, and the average elevation is 6000 ft. above sea-level. Mount Davidson, at an approximate altitude of 7800 ft., stands directly west of the Middle mines. The foot wall of the lode is diorite and the hanging wall diabase, though the walls consist of other rocks in some parts. The geology of the Comstock region was investigated and reports were published by von Richthoven (1865), Church (1877) and Becker (1882). The promise of future yield at greater depth than former ore horizons has been at least partly sustained by the recent development in the deep levels of the Northend mines.

The accompanying longitudinal section illustrates

2000-ft. level. In the period of 1912-14 draining and exploration proceeded to the 2500-ft. level. The complete drainage undertaken by the present operators in the Sierra Nevada, Union, Mexican, Ophir and Con. Virginia to their respective lowest working levels was accomplished by the end of June, 1917, and exploration was in progress in every available part of the Northend mines by the end of July. Development followed closely, and in practically all the levels explored ore has been disclosed. Exploration has not extended north of the Sierra Nevada shaft nor into the southern half of the Con. Virginia. The present purpose is to continue exploration and development within the area between the Sierra Nevada shaft on the north and the C. & C. shaft on the south. With the unwatering of the North Middle mines, the extension of Northend exploration will proceed to the south.

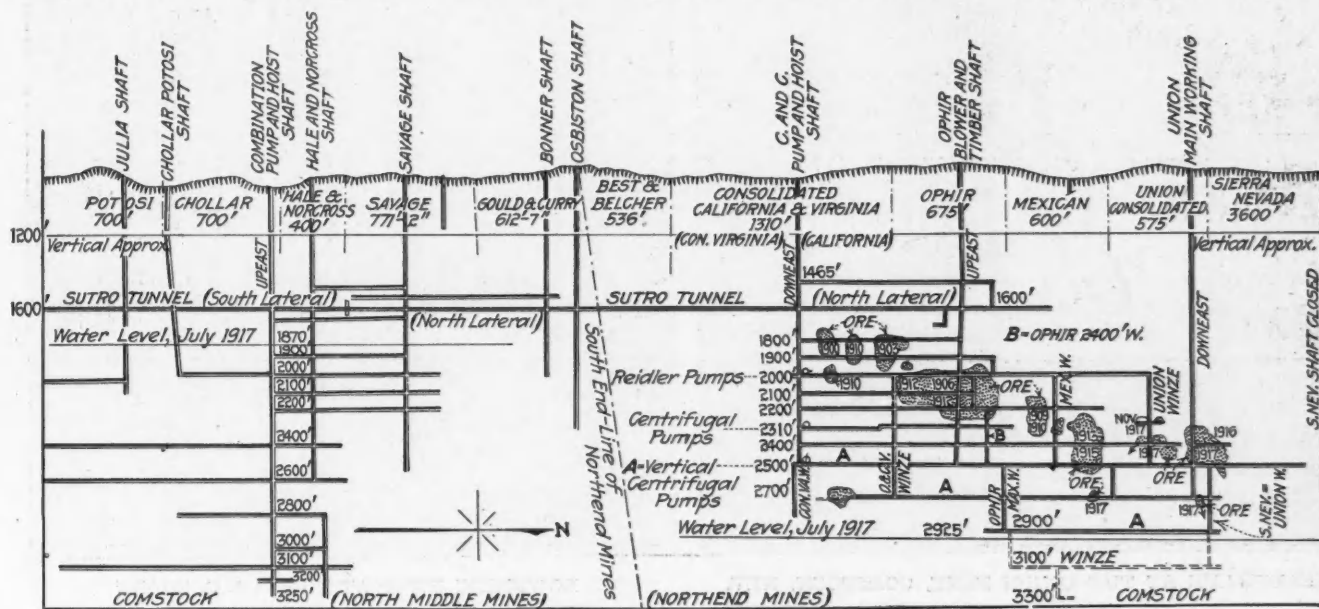
That there are payable orebodies below the 2900-ft. level is not improbable. In fact, ore is said to have been disclosed in 1884 in the 3100-ft. level of the Mexican and in the deep winze below the 3100-ft. level. This was during the progress of the early mining in the Mexican, and the work was done in 1884, the year the mine was closed, the upper levels being kept open only for air. The 3100-ft. level and the deep winze are shown on the map by broken lines, indicating that the workings are closed. They could be reopened and the reports of ore discovered investigated, but there is now sufficient area and depth of ground drained and available above the 2900-ft. level to assure a long period of development and possible production in the Northend mines.

Deeper drainage and exploration may be more economically applied to the reopening of the Middle mines, even though the possibilities of great depth may not be so good. It is of record, however, that \$30 ore was being extracted from the 2800-ft. to the 3100-ft. levels of the Combination shaft at the time pumping was abandoned in 1886. But it is imperative, if the Northend mines are to be operated with the greatest possible economy, that another upcast shaft shall be added to the complement of openings to the

The pumping equipment, electrically driven and operated through the C. & C. shaft, is composed of three Riedler pumps installed on the 2000-ft. level, three centrifugal pumps on the 2310-ft. level, two vertical centrifugal pumps on the 2500-ft. level, all situated near the C. & C. shaft; two vertical centrifugal pumps on the 2700-ft. level and two vertical centrifugal pumps on the 2900-ft. level in the Ophir-Mexican winze. The Riedler pumps were installed in 1903; the centrifugal pumps in 1913 and 1915-16. The Riedler pumps were made by the Allis-Chalmers Co. and the centrifugal pumps by the Byron Jackson Iron Works and the Krogh Manufacturing Company.

The Riedler pumps have capacity of 1500 gal. per min. each and a combined capacity of 4500 gal. per min., lifting to a height of 400 ft. The 2310-ft. level centrifugal pumps are each of 1500 gal. per min. capacity and are required to lift only to a height of 320 ft. The vertical centrifugal pumps on the 2500-ft. and 2700-ft. levels are of 2250 gal. per min. capacity, and the Krogh vertical shaft pumps on the 2900-ft. level are each of 500 gal. per min. capacity. These pumps drain a large area of old workings.

As the mines are now clear of water to their lowest working levels, from the Sierra Nevada to the Con.



PROXIMATE LONGITUDINAL SECTION ALONG NORTHEM COMSTOCK LODGE

levels below the Sutro tunnel. There are now two downcast shafts and one upcast shaft in the Northend mines.

In June, 1917, the Northend operators, acting in connection with the Best & Belcher, Savage, Hale & Norcross, Chollar and Potosi, began pumping from the Combination shaft, with such pumps as were available. By the middle of July the water was lowered to the 1870-ft. point, or more than 270 ft. below the Sutro tunnel level. That was the limit of the pumps available, and the work is now waiting upon the installation of a larger pumping plant. The tentative plans for development of the North Middle mines contemplate beginning exploration of the 2000- and 2100-ft. levels of the Chollar and Hale & Norcross and extending north into the Savage and Best & Belcher and south into the Potosi.

Virginia, a length of about 3200 ft., the pumps will be relieved of part of their former duty. The engineering department is thus free to proceed more rapidly with development and production of ore. The North end equipment includes electric hoists at the Union and the Ophir and a steam hoist at the C. & U. shaft.

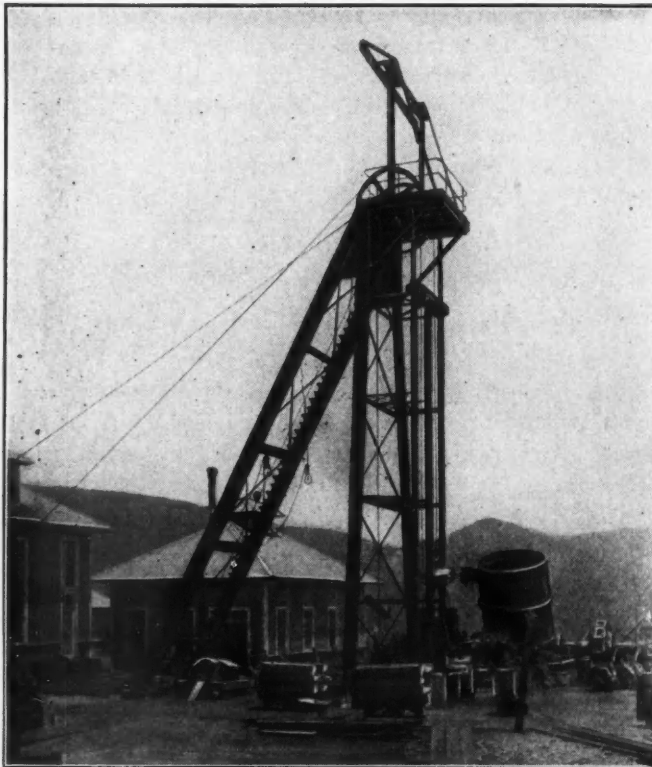
The Sierra Nevada plant is not in operation, the development and extraction of ore being carried on through the Union shaft. The initial sinking on the Sierra Nevada was by vertical shaft situated about 1100 ft. from the south line of the mine and extending to a depth of 1700 ft., then by an incline to 2300 ft., and by winzes from drifts and crosscuts to the 3100-ft. level. Many of these workings are closed, and the development and extraction of ore proceed from extensions of the Union 2400-ft. and 2500-ft. levels north

into Sierra Nevada ground. The upper extension includes a 300-ft. drift and stope. At the 2500-ft. level, there is a crosscut, 600 ft. long, with an inclined sump and a stope near the Union north line. Further development may be carried down, working north from the Sierra Nevada-Union joint winze, which extends from the 2500- to the 2900-ft. level, with another winze (not yet unwatered) going to the 3100-ft. level.

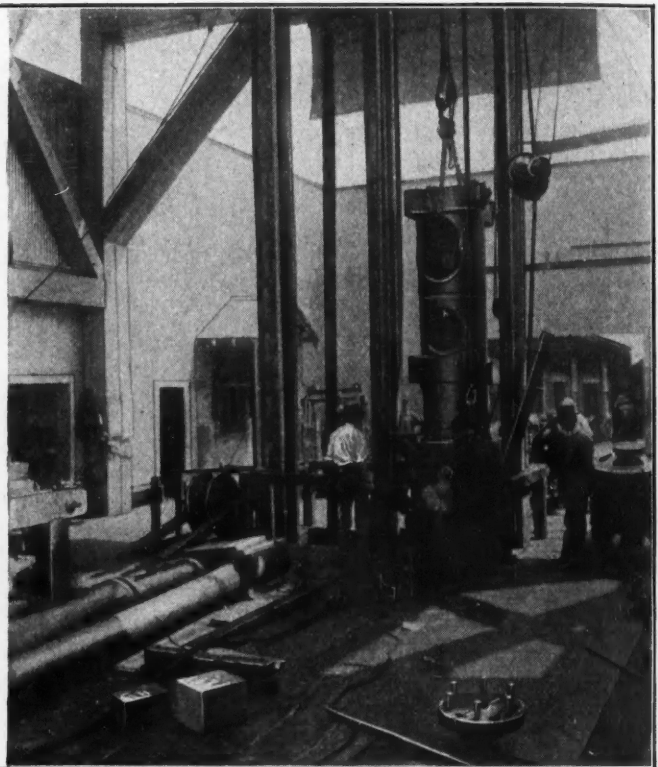
The Union shaft is 800 ft. from the Sierra Nevada shaft and 100 ft. from the Union north line. It is a three-compartment vertical shaft, 2700 ft. deep, and was reopened to the 2000-ft. level in 1908-12, explored from 2000 to 2500 ft. deep in 1912-14, unwatered and explored to the 2700-ft. level in 1915-17. Development and extraction of ore closely followed exploration. Actual mining at and below the 2700-ft. level was begun on July 16, 1917. The extension in depth from the

a Sturtevant multivane exhaust fan of 100,000-cu.ft. per min. capacity driven by a 100-hp. motor.

The C. & C. shaft is vertical and 2500 ft. deep. It is connected by a 600-ft. crosscut and 1000-ft. drift on the 2500-ft. level to the Ophir incline. The Con. Virginia ground was opened by the Con. Virginia winze to the 2800-ft. level. This winze is now in working order to the 2700-ft. level. Besides being used as the pump shaft, it is also used for hoisting ore from the Con. Virginia and the Ophir which does not go through the Union. The hoist is the same as installed in 1875 jointly by the Con. Virginia and California companies, which have since consolidated to form the Con. Virginia Mining Co. Steam is now generated by oil fuel, which was substituted for wood in 1903. The plant has been properly maintained and its capacity is the same as when first installed. Since this hoist



HEADFRAME AT THE UNION MINE, COMSTOCK, NEV.



LOWERING PUMP AT THE C. & C. SHAFT

2700-ft. to the 2900-ft. level is 680 ft. east and is called the Sierra Nevada-Union joint winze.

Surface equipment of the Union shaft consists of a 200-hp. electric hoist installed in January, 1917, and a steel headframe installed about 12 years ago; also a machine shop, a timber-framing house, an assay office and a change house. The Union shaft handles the ore from the Sierra Nevada, Union and Mexican, and part of the ore from the Ophir and the Con. Virginia.

The Ophir shaft is vertical for 1465 ft., then inclined to the 2500-ft. level and connected to the 2700-ft. level by the Ophir-Con. Virginia winze. The 2000-ft. level is worked through the Union shaft, the other levels through the C. & C. shaft. Still other levels, as development and extraction proceed, will be worked through the same shafts. The Ophir is equipped with a 50-hp. electric hoist, which is used for handling timbers and making repairs. It is also equipped with

is not required to hoist a heavy tonnage, and the change to electric power would be more costly than results would warrant, steam power is still retained. In fact the operation by steam is the more economical and provides a dependable means of exit from the mines in case of disturbance or interruption of service by the electric plants, which occurs because of climatic conditions nearly every winter. Altogether the equipment at the several mines in the Northend group is sufficient.

Tasmania's Mineral Production for 1917 has been officially reported by the Secretary for Mines as follows, the items being arranged in order of descending value: Blister copper, 5828 tons; tin ore, 2637; silver-lead ore, 9576 tons; gold, including gold contained in blister copper, 14,496 oz.; coal, 63,412 tons; wolfram, 172; scheelite, 69; iron pyrites, 7686; copper and copper ore, 771 tons; osmiridium, 332 oz.; zinc, 48 tons; bismuth, 4; barytes, 52; asbestos, 271 tons. The total value of the mineral products was £1,584,290.

Artificial Pebbles for Tube-Milling

By A. W. ALLEN*

The substitution of one material for another which has established itself in a given kind of work raises a number of questions which must be considered by the engineer. There is first the question of suitability and then that of cost. Large-scale tests have the disadvantage of considerable expense, and, as a consequence, if methods of testing on a small scale can be devised, they are more suitable and convenient. The author of this article proposes to make use of the methods that have been developed for the testing of rocks used in the construction of roads. He describes these tests in detail. In addition he describes the results of working-scale tests with tube-mills in which various substitutes for Danish flint pebbles were used. Operators of cyanide and flotation plants will find the article of value.

THE high cost of imported flints, on account of decreasing transportation facilities, and the inability to obtain regular supplies are factors now influencing tube-milling practice. The substitution of small steel balls is feasible in some instances, but the change is seldom possible without expensive modifications in the design of the mill liners and an alteration in the driving arrangements to permit the transmission of the additional power required. The ability of the tube-mill to stand increased weight strains must also be taken into consideration. The depth of load, whether of steel balls or pebbles, is an important consideration in efficient milling, and the abandonment of flint pebbles and the substitution of an equal weight of steel balls cannot be expected to produce the same result.

EXPERIENCE WITH IMPORTED FLINT PEBBLES

Prior to the war there were numerous instances where the ultimate cost of imported flints was excessive. My earliest experience was in Western Australia in 1905, where such pebbles, imported from the shores of the Baltic, cost about \$40 per ton delivered in Kalgoorlie. Later, in 1909, at the Rio Plata mine, in Northern Mexico, it was estimated that freight charges from the coast amounted to over three times the original invoice price, and the ultimate cost of the pebbles was about \$65 per ton. The ore being high grade, there was no urgent consideration of the question of economy in this direction, and at that time the imported flint was considered the only suitable grinding medium. A few months later I was called upon to reconstruct the Ceniza mill, in the Guadalupe y Calvo district, and sliming the ore preparatory to cyanide treatment was again a fundamental consideration.

The rival merits of regrinding with a battery of pans of primitive design, already on the property, and a modern tube-mill installation were duly considered, and the latter system was adopted. Imported flint pebbles would have cost about \$70 per ton delivered at the mine, and this expense was prohibitive on account of the low grade of the ore to be treated. Local manufacture of

artificial pebbles was the obvious alternative. The middle portion of the vein carrying the silver consisted of an exceptionally hard chaledonous quartz, and the flinty portions were broken down and sorted for the purpose. The picked stones, of roughly spherical shape, were delivered by contract, and were slightly larger than the finished pebbles required. They were then rounded by a 10-hour treatment in an ordinary tube-mill, a small amount of water being added to prevent dusting. The mill was charged slightly above the center line in each instance, and about 80% of the original weight of stone was discharged in the form of rounded pebbles. These were of proved resistance to fracture

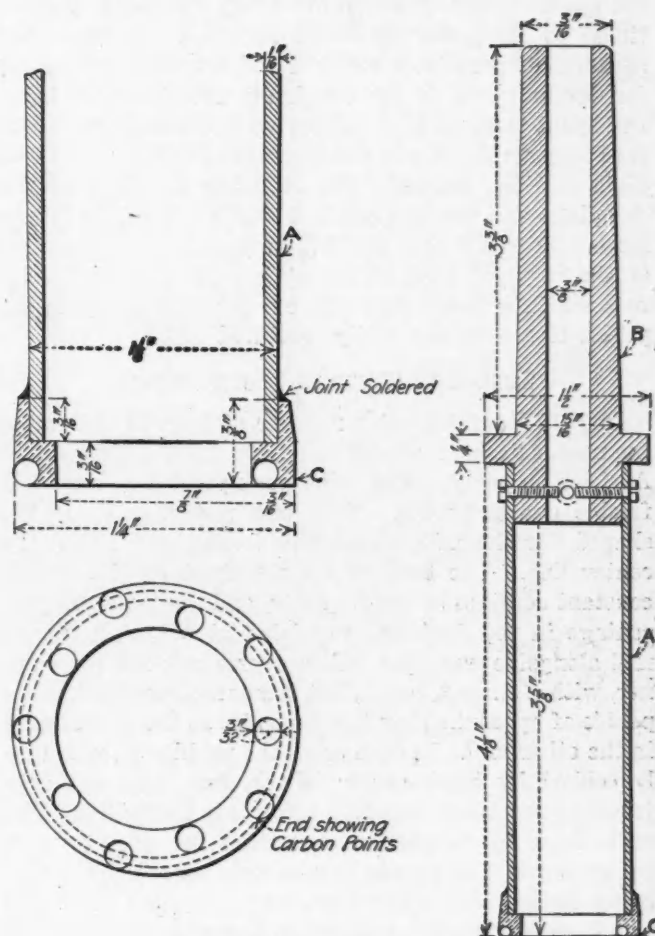


FIG. 1. DIAMOND CORE DRILL

under similar conditions, and this feature, in addition to the natural hardness of the rock, insured a grinding power equal or superior to the best imported flint.

The total cost of the pebbles was about \$6 per ton, a figure that showed a large saving over the imported article. The published suggestion advocating the adoption of a tumbling mill for the local manufacture of pebbles on properties operating under similar conditions, and possibly arranged for the continuous feed of rough rock and the continuous discharge of finished pebble and gravel, was not generally viewed as feasible. Hard rock was seldom obtainable, and there was little inclination shown to question what was considered the infallible superiority of the imported flint or to adopt any via

*Metallurgical engineer, 309 Broadway, New York.

¹Mining Magazine, Sept., 1911.

media between the two extremes, namely, the use of the Danish or French pebble or the utilization of rough mine quartz. It was soon realized, however, that the latter chipped to a considerable extent before being of any service in the mill, and that this led to an undesirable accumulation of gravel and broken quartz, which seriously retarded grinding and involved a consumption of power out of all proportion to the results achieved. In the case where sliming was being practiced, the method was even more unsatisfactory than when only medium grinding was required.

ROCK SUITABLE FOR TUBE-MILLING PURPOSES

Rock used for tube-milling purposes may be considered under two headings, depending on whether or not it possesses the necessary toughness. Hardness plays an important but secondary part in the economics of the question, the consumption being indirectly proportional to its power to resist abrasion. A rock that abrades comparatively easily is not, however, unsuitable for the purpose, if its toughness coefficient be high. Inefficient work in tube-milling where ordinary stone is used is generally due to the fracture of the grinding medium and the necessity for reducing the bulk of the chippings and gravel produced to the normal discharge mesh. Provided that the load of pebbles is maintained at the required level in the mill, a comparatively soft rock which is tough may prove a far superior grinding pebble to a hard but easily fractured flint.

TUBE-MILL TESTS IN SOUTH AFRICA

In 1913 I carried out a number of tests to determine the most suitable material to use for tube-milling on an African property. The mine rock yielded a hard but friable quartz pebble. This was picked and roughly shaped for the mill, which was loaded just above the center line. The level was maintained by the almost constant addition of fresh quartz, and the moisture percentage in the feed was regulated at 35%. A second mill alongside was operated in a precisely similar manner, with a shaped, tough, but comparatively soft felsite pebble of approximately the same size as the quartz used in the other mill. In both cases the pebbles were roughly cobbled by hand (Kafir labor), but were not subjected to any other rounding treatment before use. The mills were in competitive operation for over a week before any test was made or data obtained. The tonnage being fed to each mill to produce a similar discharge was then corrected for standard internal diameter and results given in Table I were obtained:

TABLE I. 1913 SOUTH AFRICAN TUBE-MILLING TEST

	No. 1 Mine Rock Feed 101 Tons per Day		No. 2 Felsite Feed 133 Tons per Day	
	Feed, %	Discharge, %	Feed, %	Discharge, %
+ 30	19.5	0.5	28.5	0.5
+ 60	15.5	6.0	19.5	10.5
+ 90	37.5	35.0	32.0	37.0
+150	13.0	16.5	10.5	12.0
-150	14.5	42.0	9.5	40.0

On the question of tonnage ground per horsepower, the results were much in favor of the softer but tougher stone. With regard to first cost of pebbles, the results showed that the superior hardness of the quartz was more than offset by the superior toughness of the felsite, the actual consumption of the latter being less than two-thirds of the former to handle 30% more tonnage of a coarser mesh and to produce the same result. The cost of the felsite was approximately twice that of the quartz,

but the supply of the latter was limited, owing to difficulties in manufacture as a result of fracture in the final stages of cobbing. Of the felsite an almost inexhaustible supply was available.

An examination of the mill contents in the case where the quartz was used showed that any preliminary rounding treatment in a tumbling mill would be useless, on account of the brittleness of the stone. A 1½-in. grating at the discharge end of the mill permitted the elimination of a proportion of the chippings formed, but it was evident that a large amount was retained in the mill until slimed or ground to a fine mesh.

The sole advantage in favor of mine quartz was that the ground pebbles consisted of gold-bearing ore rather than country rock. The quartz pebbles were available only after preliminary crushing; and whether hand breaking or mechanical reduction was employed, the quartz tended to fracture into pieces too small to form effective pebbles for a coarse feed. For this reason it was impossible to use a larger screen than 6-mesh on the battery.

COMPARISON OF TESTS

A comparison of the results of the above tests and the earlier work in Mexico confirmed the opinion that some rounding process was imperatively necessary to insure efficient working of hard rock of the nature of quartz. It was also obvious that a quartz that fractured badly would not survive the tumbling treatment. The local mine quartz was therefore considered unsuitable from every point of view. In the example under consideration the requirement was an increase in mill duty, and this could only be accomplished by putting coarser screens on the battery and arranging for more efficient work in the tube-mills. The battery screening aperture was then raised from 6 x 6 to 2 x 3 openings per linear inch, and a large and heavy felsite pebble was used in the mills. Experience showed that there was practically no chipping from this type of rock before it became rounded, provided, of course, that the jagged edges were cobbled off in preliminary preparation. There was neither necessity nor advantage in preliminary tumbling treatment, and the expense of this was therefore avoided.

LARGE-SCALE TESTS

In a test to determine the relative efficiencies of imported flints in comparison with artificial pebbles, two tube-mills were operated under identical conditions, one being charged with the normal load of felsite pebbles and the other with an equal volume of imported flints. The mills were run for some days before tests were made, so that operating conditions would be normal. The results are given in Table II:

TABLE II. TEST OF RELATIVE EFFICIENCY OF IMPORTED FLINTS AND ARTIFICIAL PEBBLES

	No. 1 Felsite Pebbles Feed 176 Tons per Day		No. 2 Imported Flints Feed 175 Tons per Day	
	Feed, %	Discharge, %	Feed, %	Discharge, %
+ 10	15.0	0.4	5.8	0.4
+ 20	12.8	0.4	4.3	0.8
+ 30	6.2	1.4	3.0	0.8
+ 60	20.3	15.0	16.6	9.4
+ 90	31.9	36.4	45.8	41.4
+120	4.7	7.2	9.2	11.2
+150	3.0	7.2	4.3	5.4
-150	6.4	32.4	11.0	31.4

The principal requirement at that time was that as much 150-mesh slime should be produced as possible. The secondary consideration was that the discharge from the tubes should contain a minimum of plus 20-

mesh material. The mills were therefore started with equal loads, and in the case of the mill running with the flints the percentage of coarse material in the feed was reduced until the discharges from both mills were similar in percentage composition. The failure of the imported flint to equal the local pebble was due to a number of factors, chief of which was that the latter were produced of a size and shape to exactly suit requirements and in strict proportion to the coarseness of the feed. The additional weight of the felsite per unit volume was also a favorable condition. The flints were of irregular shape and size. As regards comparison of pebble cost, the softer stone was consumed at the rate of one ton per day per mill, with a total cost of \$4.75. The consumption of flints was only a quarter of this, with a total cost of over \$12. The results were therefore entirely in favor of the softer stone, both with reference to first cost and to grinding efficiency. It was estimated that had an imported flint of exactly

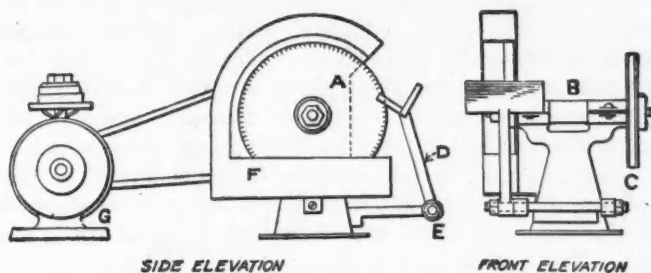


FIG. 2. DIAMOND SAW

the same size and shape as the felsite pebble been procurable, the net result would still have been in favor of the local stone.

A proportion of the work done in a tube-mill, especially when sliming is being practiced, is due to abrasion rather than impact. The imported flints present a highly polished smooth surface, which permits no gripping of the sand between the faces. A softer stone, on the other hand, will never polish in this manner when used in tube-milling, but will always retain a comparatively rough surface. The advantage of this, provided of course that the stone is not so soft that pitting is produced, is that slippage is prevented and that there is a true grinding action between the faces and a maximum reduction of the material being handled. This is a point which may tend to explain the high efficiency of a close-grained lava stone in comparison with the more expensive imported flint. An analogous action is seen in the operation of the grinding pan, where reduction is solely the result of abrasion. In this case a high quality steel is entirely unsuitable for shoes and dies, a softer iron being found to give by far the best results.

An additional cause for the frequent failure of the imported flints, and one which is seldom realized, is due to their brittleness, often caused by long exposure to severe climatic conditions. W. O. Hotchkiss describes² a number of tests carried out with a Deval abrasion machine (to be described later in this article) for the purposes of comparing the qualities of several samples of imported flints with the quartzite pebbles found in a conglomerate deposit near Madison, Wis. These tests clearly demonstrated the superiority of the local quartzite and showed that the failure of the imported flints

was due to the development of "half-moons," formed by impact, which were readily chipped out in succeeding concussions.

It has been recognized that the essential qualities for a tube-mill pebble are toughness and hardness. By toughness is meant its ability to withstand fracture under impact, whereas hardness is the measure of resistance to abrasive action. Excluding the question of weight per unit volume, in which flints possess no advantage, it may be said that the efficiency of a stone may be gaged by its combined power to withstand impact and to resist abrasion. This naturally leads to a realization of the fact that the efficiency varies with the condition of the stone at the time it is utilized. A jagged flint has a low efficiency until its corners have become rounded and the sharp projections worn off. A softer stone may have a high efficiency both in the rough and after rounding, because it may not be brittle enough to produce any appreciable amount of chippings.

For the purposes of classification of tube-mill pebbles, the recognized definitions of hardness and toughness are applicable, provided that they are used with reference to a prepared specimen whose surfaces present no weaknesses not met with in the central and less disturbed part of the rock. The efficiency of a rounded pebble may therefore be estimated by a measure of these two characteristics. The efficiency of rough broken rock for tube-milling purposes is the measure of its ability to withstand both chipping, fracture, and abrasion under milling conditions.

EXPERIMENTAL WORK IN SELECTING ROAD METAL

In 1912 attention was drawn³ to the amount of experimental work which had been done in order to permit of a more scientific selection of rock for road-building purposes. Excluding the question of cementing power, the requirements are precisely the same as those needed in the metallurgical industry or in cement manufacture. Since that date the publication of numerous papers dealing with the subject indicates that a large amount of research has been carried out, and it would certainly seem that the results might be utilized to advantage in a number of industries. The subsequent data in this article dealing with the testing of rock have been abstracted from bulletins issued during 1916 and 1917 from the Office of Public Roads and Rural Engineering.⁴ An interesting article in the *Journal of Agricultural Research*⁵ has also been used in the same manner.

The first systematic attempts to determine the value of rock for road-building purposes by means of laboratory tests were made in France, where in 1878 a road-material laboratory was founded in the French School of Bridges and Roads at Paris. Here the Deval abrasion test was adopted, and this test, with slight modification, has been accepted as standard in the United States. The test is named from its inventor, and was

³"Pebbles for Tube-Milling," by A. W. Allen, *Min. Mag.*, April, 1912.

⁴Bull. 347, "Methods for the Determination of the Physical Properties of Road-Building Rock," by Frank H. Jackson, Jr., assistant testing engineer.

Bull. 370, "The Results of Physical Tests of Road-Building Rock," by Prevost Hubbard, chemical engineer, and Frank H. Jackson, Jr., assistant testing engineer.

Bull. 537, "The Results of Physical Tests of Road-Building Rock in 1916," by Prevost Hubbard, chemical engineer, and Frank H. Jackson, Jr., assistant testing engineer.

⁵"Relation Between Properties of Hardness and Toughness of Road-Building Rock" by Prevost Hubbard and Frank H. Jackson, Jr. Vol. V, No. 19.

²*Eng. & Min. Journ.*, Aug. 18, 1917.

first used in connection with contract work in the city of Paris.

Outside of France very little work was done in road-material testing in either Europe or America until 1893, when the Massachusetts Highway Commission established a laboratory in the Lawrence Scientific School of Harvard University, under the direction of Logan Waller Page. The Deval abrasion test was adopted, and a test to determine the binding power of rock dust was developed by Page in this laboratory.

In December, 1900, the United States Government established a laboratory in the Bureau of Chemistry of the Department of Agriculture, under the direction of Page. This laboratory became in 1905 a part of the Division of Tests of the newly organized Federal Office of Public Roads. On July 1, 1915, during a general reorganization, it was placed in the Division of Road Material Tests and Research of the new Office of Public Roads and Rural Engineering.

DETERMINATION OF SPECIFIC GRAVITY, DENSITY AND ABSORPTION

The object of the experiments conducted is to determine the weight of a solid cubic foot of the material and the number of pounds of water which will be absorbed by a cubic foot in 96 hours. The equipment required comprises a beam balance weighing accurately to 0.01 gm. and provided with suitable means for suspending the material in water while weighing; a drying oven, a desiccator and calcium chloride, and a thermometer.

A fragment of the rock weighing approximately 10 gm. and representing as nearly as possible an average of the entire sample is dried for several hours to constant weight in a hot-air bath, cooled in a desiccator, weighed in air, weighed in water at 25° C., immersed in water for 96 hours, and again weighed in water. The specimen should be suspended by means of a thin silk thread from the hook on one of the beam supports about 1½ in. above the pan when weighing. When weighed immersed in water, the small amount of water absorbed by the thread is neglected. It is essential that the first weight in water be obtained as quickly as possible, in order to secure the correct specific gravity of the material. This is especially true of very porous rock. In practice it is customary to do this by first obtaining the approximate weight of a trial specimen, both in air and in water, and of the true test specimen in air. The correct weight of the true specimen in water is next calculated as nearly as possible by proportion. This weight is then placed on the scale pan previous to the immersion of the true specimen in water.

The computations follow: Calling the weight in air *A*, the weight in water *B*, and the weight in water after 96 hour immersion *C*,

$$Sp.gr. = \frac{A}{A - B}$$

$$Weight\ in\ lb.\ per\ cu.ft. = \frac{A}{A - B} \times 62.37\ lb.$$

$$Water\ absorption\ in\ lb.\ per\ cu.ft. = \frac{C - B}{A - B} \times 62.37$$

The weight per cu.ft is of value in estimating the weight of any given volume, as a cubic yard or earload, of the crushed stone. Thus, assuming 50% voids in the crushed

material, the weight in pounds per cubic yard loose, approximately, equals

$$\frac{Wt.\ per\ solid\ cu.ft.}{2} \times 27$$

The absorption test is of value in judging the probable lasting qualities of the rock under the action of frost, since this is likely to promote weakness or even disintegration. It may also be of value in estimating the probable error due to absorption in the weight of a quantity of stone exposed for some time to the weather.

EQUIPMENT FOR HARDNESS TEST

The object of the hardness test is to determine the resistance that a rock offers to the displacement of its surface particles by friction. The following equipment was utilized in making the tests:

Diamond Core Drill.—The drill is shown in Fig. 1, and consists essentially of a steel core tube *A*, measuring 1 in. inside diameter and 4 in. in length, fastened at its upper end to the hollow shank *B*. This is held in an ordinary drill press, equipped with a hollow spindle. Running water is introduced in the upper end of the spindle from a ¼-in. pipe, while the drill is held in its lower end by means of a headless setscrew instead of the usual drift hole. In this way water may be carried in a simple and convenient manner to the inside of the revolving drill. The Tobin bronze drill-crown *C* is soldered to the lower end of the steel core tube *A*, as shown in the cut. The crown should measure ½-in. thick across its lower face, should be about ⅜-in. thick, and show a slight taper in its outer side, to allow clearance when cutting. Eight or ten holes are drilled in the lower face of the crown of such size that the diamonds will wedge firmly into them, until nearly flush with the surface. The diamonds used in the drills and saws should be dense, regular in shape, and should range in size from ⅛-in. to ⅜-in. in diameter. No flat, scaly, or porous diamonds should be used. Diamonds suitable for this work will usually weigh about ⅓ carat (0.02 gm.) each.

Diamond Saw.—The diamond saw is shown in Fig. 2. The saw is made of Russia iron and consists of a flat disk 8 in. in diameter and 0.03 in. thick. It is made as follows: The disk is firmly clamped between two circular wooden blocks 7½-in. in diameter, leaving ½-in. projecting all around. Radial cuts are then made in the saw ½-in. apart and ¼-in. deep, by means of a small ¼-in. steel chisel. The spaces between the cuts are then slightly opened by bending the projections alternately to the right and left. A mixture of vaseline and fine diamonds is inserted in each cut. The cuts are then closed with a pair of pincers and hammered down to the original thickness of the saw, thus driving the diamond dust into the metal. The diamonds are not ground to a fine powder, but are merely broken up into very fine fragments. A small amount of the mixture taken on the end of a toothpick is sufficient for each cut. Just enough vaseline is used to enable the diamonds to be picked up. The saw is mounted on a spindle (*B*, Fig. 2) driven by the pulley *C* at 600 r.p.m. from the motor *G*. The specimen to be cut is held in the V-block *D*, which is mounted on a swinging arm pivoted at *E*. The lower end of the saw runs continuously in water contained in the galvanized-iron pan (*F*).

Dorry Hardness Machine.—The Dorry machine in use at the present time is a modification of the original

French machine and consists fundamentally of a circular steel disk, *A*, Fig. 3, which is revolved in a horizontal plane by means of the bevel gear *D*, driven by the pulley *C*. At *F* is shown the brass grip for holding the test specimen. The grip holding the specimen is maintained in a vertical position over the steel disk by inserting it in the sleeve *G*, which is of a size to form a sliding fit, allowing free vertical but no lateral movement of the grip. The abrasive, crushed quartz, is fed onto the disk through the funnel *H*, the lower end of which should form an opening $\frac{1}{4}$ -in. in diameter. The sleeve *G* is so placed that the center of the grip, when in position, will be 26 cm. from the center of rotation of the disk.

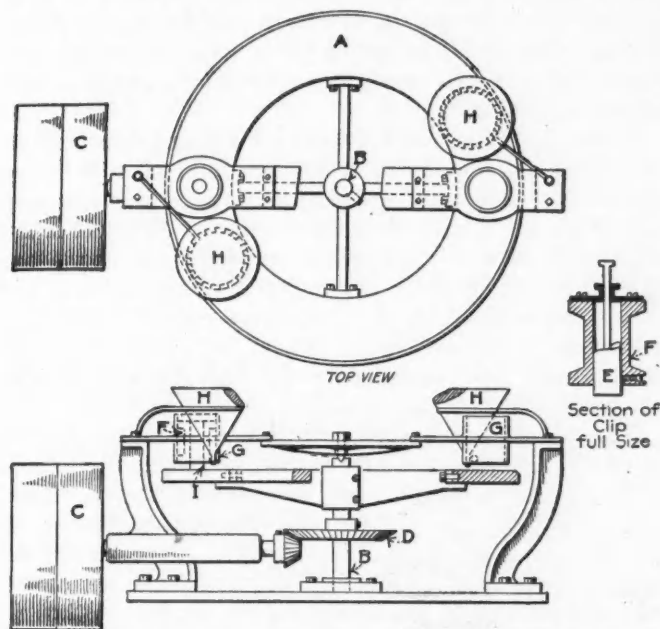


FIG. 3. DETAILS OF DORRY HARDNESS MACHINE

A revolution counter is mounted as at *B*. A galvanized-iron hopper, not shown, is fitted under the disk to receive and carry away the used sand.

Crushed Quartz Sand.—The sand used as an abrasive agent is a crushed quartz, screened to pass a standard 30-mesh sieve and to be retained on a standard 40-mesh sieve. Since it is almost impossible to obtain such a sand commercially, it is customary to specify a material not more than 5% of which will be retained on a 30-mesh sieve, and not more than 25% of which will pass a 40-mesh sieve. Sand known to the trade as No. 2½ quartz will usually fulfill these requirements.

The screens required are a 30-mesh and 40-mesh, each 16 in. in diameter, and the balance is the same as used in the abrasion test. Several small metal washers are required.

METHOD OF MAKING HARDNESS TEST

A core 25 mm. in diameter and about 10 cm. long is cut with the diamond drill from the specimen to be examined. To use the diamond drill properly, so as to avoid undue wear, requires great care and considerable experience. It is convenient to mount the specimen under test on the table of the drill press by means of a bag filled with sand, which forms a cushion for the irregular, projecting edges of the rock. Very small specimens may be mounted in plaster-of-paris. The core should in every case be drilled perpendicular to the bed-

ding plane of the rock, using the hand feed of the drill press only, with just enough pressure to cut. Should the core be not cut entirely through the specimen, it may be removed by inserting the end of a small screwdriver into the cut and using it as a lever to break the core away from the bottom.

After thoroughly drying, the specimen is inserted in the brass grip of the Dorry machine, leaving about 1 in. projecting from the lower end. The grip is then inserted in the sleeve so that the lower end of the specimen rests on the steel disk. The funnel is filled with sand and the machine run until the lower end of the specimen has been worn down to the plane of the disk. The grip carrying the specimen is then removed, brushed free from dust, and accurately weighed. By means of the small metal washers, any one or more of which may be slipped over the projecting rod of the grip, the initial weight should be adjusted to exactly 1250 gm. The grip is then replaced in the same position as before and the machine given 1000 revolutions at the rate of 30 per min., after which it is again weighed. The test should be repeated with the specimens reversed, in order to obtain the average hardness of the two ends. The $\frac{1}{4}$ -in. opening in the funnel of the hardness machine will allow 18.5 lb. of sand to pass through during a test.

Computations.—Calling the initial weight of grip plus specimen *A*, and the final weight after 1000 revolutions *B*,

$$\text{The coefficient of hardness} = 20 - \frac{A - B}{3}$$

The coefficient 20 was chosen as the standard of comparison to give about the same range as that obtained by the Deval abrasion test. The loss in weight is divided by three in order to avoid negative coefficients, since it was found that a specimen might lose as high as 60 gm. in a single test.

The test is of value in determining the resistance of a rock to grinding action. The coefficient of hardness for various types of rock will run from 19.7 for the hardest varieties of quartzite to 0 for very soft limestones and sandstones.

EQUIPMENT FOR TOUGHNESS TEST

The object of the test for toughness is to determine the resistant offered to fracture by impact. The diamond core drill and the diamond saw are used in addition to the equipment described, which comprises:

Grinding Lap.—The grinding lap used for preparing specimens for the toughness test is the same as that used in preparing petrographic specimens. It is 9 in. in diameter and is driven by means of a small electric motor at a speed of 400 r.p.m. Finely powdered carborundum (No. 120) is used as an abrasive agent.

Page Impact Machine.—In the Page impact machine (Fig. 4), a 2-kg. hammer *N* is guided by two vertical rods *J*. The upper end of the hammer has a small cone set in it, which fits snugly into a concentric electro-magnet, and this is attached to the lower side of the cross-head *M*, which slides freely in the guide rod *J*. The crosshead is provided with a slot in its rear side through which a sprocket chain *S* passes, and this sprocket chain is supported on the sprocket wheels, which are attached to castings at the top *I* near the base *H* of the machine.

When the crosshead *M* is raised by the lugs on the sprocket chain, and the current turned on the magnet,

the hammer is lifted until the crosshead *M* comes in contact with the make-and-break on the crosshead *L* and thus releases the hammer, which falls, striking a plunger *O*. The plunger is made of armor-piercing steel, with the maximum temper at its lower end, which is spherical in shape. The upper surface of the test piece, which rests on a counter anvil *W* of hard steel, is in direct contact with and tangent to the spherical end of the plunger at its center point.

It will be observed that the blow as delivered through a spherical-end plunger approximates as nearly as practicable the blows of traffic. Besides this, it has the further advantage of not requiring great exactness in getting the two bearing surfaces of the test piece parallel, as the entire load is applied at one point of the upper surface.

The upper crosshead *L* is raised through any desired height by means of the long revolving screw *K*, which is geared at its lower end to a dial *Q*, on which the height of the make-and-break attachment, and therefore the height of the hammer drop, may be read directly. By means of the revolving dial and screw, the height of the crosshead may be adjusted, by very close approximation, to within 1 mm. In order to prevent the crosshead *M*, which holds the electro-magnet, from striking too hard a blow on the hammer when falling, a dashpot was first used, but it has been found that a few drops of cylinder oil on the lower end of the guide rods completely eliminate this difficulty.

METHOD OF MAKING THE TOUGHNESS TEST

A core of the rock which is to be tested is first drilled, as described under the hardness test. In many cases the core which has already been subjected to the hardness test may be used. A cylinder a little over 25 mm. long is next cut from the rock core by means of the diamond saw. The ends are then ground plane on the grinding lap, making the length of the specimen when completed exactly 25 mm. Although it is not necessary that the two ends of the specimen be exactly parallel, one surface at least should be as nearly perpendicular to the axis of the cylinder as it is possible to make it.

After drying, the specimen is placed on the anvil *W* of the Page impact machine, taking extreme care that when in position the specimen rests with a perfect bearing on the anvil and that the spherical end of the plunger touches the specimen exactly in the center of its upper surface. The small thumbscrew used for separating the clips which hold the specimen in place should be so adjusted that the clips hold the specimen firmly without any undue pressure on the spring. Attention to these details is important if accurate results are to be obtained. When the specimen is in position, the current is turned on the magnet and the upper crosshead is lowered until the rod projecting from it just comes in contact with the rod projecting up from the lower crosshead *M*. This occurs at the instant the pilot lamp, in series with the magnet circuit, flashes out. The dial *Q* is then adjusted to *O*, the upper crosshead raised 1 cm. and the motor started. After each blow the fall of the hammer is increased 1 cm. until failure of the test piece occurs.

The height in centimeters of the blow at failure is recorded as the toughness of the material. The average of two determinations is taken. The test is useful in determining the comparative resistance of rock to im-

pact. Toughness in rock varies through a wide range, from as low as two to three in the case of some limestones and sandstones to as high as 60 in rare instances.

DEVAL ABRASION TEST

The object is to determine the percentage of wear and the French coefficient of wear. The equipment is as follows:

Deval Abrasion Machine.—This machine (Fig. 5) consists essentially of the pulley *A*, or worm gear and motor as at present used, driving the shaft *BB*, upon which are mounted the four cast-iron cylinders *CCCC* in such a way that the axes of the cylinders are inclined at an angle of 30° with the axis of rotation. These cylinders are 20 cm. in diameter and 34 cm. in depth inside. The shaft is set in three bearings *DDD*, and carries at one end a revolution counter, which is not shown in the illustration.

Balance.—This should weigh to 5 kg. and be sensitive to 0.5 gm. It should preferably be equipped with a supplementary scale pan, measuring 10 in. in diameter and 2 in. high, and a suitable counterweight. This will make it possible to weigh the entire sample in one operation. A 50-lb. anvil, stone hammers, several 3-quart enameled-iron pans, a sieve, preferably brass rimmed and reinforced to withstand heavy usage, 16 in. in diameter, with square $\frac{1}{16}$ -in. openings, and a drying oven complete the equipment.

The material is broken into pieces as nearly of the same size and shape as practicable, so that approximately 50 pieces shall weigh, after thorough drying, to within 1 gm. of 5000 gm. In no case should the number of pieces exceed 60 or be less than 40. Care should be taken to use only freshly broken fragments, as pieces with rounded edges will give different results. Although the size of the individual pieces composing the sample varies theoretically with the sample's specific gravity, in practice the pieces may be so broken as to average 2 to 2½ in. in diameter, with the assurance of obtaining a properly sized sample.

After weighing, the sample is placed in one of the cylinders of the Deval machine, the cover is bolted on, and the machine given 10,000 revolutions at the rate of 30 per min. At the conclusion of the test the sample is screened on the $\frac{1}{16}$ -in. sieve, the material retained washed thoroughly free from dust, dried in the oven and again weighed. The difference between this weight and that first obtained represents the wear as determined by test.

The initial weight in every case being 5000 gm., and calling the final weight *A*:

$$\text{Per cent. of wear} = \frac{5000 - A}{5000} \times 100$$

The French coefficient standard is based on the theory that a rock of standard excellence does not lose more than 100 gm. under $\frac{1}{16}$ -in. in size during a test. This is equivalent to 20 gm. per kg. of rock used, or 2% of the original weight. Assuming, then, a coefficient of 20 for such a rock, the French coefficient of wear for any material equals:

$$20 \times \frac{20}{W} = \frac{400}{W} = \frac{40}{\% \text{ of wear}}$$

where *W* is the loss of weight under $\frac{1}{16}$ -in. in size per kg. of rock used.

In this test, the sample is thrown the length of the

cylinder twice in each revolution, so that the individual stones grind against each other as well as against the sides of the cylinder. The rock may likewise be broken by the impact, and the test thus may be considered as one not only for hardness but for toughness. The percentage of wear runs from as low as one in certain rare

From many tests the conclusions having a special bearing on tube-milling work may be stated as follows: (1) Average hardness increases with toughness, and rate of increase becomes less as hardness becomes greater. (2) Individual estimates for hardness vary through wide limits for low estimates for toughness. (3) A determination of toughness is almost sufficient to show whether the material is hard enough to resist abnormal abrasion in tube-milling.

After the testing of many samples from the United States and Canada, the results were classed in groups according to the rock-family order. The following conclusions were reached with reference to the more durable classes of rock:

The first six rock families, *Andesite, Basalt, Diabase, Diorite, Gabbro* and *Rhyolite*, comprise the well-known group of road-building rocks commonly known as trap. They are all of igneous origin, but are denser and finer grained than the granites, possessing, as a rule, a peculiar interlocking crystalline structure which imparts to them their distinguishing characteristic—high toughness. The average toughness of all the traps, with the exception of gabbro, which runs somewhat lower, is about 18. This is a considerably higher average than that shown by any of the other types or groups. The same relationship holds true in the abrasion test, the average French coefficient of wear running from about 13 to 15. Comparatively slight variations in hardness are noted for any family or for the group as a whole, the average hardness for which is about 18. The specific gravity of this group averages about 2.9, with an average weight per cu.ft. of 180 lb. Individual samples have a specific gravity seldom less than 2.7 nor more than 3.2. Water absorption may vary from a few hundredths of 1% to over 7 per cent.

Chert is a very hard material, but frequently shows a low resistance to wear, owing to its tendency to fracture along lines which have developed as shrinkage cracks in the rock structure. For this reason it is extremely difficult to test for toughness. Comparatively few samples have been found suitable for all tests. Of those examined, however, the French coefficient has usually been found to lie between 2 and 8, with an average of 5; toughness between 7 and 26, with an average of 16, and hardness between 19 and 20. Specific gravity usually lies between 2.4 and 2.65, and the average weight per cu.ft. is about 160 lb. Water absorption may run from a few tenths of 1% to over 8 per cent.

Marble and quartzite are the two families of non-foliated metamorphic rocks corresponding to limestone and sandstone, respectively. While in some respects it is convenient to consider marble with the limestone and dolomite group, its average toughness, about 5, is lower; and average hardness, about 14, is also lower. For those samples tested the specific gravity ordinarily falls between 2.7 and 2.9, and the weight per cu.ft. averages 173 lb., which is somewhat higher than the average for either limestone or dolomite. As would therefore be expected, the maximum absorption is less, being under 2.5%. Quartzites show an average toughness of 15, as compared with 10 for the sandstones. The coefficient of hardness is also higher, and for the samples tested shows a much smaller range than for the sandstones. Their specific gravity from tests made usually lies between 2.6 and 2.8, and average weight

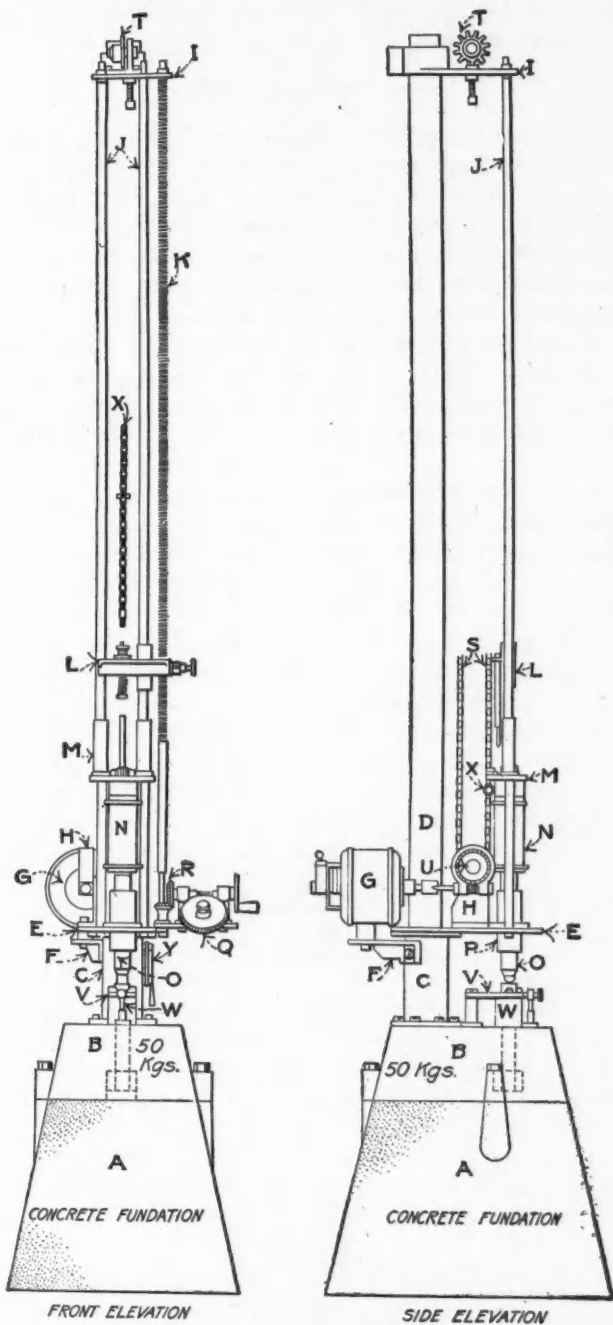


FIG. 4. DETAILS OF PAGE IMPACT TESTING MACHINE

cases to as high as 30 or even 40 for some sandstones and limestones.

In considering the numerical results obtained by the method of testing in each case, it will be noted that, whereas the hardness and toughness coefficients increase with the hardness and toughness of the materials being tested, the French coefficient of wear varies inversely with the actual amount of fracture and abrasion. It would therefore seem more reasonable to refer to the French coefficient as a figure indicating proportionate resistance to wear.

per cu.ft. is about 167 lb. Water absorption runs from a few hundredths of 1% to nearly 3 per cent.

SUITABLE PEBBLES FOR TUBE-MILLING

In utilizing the tests as a guide for selecting suitable pebbles for tube-milling, some modifications in the interpretation of results may be advantageously employed. On the assumption that toughness is the principal requirement, and that where a sufficient degree of toughness is found the hardness will be sufficient to resist abnormal abrasion, it is possible to classify a large number of available rocks which, if freed from surface irregularities, may serve the purpose. In any case, where toughness exceeds a certain limit the hardness may then be taken as a measure of the quality of the stone for tube-milling. On the other hand, the French coefficient (of general resistance to impact and abrasion) may serve to indicate the efficiency of the rough rock when introduced into the tube-mill without preliminary tumbling treatment.

Sometimes a high figure may be obtained in both cases, and this is especially noticeable with the trap-rock group. This would indicate that there is nothing

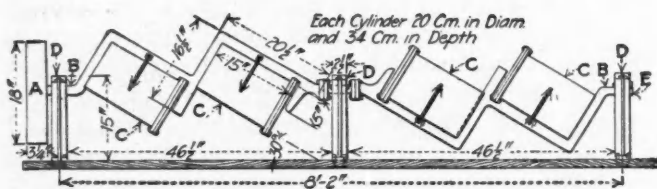


FIG. 5. ABRASION MACHINE—DEVAL TYPE (FRONT VIEW)

to be gained by preliminary tumbling treatment, provided, of course, that the pebble has been roughly shaped before use. When the French coefficient falls below 16 (2.5% of wear), the rock under consideration may be considered unsuitable, as the amount of chippings produced would impede grinding of the ore and reduce efficiency in the mill. This limit is, however, purely arbitrary, as the actual efficiency of the stone would depend on the work it was called upon to do. When the toughness coefficient falls below 18, it may be assumed that the possibility of fracture is such that no reliance could be placed on the rock to withstand heavy duty. The toughness may be considered by itself a sufficient indication of the suitability of the rock. Quality is then measured by hardness. The French coefficient may be considered as indicating an efficient stone only when the proposed standard has been reached in the toughness test. The limit of toughness is, of course, also arbitrary, as stones with a much lower toughness than 18 have been used successfully in tube-milling work.

A rough test to determine the relative efficiency of prepared rock is to pile a few tons of the pebbles in a conical heap and then, standing about six feet from the pile, throw one of the pebbles onto the heap with maximum force. If the rock survives the test without chipping or fracturing, it deserves a trial in the mill. I have used this test on a number of grades of imported flints, and found, in every instance, that a proportion at least could not compare with the rocks of the trap group for toughness and ability to withstand severe impacts.

In considering the utilization of country rock for tube-milling purposes, it is important that an ample dimension should be provided in the tube-mill feed aperture

to permit the easy passage of a pebble of suitable size and necessary weight. All pebbles used should be tested before acceptance with a double-ring gage with close maximum and minimum diameter limits. The stone should pass the larger ring and rest on the smaller one. A shut-down to remove pebbles jammed in the feed is a rare occurrence, and is no more likely to occur with artificial pebbles than with imported flints if ordinary precautions are taken.

OPERATING CONDITIONS

Whatever the grinding media employed, there is ample evidence to show that the efficient load of pebbles in a tube-mill should be on a level with or just above the center line. Apart from securing a maximum cascading effect, there is a notable advantage in the fact that the automatic elimination of the smaller and useless pebbles is possible by the provision of a coarse grating at the discharge end of the mill. This grating should have openings at least $1\frac{1}{2}$ in. in diameter. An automatic screening device attached to the discharge flange of the mill will separate the mill pulp from the discarded pebbles.

To obviate unnecessary lining and pebble wear, an ample feed of ore is imperatively necessary, together with a continuous return of unground product to the feed end. The fallacy of any departure from standard cylindrical shape has been demonstrated by recent investigators, and it may not be superfluous to point out that the grinding of an ore insures a considerable increase in the gross bulk of the pulp, and involves a proportionately higher power consumption as reduction proceeds. The efficiency of the cylindrical mill in closed circuit operation may therefore be partly attributed to the balancing of duty at both ends of the mill by returning the oversize to the feed end.

CHARACTERISTICS OF HARD ROCKS

The accompanying table gives details of the varied characteristics of a few of the great number of hard rocks that have been tested in the Washington laboratory. The complete record of the qualities of the various stones has been made from samples obtained or received by the U. S. Department of Agriculture. It probably includes only a few of the stones available near milling plants, unless the latter happen to be situated near towns or where special attention has been paid to the scientific construction and upkeep of the roads of the district. The list given describes only a small fraction of the available rocks tested and reported in the bulletins previously mentioned. It is possible that these figures may be found useful, if only for comparative purposes. Details of the procedure to be adopted in the case where tests on stone are required are given in bulletin No. 347.

Where any appreciable quantity of ground rock is introduced into a milling circuit, the fact that a correction should be made in the assay residue results is sometimes overlooked. In the case of a sliming mill where the consumption of pebbles is 2% of the weight of the ore, and where the original ore assays \$10 and the total residue \$1, the correct extraction is not 90% but 89.8%, with an actual ore residue content of \$1.02 per ton.

That the prejudice against the use of artificial pebbles is giving way to a realization of the fact that as good if not better service can be obtained by the cheaper substitute is seen in recent practice. A rhyolite that

TABLE III. CHARACTERISTICS OF SOME ROCKS WITH A MINIMUM TOUGHNESS OF 18

State	Town	County	Material	Weight Cu.Ft.	Water Absn. Cu.Ft.	French Coeff.	Hardness
Ala.	Anniston	Calhoun	Quartzite	165	0.20	11.7	19.7
Cal.	Oakland	Alameda	Rhyolite	165	0.36	23.0	18.7
	Milton(a)	Calaveras	basalt	181	0.58	27.4	19.2
	Bakersfield	Kern	Diorite	184	0.08	10.8	19.3
	Spadra	Los Angeles	Trachyte	153	1.49	7.9	18.7
	Lancaster(a)	Los Angeles	Altered trachyte	178	0.53	23.5	17.8
	Riverside	Riverside	Diorite	187	0.19	23.8	18.7
	Folsom	Sacramento	Altered andesite	175	0.29	28.6	19.3
	Cordelia	Solano	Olivine basalt	175	0.38	24.1	18.9
	Petaluma	Somoma	Basalt	181	0.89	19.6	18.2
	Round Mountain	Ventura	Andesite	172	1.27	14.2	17.8
Col.	Boulder	Boulder	Augite andesite	175	0.52	13.4	18.3
	Colorado Springs(a)	El Paso	Trachyte	134	4.21	12.7	19.1
Idaho	Coeur d'Alene	Kootenai	Basalt	178	0.98	19.0	19.0
S. Dak.	Rapid City	Pennington	Feldspathic quartzite	168	0.21	16.7	19.0
	Sioux Falls	Minnehaha	Olivine diabase	190	0.37	14.8	18.7
Tex.	Austin (a)	Travis	Nephelite basalt	199	0.21	23.5	18.7
Utah	Provo	Utah	Siliceous limestone	162	2.36	11.0	18.2
Wis.	Portland	Dodge	Quartzite	168	0.14	14.2	19.0
Bruce Mines, Ont., Canada			Altered diabase	187	0.17	18.2	18.5
			Altered augite andesite	181	0.34	18.7	17.9
Copley Is., Ont., Canada			Feldspathic sandstone	168	0.30	16.3	18.2
Belmont Township, Ont., Canada			Amphibolite	187	0.31	.....	18.3

was being tested for the purpose in Nevada in 1914⁶ has since been adopted in three mills in Manhattan and two at Tonopah, and practically the same service is being obtained from pebbles made from this material as was possible from the best imported flints.⁷

Prospecting for Dominican Oil

Renewed interest is being shown in the oil possibilities of the Dominican Republic, according to Consul C. S. Edwards at Santo Domingo. Representatives and engineers of an American corporation were on the ground in April awaiting the arrival of the requisite drilling machinery to begin active operations.

The region about Azua, on the south shore, about 60 miles west of the capital, is the scene of this renewed activity. That there is oil in this locality does not appear to admit of doubt. Its presence is shown not only by the seepages but by other indications as well. An effort was made 10 or 12 years ago to develop this region, and drilling was done to a depth of about 1000 ft., but was abandoned owing to the fact that the sea water encountered presented a difficulty which could not then be overcome.

From this abandoned well—which, once each 24 hours, continues to send a volume of oil some 50 ft. into the air—comes another encouraging indication, that is, the purpose of the new effort to continue drilling on this site in the belief that by going to a greater depth, and by overcoming the water, the reservoir of oil may be reached.

⁶"Danish Tube-mill Pebbles and Their Substitutes," by Jay A. Carpenter, Min. & Sci. Press, Jan. 23, 1915.
⁷Eng. & Min. Journ., July 14, 1917.

Great Britain's Steel Production in 1917

Great Britain's steel production in 1917, which was the largest in history, amounted to a total output of ingots and castings, exclusive of crucible steel, of 9,752,328 tons, a gain of 555,871 tons over 1916 production, writes the *Iron Trade Review*. Almost four-fifths of this gain was in basic openhearth steel. Production of electric ingots and castings also showed a large proportionate increase, reflecting the stimulus given to this branch of manufacture by war demands for high-grade material.

Pig-iron production in Great Britain in 1917 showed an increase over 1916, but is still below its record for the years immediately preceding the war. The 1917 output of all grades, including ferromanganese, spiegel-eisen, ferrosilicon, etc., and direct iron castings, was 9,420,254 tons, but this is less than the 1913 figure of 10,260,315 tons. The following tables show the production of pig iron and steel in Great Britain for four years:

GREAT BRITAIN PIG-IRON PRODUCTION, IN TONS

Grade	1917	1916	1915	1914
Forge	864,759	899,467	1,024,063	(a)3,369,516
Foundry	1,162,982	1,418,824	1,573,375	482,444
Basic	3,082,562	2,290,549	2,272,684	2,002,500
Hematite	3,993,374	4,042,014	3,564,276	3,225,403
Spiegel, ferromanganese, ferrosilicon, etc.	296,524	291,845	255,484	326,354
Direct iron castings	20,053	105,284	103,577	.....
Totals	9,420,254	9,047,983	8,793,659	8,923,773

(a) Includes forge and foundry pig.

GREAT BRITAIN STEEL PRODUCTION, IN TONS

Grade	1917	1916	1915	1914
Acid bessemer	1,059,281	1,096,153	821,408	797,072
Basic bessemer	602,265	505,817	479,816	482,444
Acid openhearth	4,413,843	4,393,004	4,090,752	3,680,848
Basic openhearth	3,421,170	3,012,558	2,958,968	2,874,749
Electric ingots	57,156	39,968	20,000	.....
Electric castings	11,693	9,288	2,000	.....
Other steel castings	186,920	139,669	177,071	.....
Totals	9,752,328(a)	9,196,457(a)	8,550,015	7,835,113

(a) Excluding crucible steel.

Foreign Trade in Copper

Exports of copper from the United States in February and March, 1918, and the first three months of the year are reported by the Department of Commerce as follows:

	February Lb.	March Lb.	Jan.-Mar. Lb.
Ore and concentrates, etc., contents	183,670	381,495	925,981
Unrefined, in bars, pigs, etc.	1,431,009	4,291,367	10,156,647
Refined, bars, etc.	59,033,853	61,902,754	202,034,816
Old and scrap	.....	64,900	70,690
Plates and sheets	783,397	2,729,851	8,322,169
Pipes and tubes	237,030	449,197	1,348,735
Wire, except insulated	1,834,948	939,536	3,252,762
Composition metal, copper chief value	2,884	42,660	48,847
Totals	63,506,791	70,801,760	226,160,653

The weight of ore exported in March was 3386 long tons, and of concentrates, matte and regulus, 539 long tons.

Imports of copper in February, March, and the first three months were:

	February Lb.	March Lb.	Jan.-Mar. Lb.
Ore and concentrates, contents	13,720,881	14,793,141	37,722,625
Matte and regulus, etc.	1,275,562	3,724,800	5,079,912
Unrefined, in bars, pigs, etc.	41,016,225	36,514,548	112,043,938
Refined, in bars, etc.	6,385,748	.....	6,385,748
Old, etc., for remanufacture	82,249	36,400	280,353
Composition metal, copper chief value	56	.....	28,066
Totals	62,480,721	55,068,889	161,540,642

Ore imported in March amounted to 38,081 long tons; concentrates, 14,283; matte and regulus, 2632 long tons.

Mineral Production of South Africa in 1917

By A. COOPER KEY*

In 1917, the gold output of the Rand decreased, that of coal increased, while copper production remained stationary, though shipments of the latter metal were irregular. Working costs increased, while profits and dividends decreased.

OFFICIAL statistics of the Mines Department of the Union of South Africa and of the Transvaal Chamber of Mines relating to the production of minerals in 1917 have been issued subject to amendment. The value of the mineral production for the Union was £51,202,367; of this, gold accounted for £38,307,675 and the Rand itself contributed £36,978,236. The grand total was about £709,000 over that for 1916, and about £7,670,000 more than in 1915, when, however, the yield of the diamond mines was insignificant.

The gold output in 1917 decreased by £1,182,000, but this was more than offset by the increase of £2,008,000 in the value of diamonds produced, which was £7,736,371, compared with £5,728,391 in 1916. The increase is partly attributable to a rise in value from 49s. to 53s. 3d. per carat. The policy followed by the diamond interests is to supply the market with only its actual demand for stones, a policy which can now be pursued without exception, owing to the De Beers Consolidated Mines, at Kimberley, having recently acquired a controlling interest in the Premier mine, near Pretoria. In earlier years this mine was an active competitor of the De Beers company, but it has latterly been party to a selling agreement. By restricting the sale to the actual demand, better prices are obtained and the life of the mines is prolonged.

COAL PRODUCTION INCREASE DUE TO CHANGE IN SHIPPING ROUTE

Coal production was 10,382,623 tons, valued at £3,255,659, an advance of £516,000. The increase is due to the enlarged demand for bunker coal at Durban and Delagoa Bay, caused by diversion of ships from the Suez to the Cape route to avoid enemy submarines in the Mediterranean. Contracts made by the gold mines of the Rand have kept the price of Transvaal coal steady at the moderate figure of 4s. 9d. per ton at the pit's mouth. In Natal, however, in consequence of the shipping demand, the average price advanced from 6s. 10d. in 1914 and 1915 and 7s. 5d. in 1916, to over 10s. per ton in 1917.

COPPER SHIPMENTS FROM PORTS IRREGULAR

Copper production in 1917 was 20,174 tons, valued at £1,106,085, much the same value as in the two previous years. The Mines Department's figures are those of sales and shipments, and, in these days of irregular shipping, do not necessarily reflect the output of the Cape Copper and Messina companies. This method of recording statistics gives irregular results; for example, Transvaal copper is reported thus:

August, £951; September, £39; October, £97,029; November, nil; December, £116,244; Cape Colony: October, nil; November, £207,432. The production of the mines, sent to the ports for shipment, sometimes waits for weeks on the wharves.

To tin is assigned a value of £375,615; here, again, "sales and shipments." Recently the Zaaiploats company started a small smeltery for ingot tin.

SHRINKAGE IN GOLD OUTPUT DUE CHIEFLY TO LABOR SHORTAGE

The decrease in gold output in 1917 is attributable to a decline in the quantity of ore milled, the tonnage handled by the 56 Transvaal mines which reported their output and profits to the Chamber of Mines being 27,862,851, compared with 29,175,468 in 1916. The total for the Rand, the outside mines being insignificant, with the exception of the Sub-Nigel, Glynn's Lydenburg and the Transvaal Gold Mining Estates, was 27,251,960 tons, as against 28,525,252 in 1916. The chief cause of the shrinkage was the inadequate supply of native labor during the year. This, in turn, was due to the reopening of diamond mines, the dispatch of a labor contingent to France, and the demands of new industries within the Union, that were promoted by importation difficulties. The mills ran only 301 days, compared with 317 in 1916, a drop of 5%, which corresponds approximately with the decrease in tonnage. Some older mines are approaching exhaustion and becoming difficult to work.

The recovery improved, doubtless owing to a greater proportion of rock from the richer mines of the Far East Rand entering into the aggregate, and to the closing, either wholly or in part, of some low-grade mines. The total number of stamps working on the Rand was 9029, as against 9243 in 1916. At the May Consolidated 100 stamps, and at Vogelstruis Estates 80 stamps were shut down because of exhaustion of the property. At the Randfontein Central, the Robinson and the Witwatersrand Deep, it was expedient or necessary to hang up 100, 45 and 50 stamps respectively. Against these reductions, the Government Areas put 25 extra stamps into commission, while the new battery of Springs mines started operations.

WORKING COSTS INCREASED

The average working cost for the year was 19s. 2d., compared with 18s. 1d. in 1916, but the figure for December, 1917, was exactly a sovereign a ton. As the recovery for the Rand averages only 27s. 6d., say 6½ dwt. per ton, the margin is a narrow one. The industry has suffered from ever-increasing costs of supplies, a large part of which has to be imported.

In the last two years, the native labor supply has fallen by 40,000 in face of increasing demands. Mining companies have agreed to pay to married men who have entered the service, and to single men with dependents, a percentage of their wages. A war bonus to meet the increased cost of living was introduced in September, 1916, and increased in July, 1917, costing £500,000 a year.

*Box 3621, Johannesburg, South Africa.

The constantly rising costs are having a harmful effect on the lower-grade mines, which constitute about a quarter of the total. In November, 1917, 10 mines crushed 333,000 tons for a net profit of £8250, none making more than 1s. 6d. per ton profit and six as little as 6d. per ton. Another group of five made between 1s. 6d. and 2s. per ton profit. The 15 mines crushed altogether 576,000 tons, with a total profit of only £31,300.

So important are these low-grade mines to the state, on the score of indirect taxation, and to the community, that the government has appointed a committee to devise schemes to prevent their shutdown, which would mean throwing 5000 white workers out of employment, only a small part of whom could be absorbed.

DIVIDENDS OF RAND COMPANIES DECREASED

The dividends declared by the Rand mining companies in 1917 totaled £6,556,187, against £7,095,066 in 1916, a decrease of about £540,000. The profits were only £10,225,638, compared with £11,630,001, a decrease of £1,404,400. The margin between working profits and dividend distributions is narrower than usual, owing to the completion of capital programs, inability to procure machinery for expansion, which restricted new enterprise, and to initial and advanced notifications by certain companies of the Far East Rand. For instance, the Government Areas made its first payment of 12½%, equal to £175,000; Modder Deep paid £425,000, instead of £337,500; Modder B (making the largest aggregate distribution of all Rand companies) £595,000, as against £542,500.

The nine mines of the Far East Rand were responsible for an aggregate distribution of £2,865,000, equal to 43%. With further decadence of the Central Rand mines, some of which have been in existence 30 years, and further expansion in the Far East Rand tract, the ratio may rise to 50%. In January, when several of the older mines were flooded by heavy rains, the mines in question made 51% of the whole working profit.

The Rand profit for 1917 was nearly a million less than in 1910, and £1,800,000 below the figure for 1908, in the "palmy days" of the Rand, when only 18,196,589 tons were crushed, as against 27,251,960 last year. In the intervening period there has been a drop of 4s. 7d. per ton in recovery, while mine-working costs are 1s. 2d. per ton higher. The dividend aggregate is the smallest since 1906.

Tests for Flotation Oils

Two tests by which adulteration in pine products may be determined are given in a booklet on flotation oils which was recently published by the Pensacola Tar and Turpentine Co. They are the polymerization test and the acetic-acid test. To make the polymerization test, put 20 c.c. of concentrated sulphuric acid in a graduated narrow-neck Babcock flask and place in cold water to cool. Gradually mix in 5 c.c. of the oil to be tested, cooling from time to time, not allowing the temperature to get above 60° C. When the mixture no longer warms up on shaking, agitate thoroughly. Place in a water bath and heat to 60° or 65° C. for about 10 minutes. Agitate four or five times during the heating pe-

riod. Cool to room temperature and fill the flask with concentrated sulphuric acid until unpolymerizable oil rises in the neck. Allow to stand for 12 hours or more for light oils and 48 for heavier ones, and read unpolymerizable matter on graduated neck for per cent. The longer period is preferable, as it often takes some time for separation. All the organic oils contain some unpolymerizable oil, for which the proper deduction should be made.

The acetic-acid test is for the heavier oils, such as tar oils and rosin oils. Weigh about 40 grams of rosin or tar oil to be treated into an evaporating dish; then add 100 c.c. of 10% alcohol potash solution and keep on a water bath for 15 min., stirring well. This mass is then poured into a separatory funnel and the soap washed out with water. The unsaponifiable matter is then run into a flask with 100 c.c. of glacial acetic acid and heated to 50° C., the flask being shaken to dissolve all the soluble matter. This mixture is then run into a separating funnel, a little acetic acid being used to wash out the flask. The mixture is allowed to stand for about 30 min., when most of the mineral oil will be separated out on top. The solution should be put back into the separating funnel, as there may be further separation, in which case the separated oil is added to the rest of the mineral oil, which has been run into a weighed beaker and placed on a water bath to evaporate off the acetic acid. The beaker containing the separated oil is weighed and the amount of oil is considered mineral oil; this can readily be ascertained by the odor and by treating with concentrated sulphuric acid.

The process of distilling pine wood is carried out in concrete retorts of heavily reinforced construction. They are 96 ft. long and hold 11 cars containing a cord of wood each. These cars are of all-steel construction and are left in the retorts throughout the process. The retorts are heated by internal flues from furnaces fired with fuel oil and the combustible gases formed from the distillation of the wood. The wood is subjected to temperatures which distill all of the resinous matter, leaving nothing but charcoal on the cars.

The method of handling these retorts is as follows: After complete distillation, the doors of the retorts are opened, a chain is attached to a pulling cable at one end and to another train of cars standing on a loading track at the other, and the 11 cars of charcoal are pulled into the coolers at the same time the 11 fresh cars are pulled into the retorts. The operation, which requires but a few minutes, is done while everything is hot, so that little time or heat is wasted, and in a short time the condensers are again flowing.

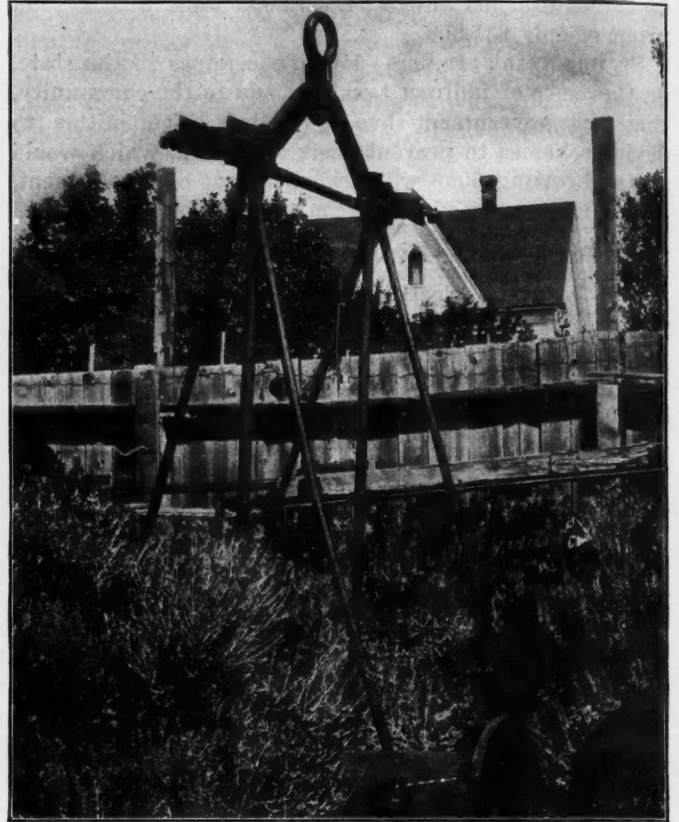
The liquids coming from the condensers are crude pine oil and pyroligneous acid or wood vinegar. This acid water, containing about 5% of acetic acid, is run to waste after settling, and the crude oil, which contains the crude wood turpentine, crude pine oils, wood creosote oils and tar oils, is pumped into a large steam still, where the lighter oils are roughed off by a system of steam jets and heater coils. The higher temperature oils cannot be driven over economically by steam, so the still is emptied into a large copper fire still, where the creosote oils and tar oils are removed.

Remember the Comfort Fund of the 27th Engineers.

Early Comstock Hoisting Apparatus



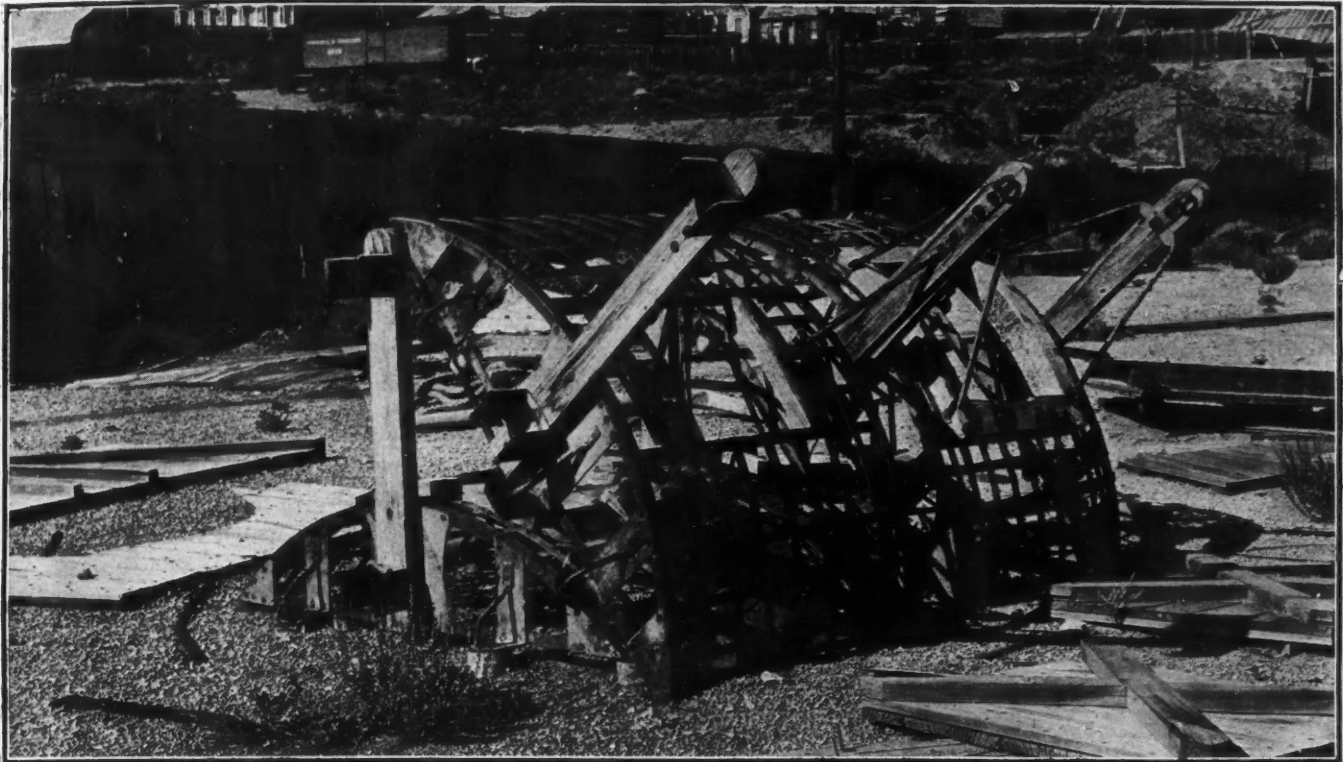
EARLY SKIP USED AT COMBINATION SHAFT



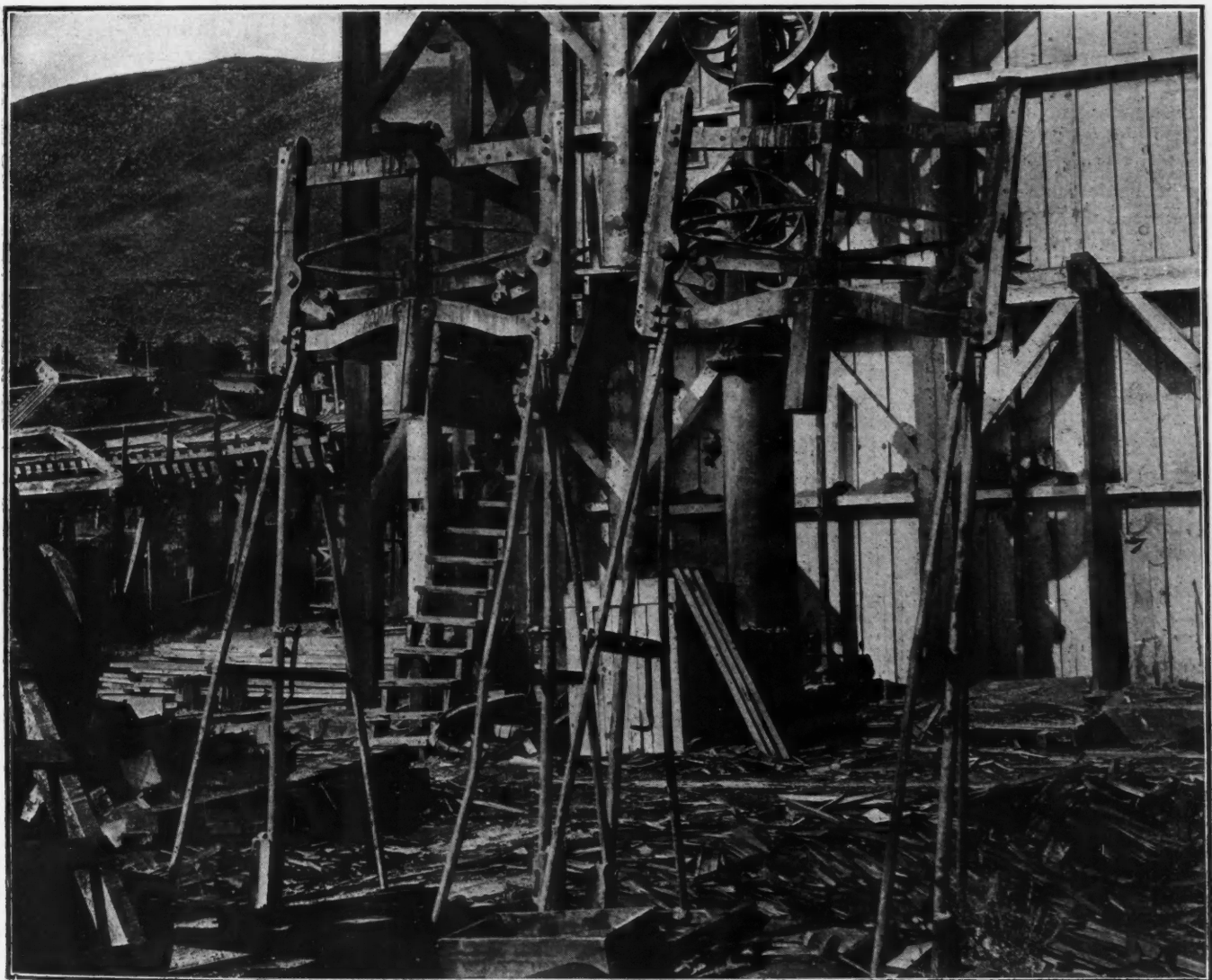
SAID TO BE FIRST CAGE USED ON THE COMSTOCK



ONE OF THE EARLIEST COMBINATIONS OF CAGE AND SKIP USED IN VERTICAL SHAFT ON THE COMSTOCK



SHAFT COVERS USED ON THE OPHIR SHAFT OF THE OPHIR MINING CO.



CAGES USED AT THE OPHIR MINE. NOTE THE PECULIAR CONSTRUCTION OF SAFETY DOGS

Details of Practical Mining

Improved Method of Igniting Fuse

BY E. M. WESTON

In "spitting a round of holes" in a drift or stope it sometimes happens that accidents are caused by delays in ignition. Such delays are often the result of failure of the "snuff" or lamp, or from concealment of unspit fuses by the smoke from the first few ignited. In some cases certain holes are not spit or are spit in the wrong

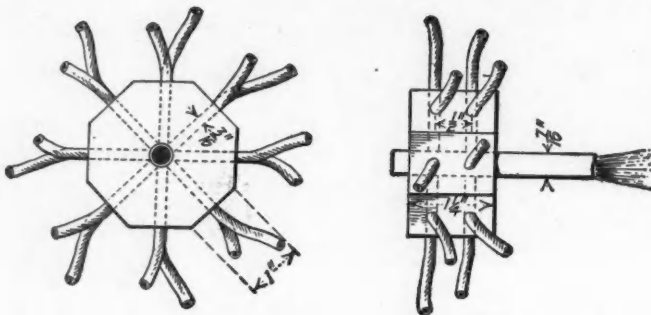


FIG. 1. IGNITER DESIGNED FOR 16-HOLE ROUNDS

order of fire, and waste of time, labor and explosives takes place. For many years on the Witwatersrand all fuses were spit by means of a "cheesa stick," which was a thin piece of pine having twisted around it a thin strip of blasting gelatin, sometimes damped with mud to make it burn slowly. The fuse ends were split in the usual manner and the spurting fire from the burning cheesa stick gave a flame that ignited the fuses easily and was difficult to put out even in a wet place. The

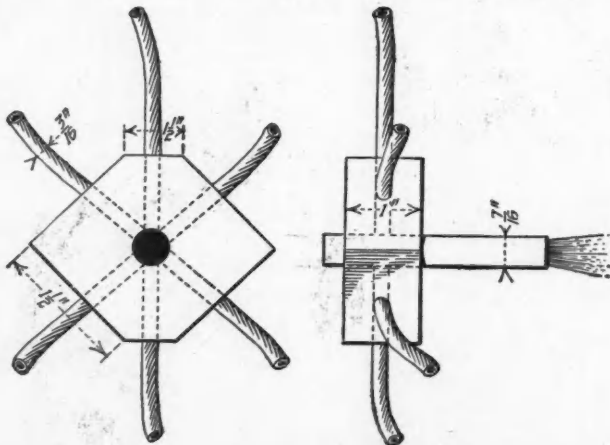


FIG. 2. PLAN AND SECTION OF SIX-HOLE IGNITERS

use of these spitters was finally forbidden by law, on account of the serious amount of carbon monoxide and nitrous gases given off, and now all fuses are ignited by specially manufactured sticks which give off only a small fraction of 1% nitrous acid gas. Some of these are manufactured by the explosive companies and others under various patents, and while there are good and inexpensive igniters on the market, other varieties give

off too much smoke and become soft through absorption of dampness if kept underground. The improved type gives out a strong flame at the end like that of a slow-burning "squib," is about six inches long and $\frac{1}{2}$ in. in diameter, burns for three to five minutes, and has a wooden handle three inches long. Fuses are usually cut six feet in length. It seemed possible to avoid loss of time and labor in igniting each hole in proper succession, and W. J. Pickford has reported as follows upon the system in use at the Crown mines, in the Transvaal, of which he is joint general manager:

"In September, 1916, a trial was made of a fuse igniter designed by Mr. Fisher. This was named the 'mouse trap.' It proved reliable, and a simple variation is shown in Fig. 1. It is made from a block of soft wood, octagonal in shape, $1\frac{1}{2}$ in. high with sides of octagon one inch long. Through the center of this block a hole $\frac{7}{16}$ in. in diameter is made, and each face of the octagon has two $\frac{3}{16}$ -in. holes with $\frac{1}{2}$ -in. centres bored through horizontally to the centre hole. A 'cape explosive' 'cheesa stick' with the glazed paper wrapping taken off the portion in the block is put in the $\frac{7}{16}$ -in. hole and

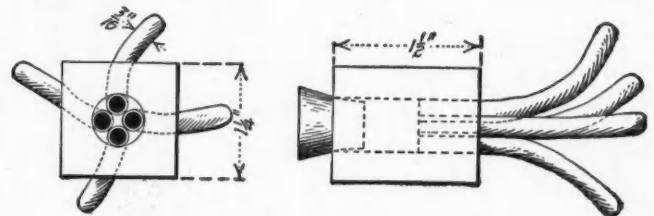


FIG. 3. ARRANGEMENT OF FOUR-HOLE FUSE IGNITER

the pieces with ends cut off square are put into the $\frac{3}{16}$ -in. holes and pressed up to the 'cheesa stick.' The pieces are cut for timing beforehand. The miner lights the 'cheesa stick' at the other end and has an extra three or four minutes to get away, or the fuses can be shortened. Miners are so used to coiling the fuses outside the hole to prevent cut-off that they may be prejudiced; but it must be remembered that if the fuse is good and properly cut it should have burnt into the tamping of all holes before the first one goes off.

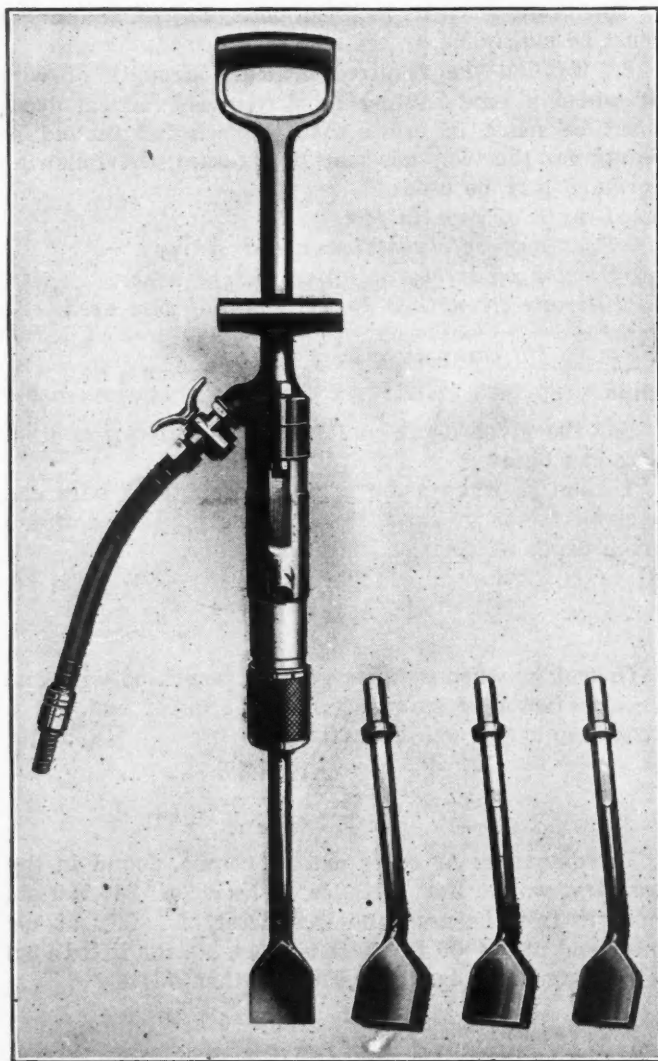
"A small six-hole block shown in Fig. 2 was tried for stoping. A still simpler form is shown in Fig. 3. The miner cuts his fuses for timing, and, holding the four ends together, inserts them as shown. When blasting, he pushes the end of the 'cheesa stick' into the block, and the fuses all ignite together. If less than four holes have to be spit a short length of 'dummy' fuse makes up the number to fill the holes. This device has led to the introduction of a blasting gang, comprising a white man and several natives. The miners load the holes in the usual way and prepare the blocks for blasting, leaving a cork on the open end. When the miners come off shift they see the blaster and tell him what holes and benches to blast. The blaster goes down, and, working against the air current and down the stopes, collects

Mining and Metallurgical Machinery

Mechanical Tampers in Mine Track Work

By H. L. HICKS*

Mine operators are beginning to profit by the experience of railroad men who have used mechanical tampers for ballasting track, and to utilize them both above and below ground. Pneumatic tie-tamping tools have been in use on the railroads for about three years, and have firmly established themselves as standard track-



PNEUMATIC TAMPER WITH VARIOUS SIZED TAMPING BARS

maintenance equipment. Tabulated comparative performance records compiled by several large users show an average labor saving of about 75% over hand tamping and a worth-while reduction in cost.

The pneumatic machines are used in pairs, working simultaneously on either side of a tie. They develop

considerable power and force the ballast down under the center of a tie, where it affords maximum support. The "Imperial" tie tamper, shown in the cut, consists of a cylinder containing a non-rotating valveless hammer, somewhat similar to a hammer drill, but having a suitable extended handle and a special retainer to hold the tamping bar. These bars are to be had in three styles, the varying size of the tamping face adapting them to use in coarse, medium or fine ballast. Pneumatic tampers have fully demonstrated that the kind of material used as ballast is not a factor; they are equally effective in crushed rock, cinders, slag, gravel, earth, chats, etc.

Mine labor is growing scarcer, and it stands to reason that, if two pneumatic tampers will do the work of eight men of a railroad gang, they will effect an equally important saving at the mine. While the maintenance of mine trackage is not as important as that of railroad roadbed, still, in the aggregate, it is a considerable item at many properties. Mines in general have air already available, and with this advantage the investment for equipment is a small item. In the open-pit mines of the Mesabi range, however, conditions are more akin to those obtaining in railroad work. At the Mahoning, Hull-Rust and other mines the extensive trackage, while of but semi-permanent character, must needs be firmly ballasted to a large extent. Operating economy demands that the cost of building and maintaining track be reduced to a minimum, and for this reason the introduction of the mechanical tamper has proved a welcome innovation. At these properties, air power for operating the tampers is supplied from portable compressor cars of the standard hand-car mounted type used on the railroads. The compressor units are driven by gasoline engines and are built to operate two and four tampers. Both sizes are used in the open pits.

Under the action of pneumatic tampers, the fine iron ore used as ballast packs very hard—it is tamped so tightly, in fact, that a shovel cannot be put into it. As an example of the rapidity with which the work is done, a performance at the Mahoning mine may be cited where a two-tool outfit was observed to tamp 35 ties in one hour. It would require at least nine men to do the work by hand, whereas by the new method two men operated the tamping machines and the foreman attended to the compressor. Assuming the compressor operating cost to equal that on railroad work, the comparative daily costs on the above working basis may be estimated as follows: Hand tamping—nine men, \$31.05; foreman, \$5; total, \$36.05; pneumatic tamping—two men, \$6.90; foreman, \$5; compressor operation, \$3.75; total, \$15.65.

In addition to the tie tamping, the air furnished by the portable compressors is advantageously applied to operating Jackhammers for block holing and pneumatic drills and riveters for repair work around the steam shovels and engines. This latter is an asset, as with

*Ingersoll-Rand Co., 11 Broadway, New York.

this convenient portable air plant, repairs do not necessitate the transportation of heavy equipment to the shop. During the severe cold of last winter, tie tampers at several of the transportation centers were fitted with pointed picks and used for unloading frozen coal, cinders, ore, etc., from hopper cars and at some of the steel mills for breaking up frozen mill scale in the chutes and cars.

A Plastic Refractory for Boiler Baffles

Defective baffling is the most common cause of high chimney temperatures, the greatest source of heat loss in boilers. The baffles may have fallen down, or bricks or blocks may have slipped out from between the boiler tubes, short-circuiting a large amount of gas. Pyrometers measure flue gas temperatures and serve to notify the operator at once regarding baffle failures. Baffles for water-tube boilers usually consist of tiles, bricks or blocks of refractory material fitted between the tubes. In cross-baffled boilers tiles are introduced between the tubes by springing them apart, and naturally do not form tight joints. It is also difficult to retain blocks where they are placed, as they have a tendency to slip and fall out, leaving large openings. Because of the manner in which baffles are made, it is almost impossible to cement them together, as the difference in expansion and contraction of the boiler tubes and baffle would break and sever the joints. Brick and blocks also warp and twist and are frequently split by the pinching effect of the tubes.

Jointless, and therefore gas-tight, baffles can be made by the use of a refractory material known as plastic fire brick, which is manufactured by the Betson Plastic Fire Brick Co., Rome, N. Y. This material was originally introduced for lining boiler furnaces, and is compounded of refractory materials so prepared as practically to eliminate the expansion and contraction effect with changes in temperature.

The material is shipped in barrels in a moist plastic condition ready for use. In forming a cross baffle for a water-tube boiler, the ordinary cast-iron baffle plate is used as on one side of the mould, while the other side is made by thrusting wooden slats in through the diagonal spacing between the tubes. The plastic material is then tamped down to fill the space between the cast-iron baffle plate and the slats. It is sufficiently plastic to be forced out sidewise around the tubes, making a snug fit all around. The boiler is fired up slowly, the criss-cross of slats burns out, and the plastic material is dried out vitrified in place. This operation occupies only a few hours, after which the full load may be put upon the boiler. Inasmuch as the boiler comes up to full steam pressure before the material is thoroughly set, the expansion of the metal pushes away the soft material to the position which it should occupy when the boiler is hot, and while the boiler tubes will draw away from the material upon cooling, the baffles will always fit tightly when the boiler is under steam.

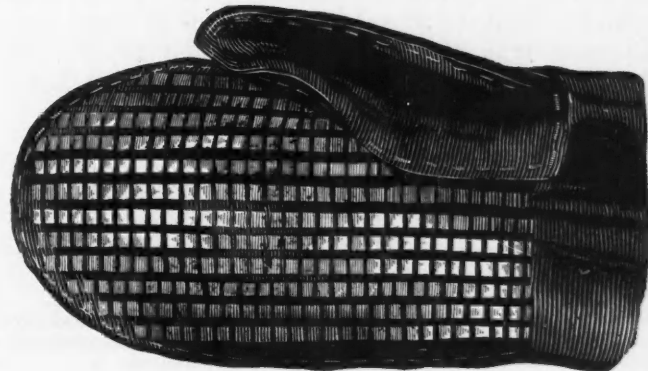
In forming a horizontal longitudinal baffle, blocks of wood are placed in between the tubes, above and below the space to be occupied by the baffle, thus confining the plastic material, which is filled in from the

side in the case of baffles in the middle of the tube bank, or from underneath or overhead, in the case of the baffles at the bottom or top of the tube bank. The slats are placed in position between the tubes, and, where not directly supported by the tubes below, are held in place by balls of the material placed underneath. The refractory material is then pushed into the space between seats and rammed. Starting work on each side, the operator works toward the middle. As fast as a section is finished the next lower slat is placed, until all slats are in place on the lower row. With this material there is no limitation to the shape or size of baffles. In cross-baffled boilers, it is becoming the practice to slope or incline the baffles, so that the gas passage will contract progressively from the point where the gases enter the tube to the point where they leave, and thereby maintain a uniform gas velocity. This can be easily accomplished with the plastic material, whereas with the solid bricks or blocks a special block is required which can be inserted and maintained in place only with difficulty.

The refractory material also finds use as a substitute for special forms of bricks or blocks, as when the front headers of horizontal water-tube boilers rest upon the front arch; also for lining furnace and combustion chambers, including front arch, side walls, bridge wall, rear arch, etc. Exacting tests in direct contact with the fuel bed and with the gases of combustion before they have been cooled by the boiler surfaces have demonstrated the ability of the material to withstand high-temperature gases and stresses such as occur in furnace construction, for long periods without crumbling or deteriorating.

Steel-Grip Glove for Handling Metal

Handlers of scrap, pig iron and castings, and sand blasters also, will be interested to learn of the steel-grip gloves shown in the illustration. These gloves are made either as mittens or fingered gauntlets. Mitts are made of heavy chrome tanned leather and are especially suitable to unloading light metal sheets, bars, or



MITTENS HAVE REINFORCED STEEL RIBBON PALM

scrap iron, etc. A heavy chrome leather mit reinforced in the palm with steel ribbons over added strips of tough napa leather is suitable for heavier work. A gloved gauntlet of similar construction is especially designed for sand blasting. Seams of all mitts or gloves are sewed closed with steel thread.

Events and Economics of the War

Continuing their advance beyond the Aisne and Vesle rivers, the Germans took Soissons and, meeting with small resistance, reached the Marne near Dormans, later extending their gains westward to Chateau Thierry and, further north, to Troesnes, on the Ourcq; an advance of five miles between Soissons and Noyon was also made by the enemy in an effort to link the new front with that on the Oise; 35,000 prisoners and much booty are claimed by the Germans.

In the United States, a combination under Government control of the largest four express companies was announced by Director General McAdoo. The price of aluminum was fixed at 33c. a pound at the plant for 50-ton lots and over by agreement of producers with the War Industries Board. The Western Union Telegraph Co. refused mediation by the National War Labor Board to avoid the strike threatened by the former's employees over the discharge of 800 men for joining a union. The U. S. S. "President Lincoln," an 18,000-ton transport, was sunk by torpedo on May 31, when homeward bound, with a loss of 25 lives. The destroyer "Ward" was launched 84% complete on June 1 at Mare Island within 17½ days after her keel was laid. U-boats off the New Jersey and Delaware coasts since May 25 sank ten vessels, totaling about 20,000 tons.

Transportation Rates Increased

Increased freight rates, ordered recently by Director General McAdoo in the public interest, become effective on June 25 and cover both interstate and intrastate traffic. Class rates are to be advanced 25%, and all class rates less than 25c. first class and proportionate rates on other classes will be canceled. The increase of 25% will apply also on commodity rates generally, except the commodities of which there is a heavy movement, on which the advances will be made by adding certain amounts to all rates or by fixing specifically the new rates which shall apply. Among the principal heavy commodities and the advances thereon are:

Coal, 15 to 50c. per ton.
 Coke, 15 to 75c. per ton.
 Iron ore, 30c. per ton.
 Stone for building purposes, 2c. per 100 pounds.
 Stone for road work, sand, gravel, 1c. per 100 pounds.
 Brick, cement, and plaster, 2c. per 100 pounds.
 Lime, 1½c. per 100 pounds.
 Lumber, 25%, but not more than 5c. per 100 pounds.
 Copper bullion and smeltery products will be advanced approximately \$6.50 per ton from the Rocky Mountains and Pacific Coast states to Atlantic seaboard.

All export and import rates will be canceled, the domestic rates applying to and from the ports. The minimum charge for handling a less-than-carload shipment will be 50c., and for road handling a carload the minimum will be \$15. The important established rate groupings and fixed differentials will be continued where found practicable, even though through rates resulting from their use may be lower or higher than the exact per-

centages named in the order. The essential features of the Director General's orders as to passenger fares are: The basic fare for one-way travel in day coaches will be 3c. per mile. In the sparsely settled sections where the present fares may be somewhat higher than this, they will not be disturbed. All fares which are on a lower basis than 3c. per mile will be advanced to that basis.

Tickets purchased prior to June 10, 1918, will not be honored for passage on and after that date, except that passengers who are already en route on June 10 on one-way tickets may travel to their destination by continuous passage without extra charge; unused portions of round-trip tickets purchased before June 10 held by passengers en route on that date will likewise be honored, with certain restrictions. Unused tickets will be redeemed. Round-trip tourist fares, somewhat higher than those at present in effect, will be established to take effect about June 15.

Other provisions of the order relate to mileage, commutation and sleeping-car tickets, which are likewise affected. Fares on water lines under Government control will be advanced proportionately. A special rate will be given soldiers and sailors, having leave of absence, when traveling in uniform at their own expense.

The Copper Conference

We understand that the conference in Washington before the Price-Fixing Committee of the War Industries Board with regard to the price of copper was at times rather a peppery affair, and to say that the copper people feel they were shown scant courtesy is to put it mildly, says the *Boston News Bureau*.

What perhaps irritates them more than anything else is to be told that the price had been fixed by the committee before the copper men, summoned from all parts of the country, had arrived. In other words, the inference was that, in star chamber proceedings, before a hearing on the merits of the question, before the evidence was in, the case had been prejudged and decided.

We understand that in the course of the proceedings, one large producer was interrupted by the chairman and told that the committee did not care to listen to anything more "along that line"—only to meet with the rejoinder that he, with other copper men, had been invited to testify and he intended to finish what he had to say. He did so.

We understand also that insinuations were thrown out that the copper companies were padding their cost sheets. Result: some rather tart exchanges of words, with subsequent apologies. The copper people are eager to do their share in the present national emergency. They will strain to the limit every productive facility. They are asking for no favors at the hands of those who know less about the business than they do; but they claim a right to fair treatment. They ask no more.

Economy in Oil Urged

The transportation and conservation of petroleum products is a subject to which the U. S. Fuel Administration is said to be devoting closest attention. As a war product, petroleum occupies a position of prime interest. The movement of oil from wells to the refineries and markets is accomplished by rail, water, and pipe lines, all of which are at present taxed to capacity.

A large part of the water transportation, represented by tankers, formerly in coastwise service, bringing oil from Mexican and Gulf ports to Atlantic Coast refineries, has been commandeered by the Navy for transatlantic service. This heavy withdrawal of usual facilities imposes upon all the other mediums of transportation an extra burden. Coöperation of the public in meeting the obstacles that are presented in this branch of its activities is sought by the Fuel Administration. Patriotic assistance can be rendered if all connected with the transportation and consumption of petroleum products will act upon these suggestions:

Increase storage capacity to avoid shutdowns during periods of congested transportation.

Provide adequate unloading facilities.

Avoid delays to tank cars, oil barrels, or other containers whether loaded or empty.

Practice efficiency and economy in consumption.

Delay in the movement of tank cars or other oil containers involves a serious responsibility. Prompt action in unloading and storing tank and barrel contents and returning them to the source of supply will greatly assist the Government in its treatment of the fuel problems.

Fix Price of Aluminum

The maximum base price for aluminum, effective June 1, 1918, to Sept. 1, 1918, will be 33c. per lb., f.o.b. producing plants, for 50 tons and over of ingot of 98 to 99%. This price has been agreed upon by the producers and the price-fixing committee of the War Industries Board, whose joint action has been approved by the President.

Differentials for sheet, rod and wire will be increased by approximately 12½%. Differentials for quantity and grade and differentials for alloys will remain as approved by the committee on Mar. 3, 1918. Copies of the new lists of differentials may be obtained upon application to the Non-ferrous Metals Section of the War Industries Board.

The new price will be effective on deliveries from June 1 to Sept. 1, 1918, on contracts made during said period, and, furthermore, will be effective on deliveries made during said period on existing contracts which specify that the price shall be that in force at the time of delivery. Deliveries made from June 1 to Sept. 1, 1918, on other contracts shall be at the price stated in such contracts, except that on existing "direct and indirect Government contracts" containing a provision that refund is to be made of the difference between the price stated in the contract and the "Government fixed price, if, as and when made," such difference shall be refunded on deliveries made from June 1 to Sept. 1, 1918, on presentation of proper proof that the purchasing government gets the benefit of the refund.

The conditions are as formerly. First the producers of aluminum will not reduce the wages now being paid; second, aluminum shall be sold to the U. S. Gov-

ernment, to the public in the United States and to the Allied governments at the same maximum base price; third, the producers will take the necessary measures under the direction of the War Industries Board for the distribution of aluminum to prevent it from falling into the hands of speculators who might increase the price to the public; and, fourth, they will pledge themselves to exert every effort necessary to keep up production so as to insure an adequate supply during the war.

Express Companies Merged by McAdoo

The four principal express companies in the country, the Adams, American, Wells Fargo and Southern, having a combined capitalization of \$57,000,000, will be merged into one company capitalized at \$30,000,000, under plans recently approved by the Director General of Railroads, William G. McAdoo. The reduced capitalization of the new company represents solely the actual value of the physical properties put into the business, no provision being made for goodwill or other assets not included in property values. The Government does not guarantee the companies a definite annual income. A statement in this respect, issued by the Railroad Administration, says:

"The general method of determining the compensation is that the Director General will receive 50¼% of the operating revenues, or gross earnings, and out of the balance the express company will pay operating expenses and taxes and dividend of 5% on capital stock.

"Out of the next 2% available for distribution the express company will receive 1% and the Government 1%; out of the next 3% available for distribution the express company will receive 1% and the Government 2%; any further amounts available for distribution will be divided one-fourth to the express company and three-fourths to the Government."

June 14 Is Flag Day

The National Americanization Committee urges that every factory and industrial and commercial establishment in the country observe Flag Day, June 14, with a flag-raising ceremony. It is thought that by thus bringing patriotism into the plant the employee engaged on war work will come to realize that the way he performs his daily task will have a decided effect on the outcome of the war.

Practical patriotism for the employer, says the committee, is increased production, careful planning to avoid rush seasons and lay-offs, the checking of labor turnover by enlightened treatment of the workers, the developing of a loyal spirit among native and foreign-born employees by making them realize that America is the land of the "square deal," and then giving them a square deal in his plant.

Representatives of the Department of Commerce and of commercial organizations appeared before the House Interstate Commerce Committee on May 9 to urge a bill to provide a national trademark. They said that unscrupulous foreign manufacturers were taking advantage of the demand for American goods to use misleading marks on articles of inferior quality.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Minerals-Control Hearings Continue

After one of the most extended hearings ever conducted by the Senate Committee on Mines and Mining, that body is now framing a minerals-control bill which is expected to be radically different from that passed by the House. The members of the committee themselves are not at all certain just what will be evolved.

Special weight is attached to the testimony of Cornelius F. Kelley, the vice president of the Anaconda Copper Mining Co., who is in direct charge of its operations. "I believe," said Mr. Kelley, "it is sound business, it is good economics, it is safe Governmental policy, to permit, as far as possible, the industries of the United States, by the natural inherent development and enterprise of the American people, to meet the situation, and I think you will thus do it a great deal more effectively and a great deal more satisfactorily and a great deal more rapidly than if you attempt to violate every natural law that enters into the production, growth and development of industry.

"So far as any personal interests I may have are concerned, they would be greatly augmented, and the interests of the corporation that I represent would also be augmented, by the passage of the bill. I am opposing it absolutely upon the basis that I do not think it sound business; I do not think it is sound economics.

"Section 1 does not say, gentlemen, that this bill is intended only to include antimony, arsenic, ball clay, bismuth, etc., but it is intended to include those substances, ores and metals found in intimate association with these metals. It says 'intermediate metallurgical products,' and, if I can read the language of the bill, that means those metallurgical products that are produced in obtaining these particular elements, which, for instance, in the case of arsenic, would include gold, silver and copper, and the chemical compounds of these elements, which would include every non-ferrous metal that is produced in the United States. How can it be said, gentlemen, in fairness, when you give control over sulphur, arsenic, antimony and bismuth—those elements that are found universally in intimate association with copper, lead, zinc and some of the other metals—and you give control over all the intermediate metallurgical products up to the production of silver, arsenic, antimony, bismuth and the others enumerated, that it does not include practically every mineral that is produced in the United States? I cannot give the bill any other interpretation. I have vainly followed the explanations that this language is not so intended, but, gentlemen, that language does do it without any question, in my mind.

"What has been brought to your attention so far as the mineral industry is concerned that calls for this far-reaching and dictatorial control? What situation is there?

"I think the license feature is one that is well deserving of consideration. It may be necessary, gentlemen,

to license. It may be necessary, in the interest of public policy, to license some branch of the metal business, but why you should require every one engaged in the manufacture, storage, mining and distribution or use of these metals or mineral substances to be licensed is utterly beyond my comprehension. Where does the bill stop?

"We started the ferromanganese business. We had no transformers. We got priority orders. They began to come along pretty well. We bumped up against the electrode situation. The demand for electric furnaces has run away from the manufacture. We searched this country for a producer who would take an order. The price did not cut any figure. We could not find any. We tried to finance an outfit and to increase the equipment so as to get 200 tons a month. We found that we could not get the results that we wanted by a ramming process. We had to get a press. We said 'All right, we are going to do that.' Well, the best promise we could get was delivery within a year. Those are the things, gentlemen, that are practiced in this situation, and they are things that you cannot overcome by mere legislative enactment."

Demand for brimstone probably will greatly exceed production before the end of the current year, A. E. Wells, of the War Industries Board, declared in a supplemental statement which he made to the committee. In that connection, he said:

"At present the consumption of brimstone for all purposes is just about equal to the production of the deposits in Louisiana and Texas. I doubt if there is a large tonnage of brimstone going to foreign countries. Some is going to Canada to be made into acid and for use in the paper-pulp industry, but my understanding is that little brimstone is being sent to the Allies. We have not yet begun to supply the Government powder plants with brimstone, and many commercial plants are coming in, so that before the end of this year the demand for brimstone will be greater than those two properties possibly can meet. The rate of production of the two important brimstone operations is about 100,000 tons per month. Before the end of the year we will be using brimstone at a rate between 200,000 and 300,000 tons."

This statement was made on the assumption that no Spanish pyrites would come in after Oct. 1 and that the domestic pyrites situation remains as at present. With reference to the status of the domestic pyrites industry, Mr. Wells said, "It appears doubtful whether the production of pyrites in this country in 1918 will be equal to that of 1917. The mine operators have had difficulty in getting a price for their pyrites which would allow them to go in on an extensive scale to increase their output. The acid manufacturer so far has been able to buy brimstone. He prefers to use brimstone, rather than pyrites, and no pressure has been brought to induce him to use pyrites. Extensive deposits in the South are not operating to capacity, because of labor troubles. The

mine operators are not getting what they figure they ought to get for their pyrites ore and are not prepared to pay the wages which would keep labor at their properties."

Regarding the attitude of the Chemical Alliance toward development of domestic pyrites, Mr. Wells said:

"Substantially the Chemical Alliance says this: 'As long as we can get brimstone to run our plants, we are not interested greatly in these pyrites deposits. We can buy brimstone at a figure which is so much lower than we would have to pay to bring out pyrites that we are not interested.'

"As an example, we put up to the Chemical Alliance the matter of using some of the pyrites that could be obtained from coal brasses. They could not interest those who are in a position to use coal brasses. The answer always was that they could get brimstone."

Mr. Wells believes that Government action should be taken to assure the recovery of sulphur from the waste gases from smelteries. At the present time 56% of the sulphuric acid being made in the United States has its source in brimstone.

Manganese Price Schedule Issued

After long negotiations, the War Industries Board and the American Iron and Steel Institute have been able to agree upon a schedule of prices for the manganese ores produced in the United States. The official announcement, issued by the War Industries Board, follows in its entirety:

A schedule of prices on manganese ores produced in the United States has been agreed to by the American Iron and Steel Institute and has been approved by the War Industries Board. The prices are fixed at a figure higher than the prices on this ore that have prevailed in past months. The new price schedule is to be used on transactions taking place after midnight of May 28. No announcement is made as to the length of time that this schedule of prices is to remain effective.

The following schedule gives domestic metallurgical manganese ore prices per unit of metallic manganese per ton of 2240 lb. for manganese ore produced and shipped from all points in the United States west of South Chicago, Ill. This schedule does not include chemical ores as used for dry batteries, etc. The prices are on the basis of delivery f.o.b. cars South Chicago, and are on the basis of all-rail shipments. When shipped to other destination than Chicago, the freight rate per gross ton from shipping point to South Chicago, Ill., is to be deducted to give the price f.o.b. shipping point.

SCHEDULE FOR ORE CONTAINING WHEN DRIED AT 212° FAHRENHEIT

Metallic Manganese, Per Cent., Inclusive	Price, Per Unit
35 to 35.99	\$0.86
36 to 36.99	0.90
37 to 37.99	0.94
38 to 38.99	0.98
39 to 39.99	1.00
40 to 40.99	1.02
41 to 41.99	1.04
42 to 42.99	1.06
43 to 43.99	1.08
44 to 44.99	1.10
45 to 45.99	1.12
46 to 46.99	1.14
47 to 47.99	1.16
48 to 48.99	1.18
49 to 49.99	1.20
50 to 50.99	1.22
51 to 51.99	1.24
52 to 52.99	1.26
53 to 53.99	1.28
54 and over	1.30

For manganese ore produced in the United States and shipped from points in the United States east of South

Chicago, 15c. per unit of metallic manganese per ton shall be added to above unit prices. Above prices are based on ore containing not more than 8% silica and not more than .25% phosphorus, and are subject to silica premiums and penalties: For each 1% of silica under 8% down to and including 5%, premium at rate of 50c. per ton. Below 5% silica, premium at rate of \$1 per ton for each 1%. For each 1% in excess of 8% and up to and including 15% silica there shall be a penalty of 50c. per ton; for each 1% in excess of 15% and up to and including 20% silica there shall be a penalty of 75c. per ton. For ore containing in excess of 20% silica, a limited tonnage can be used; but for each 1% of silica in excess of 20% and up to and including 25% silica, there shall be a penalty of \$1 per ton. Ore containing over 25% silica subject to acceptance or refusal at buyer's option, but if accepted shall be paid for at the above schedule with the penalty of \$1 per ton for each extra unit of silica. All premiums and penalties figured to fractions.

Phosphorus penalty: For each .01% in excess of .25% phosphorus there shall be a penalty against unit price paid for manganese of 1/2c. per unit figured to fractions. In view of existing conditions, and for the purpose of stimulating production of domestic manganese ores, there will be no penalty for phosphorus so long as the ore shipped can be used to advantage by the buyer. The buyer reserves the right to penalize excess phosphorus, as above, by giving 60 days' notice to the shipper. The above prices to be net to the producer; any expenses, such as salary or commission to buyer's agent, to be paid by the buyer. Settlements to be based on analysis of ore sample dried at 212° F. The percentage of moisture in ore sample as taken to be deducted from the weight.

Payments: 80% of the estimated value of the ore (less moisture and freight from shipping point) based on actual railroad scale weights, to be payable against railroad bill of lading with attached certificates of sampling and analysis of an approved independent sampling chemist. Balance on receipt of ore by buyer. Actual railroad scale weights to govern in final settlement. Cost of sampling and analysis to be divided equally between buyer and seller.

Picric-Acid Plants for War Department

Two large picric-acid plants are to be erected at once by the Bureau of Ordnance of the War Department. One will be at Little Rock, Ark., and the other at Brunswick, Ga. The Little Rock plant is to cost \$4,000,000 and will be erected by the Everly M. Davis Chemical Corporation. The Brunswick plant will be constructed by the Butterworth-Judson Co., of New York. Its cost is estimated at \$7,000,000.

Spain May Go on Gold Basis

The Spanish Ministry of Finance has presented a bill in Parliament the effect of the passage of which would be to place Spain on a gold basis. It provides that silver shall not be legal tender in amounts of more than 50 pesetas, except for payments to the government. Until facilities have been provided for minting the required amount of gold, foreign gold coins will have currency in Spain, their value in pesetas being stamped on them.

Must Keep Oil Prices Steady

A communication just issued by the oil division of the U. S. Fuel Administration warns oil producers that the Government will not at this time view with approval any further advance in the price of crude oil. Competition in the form of payment of bonus is also to be restrained. By this it is not meant that varying prices should not be paid for oils of varying quality, but these differentials, once established, should not be further advanced.

Remember the Comfort Fund of the 27th Engineers.

Chronology of Mining for May, 1918

May 1—Resumption of full advances in the 90% basis on the apparent value of lead ore shipped to the Consolidated Mining and Smelting Co.'s smeltery at Trail, British Columbia.

May 3—Announcement of export tax schedule in metals shipped out of Mexico effective after Apr. 1.

May 4—End of Third Liberty Loan campaign for \$3,000,000,000.

May 13—Decision of the U. S. Court of Appeals rendered in the case of Minerals Separation, Ltd., vs. Butte and Superior Mining Co., the court ruling that in the use of more than 0.5% oil there is no infringement of patent.

May 15—Indictment by Federal Government of 21 citizens of the United States, residents of Bisbee, Ariz., for deportation on July 12, 1917, of 1186 I. W. W. agitators and other German propagandists who by their activities had stopped copper production in the district.

May 18—Opening of Red Cross campaign for \$100,000 at New York by the President.

May 18—Announcement by War Industries Board of commandeering of platinum, palladium and iridium and the fixing of prices at \$105, \$135 and \$175 per oz., respectively.

May 20—Overman bill signed by the President.

May 22—Naval Appropriation bill, carrying \$1,615,000,000, with the anti-efficiency section retained, went to conference after passing the Senate without extended debate.

May 23—Recommended that price of copper as fixed by Government at 23½c. per lb. at Eastern refineries be continued for 75 days beginning June 1.

May 24—Declaration of war by Costa Rica against Central Powers.

May 24—Price of gasoline to Allies fixed by oil division of the Fuel Administration at 21c. per gal. f.o.b. gulf ports, and 23½c. per gal. f.o.b. Atlantic ports, U. S. Navy specifications.

May 27—Official announcement that the Mother Lode Copper Mines Co. had been taken over by interests identified with the Kennecott Copper Corporation.

May 27—Red Cross campaign closed, with donations amounting to \$146,000,000.

May 29—Announcement of increase of 25% in freight rates and 20% increase in passenger rates of all Government-operated railroads as a result of increase in wages, amounting to \$325,000,000 per annum.

May 29—Price of aluminum fixed at a maximum base of 33c. per lb., effective to Sept. 1.

May 31—Maximum base prices of Grade A zinc, sheet and plate zinc, as previously established, to be continued in effect to Sept. 1.

To Study Washington Mining Problems

The College of Mines of the University of Washington has offered five fellowships in mining and metallurgical research in coöperative work with the U. S. Bureau of Mines to graduates of universities and technical schools who are properly qualified to undertake research investigations. The purpose of these fellowships is to undertake the solution of problems in mining and metallurgy which are of special importance to the State of

Washington, Alaska and the Pacific Northwest. For the year 1918-19 the following subjects have been selected for investigation: (1) Washington mining problems; (2) ore concentration, including flotation and electromagnetic processes; (3) electrometallurgy, electrothermic and electrolytic investigations; (4) coal washing; and (5) utilization of the non-metallic resources of Washington.

Stock-Taking Week for the 27th

The Comfort Fund for the 27th continues to grow, even if slowly. It is encouraging to note that a total of \$14,651.50 has been subscribed to date, and that this amount is made up from contributions averaging over \$70 per individual or group of individuals subscribing.

But unfortunately that is but one viewpoint. Looked at in better perspective, two other factors compel attention. There are 1500 men whose needs are to be supplied from this fund—needs in things which are not absolutely necessary to keep them fit for their duties in the field of war, but which will go far to make those duties more bearable. Less than \$10 per man in the regiment will not go far toward keeping its members supplied with good cheer—not under the conditions to be met in France. If you do not at first agree, compare it with your own expenses for non-essentials for one brief week.

The really significant thing in the situation is, however, that to date only 205 persons or groups have contributed to the fund. This certainly is no true criterion for judging the feeling the mining profession has for the men of this regiment, for their work, needs, and for what they may rightfully expect from us. It might be taken to indicate several things; as a matter of fact it indicates just one thing: the individual engineer has the best intentions in the world toward the fund; he wants to help and will, but he is busy doing the work that two did before the war; he sees the weekly appeal of the *Journal*, but puts off sending the check until some future date. Do it now.

The list of those who have contributed to the fund subsequently to the list given in our issue of May 18 is as follows:

Previously acknowledged.....	\$13,664.00
Students of Wisconsin Mining School.....	50.00
A. M. Plumb.....	5.00
C. W. Snow.....	2.50
Charles A. Mitke.....	5.00
A. A. Hassan.....	10.00
A. A. Hassan, Jr.....	5.00
Emin A. Hassan.....	5.00
Bernard MacDonald.....	5.00
C. F. Rand.....	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.....	400.00
Oscar Lachmund (fourth contribution).....	10.00
C. N. Bell.....	10.00
C. S. Witherell.....	25.00
W. G. McBride.....	25.00
Karl Eilers.....	50.00
R. T. Hancock.....	5.00
E. E. White.....	100.00
S. Ringlund.....	10.00
H. Foster Bain.....	10.00
Marc Bailey.....	10.00
Charles le Vasseur (second contribution).....	5.00
William Wraith.....	25.00
H. A. Wheeler.....	10.00
Nevada Mine Operators' Association.....	100.00
Louis R. Wallace.....	50.00
H. P. Bowen.....	5.00

Total

\$14,651.50

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund, contributions are acknowledged only by publication in the *Journal*.

Conservation of Technical Engineers

AN ADDRESS TO THE SECRETARIES OF WAR AND NAVY

Technical engineers of every branch of the profession who are taking part in the war activities of the Army and Navy are alarmed at the unfortunate waste of technical training caused by the drafting and enlisting of engineers for regular service, with little or no regard for their technical attainments. These technically educated and experienced men are essential to the successful conduct of the war, and cannot be replaced. There is continuing evidence that America is repeating in some measure England's mistake of sending technical men into the ranks, when they should be carefully conserved for special duties in the fighting forces or on the technical staffs of the Army, the Navy and the essential war industries.

These facts have been forced upon the attention of engineers who have been coöperating with the Government through the Naval Consulting Board, the National Research Council and the Engineering Council. Upon these organizations requests have constantly been made for engineers, chemists and other technical men for a great variety of military services. Thousands of names have thus been furnished to the Government departments and bureaus. The Engineering Council especially has devoted attention to this personal work through its committee, known as American Engineering Service, which has available classified lists of approximately 25,000 engineers, and, besides, unclassified lists of many more. It is from these lists, directly or indirectly, that most of the names have been selected for war service.

The Engineering Council was founded by the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and American Institute of Electrical Engineers, and other engineering societies are coöperating with it in this service, the total membership represented by these organizations being approximately 50,000. Already from 10 to 15% of the members of these several organizations are in the uniformed services of the country, and it is safe to say that a large majority of their remaining members are in the Government civilian service or otherwise directly or indirectly engaged in the war. Engineers do not seek to avoid fighting, but earnestly desire to be given opportunities for fighting and other services in which they can be most effective and which cannot be performed by others.

It is known that through the Committee on Classification of Personnel in the War Service Exchange (of the War Department), and in some other ways, efforts are being made to counteract the tendencies toward the loss of our technical men in the ranks of the Army and Navy. It is believed, however, that these efforts are insufficient, and that they should at once be supplemented by other stringent measures dealing with the subject in the draft boards and recruiting stations.

In view of the foregoing, the Engineering Council, created to provide means for united action and to speak authoritatively for its member societies on all public questions of common interest to engineers, respectfully offers the following:

Whereas, Technically trained engineers are indispensable to the Army, the Navy and the war industries, in engineering corps, ordnance bureaus and signal corps, in aviation,

submarine and tank service, in shipbuilding, and in many other assignments; and

Whereas, Through draft and otherwise many of these irreplaceable men have been and are being diverted so that their special qualifications are not being utilized; be it therefore

Resolved, That in the opinion of the Engineering Council technically trained men of all ages should be enrolled and conserved for technical duties, and special efforts should be made immediately by the War and Navy departments to find and record such men among drafted and enlisted forces, and to assign them to places in which their special qualifications are needed; and be it further

Resolved, That the Engineering Council offers to assist the War and Navy departments in locating and classifying such men, if its assistance be desired, provided these departments will give the necessary facilities for collection of information about engineers now in the Army and Navy, or whose names are upon the selective draft lists.

These resolutions are offered solely in a patriotic spirit of helpfulness.

ALFRED D. FLINN,
Secretary, Engineering Council.

Bisbee Deportations Misunderstood

In discussing the recent indictment by the Federal Government of Walter Douglas, president of the Phelps Dodge Corporation, for alleged participation in the deportation of I. W. W. members from Bisbee, Ariz., last July, the *Wall Street Journal* says that apparently there has been a general misunderstanding, and in some cases a misrepresentation of facts in various press statements, notably that "women and children" were deported, and left "to starve on the desert last summer."

On June 26, 1917, states this paper, the I. W. W. submitted certain demands to the mine operators at Bisbee, Ariz., and, upon their refusal, declared a strike to take effect the following morning. The great bulk of the American miners disregarded the strike call, but the Austrians, Germans and Mexicans went out with the other members of the I. W. W. who were working.

The strikers formed dense picket lines and endeavored by force to prevent those who desired to work from reaching the mines. They also resorted to intimidation and violence, their plan being to attack individuals or small bodies of miners while on their way home. The I. W. W. members also threatened the wives and families that if the husbands or fathers continued to work something would happen to them.

Capt. Harry Wheeler, then Sheriff of Cochise County and at present an officer with the American forces in France, arrived upon the scene within 24 hours after the strike had been called. Deciding that the question of organized labor was in no way involved, and that the object of the disturbers was to embarrass the National Government in producing war materials, Sheriff Wheeler issued proclamations, cautioning all to observe the peace and deputizing several hundred men to assist him. His sympathies were said to be strongly in favor of organized labor. He had been elected by the miners' vote. He was strengthened in his opinion that no labor question was concerned by a telegram from Charles F. Moyer, president of the Western Federation of Miners, repudiating the strike and stating that his organization was opposed to it.

In the meantime, the situation became so alarming that the Sheriff determined to rid the community of this

element. He therefore summoned his deputies on July 11 and posted the following proclamation:

I have formed a Sheriff's posse of 1200 men in Bisbee and 1000 men in Douglas, all loyal Americans, for the purpose of arresting on the charges of vagrancy, treason, and of being disturbers of the peace of Cochise County all those strange men who have congregated here from other parts and sections for the purpose of harassing and intimidating all men who desire to pursue their daily toil.

I am continually told of threats and insults heaped upon the workmen of this district by so-called strikers, who are strange in these parts, yet who presume to dictate the manner of life of the people of this district. Appeal to patriotism does not move them, nor do appeals to reason. At a time when our country needs her every resource, these strangers persist in keeping from her the precious metal productions of this entire district.

Today I heard threats to the effect that homes would be destroyed because the heads of families insisted upon their rights as Americans to work for themselves, their families, and their country. Other threats have and are daily being made. Men have been assaulted and brutally beaten, and only today I heard the Mayor of Bisbee threatened and his request ignored.

We cannot longer stand nor tolerate such conditions. This is no labor trouble. We are sure of that, but it is a direct attempt to embarrass the Government of the United States. I, therefore, call upon all loyal Americans to aid me in peaceably arresting these disturbers of national and local peace. Let no shot be fired throughout this day unless in necessary self-defense, and I hereby give warning that each and every leader of so-called strikers will be held personally responsible for any injury inflicted upon any of the deputies while in the performance of their duties as deputies of my office, for whose acts I, in turn, assume full responsibility as Sheriff of this county.

All arrested persons will be treated humanely, and their cases examined with justice and care. I hope no resistance will be made, for I desire no bloodshed. However, I am determined, if resistance is made, it shall be effectively overcome.

On July 12 the Sheriff, having ordered a train, shipped 1200 of the disturbers to Columbus, N. M., where a camp of the Federal Army existed. In each car there was water, bread and beef. No women or children were deported, though three women insisted on accompanying their husbands. Every deportee was first told he could remain if he would swear loyalty to the United States. About 60 deputies went with the train.

At Columbus the colonel commanding declined to permit the deportees to be unloaded there. The train was then returned to Hermanos, N. M. The next day food was sent from El Paso, arriving in the afternoon of July 13. There was, therefore, no physical suffering. Upon the following day the War Department ordered that the train be moved back to Columbus, and the deportees were supplied with food by the Government, and were permitted to leave Columbus if they desired.

The Market for Chrome Ore

Owing to the reduction in boats, foreign shipments of chrome ore have practically come to an end, and it is to be assumed that this state of affairs will continue for some time to come, if not for the duration of the war. The bichromate makers have been asked to restrict themselves to ore analyzing 45% or less, and from now on they will no doubt look to the deposits in the Western part of the country for a large part of their supply.

Attributable, no doubt, to the stimulus of high prices, a much larger tonnage of domestic ore is in sight than appeared possible five or six months ago, and present indications are, with the reduction in the use of chrome ore for refractory purposes, that there will be sufficient

to go around, or at least to take care of the manufacturers of ferrochromium, without mentioning the makers of bichromates.

In addition to asking the steel trade to cut down the use of chrome ore for refractory purposes, substitutes are being tested, and a new material is soon to be offered to the trade that may help the situation as a whole. An important buyer of chrome ore is now offering the following terms, f.o.b. California and Oregon common shipping points:

Cr ₂ O ₃ Per Cent.	Price Per Unit	Cr ₂ O ₃ Per Cent.	Price Per Unit
30	\$0.85	40	\$1.30
31	0.90	41	1.325
32	0.95	42	1.35
33	1.00	43	1.375
34	1.05	44	1.40
35	1.10	45	1.425
36	1.15	46	1.45
37	1.20	47	1.475
38	1.25	48 and up-	
39	1.275	ward	1.50

It is probable that uniform prices will be established for chrome ore, as has been done in the case of manganese ore, and it is believed that the figures given in the table, with perhaps a little variation, will be adopted.

The uncertainty and lack of dependence attached to and connected with a large part of the Western producers still exist, but conditions will no doubt right themselves with the adoption of uniform prices and the means of enforcing them.

A.I.M.E. Expels Enemy Aliens

At a recent meeting in New York of the board of directors of the American Institute of Mining Engineers, it was decided to drop all enemy aliens from membership. The meeting, which was under the chairmanship of Sidney J. Jennings, president of the Institute, was attended by 23 of the 25 directors, among them the chairman and four members of the Naval Consulting Board.

The action of the directors is said to affect the status of 21 German scientists and one Austrian professor who held either honorary or active membership in the association. The Institute now has a membership of about 6600 in this country and there are more than 1000 members abroad.

The resolution expelling enemy members follows:

Resolved, That all honorary members, members, associates and junior members who are enemy aliens residing in enemy countries be dropped from membership in the American Institute of Mining Engineers and their names be and they are stricken from the rolls;

Resolved, That the membership committee be requested to advise this board of directors of the names of all above-mentioned persons, and in addition the names of all other enemy aliens members of the Institute; and be it further

Resolved, That in the case of each of said latter class this board shall consider and act upon the question of expulsion after ascertaining their attitude toward the Government of the United States; and be it

Resolved, That publicity of these resolutions be given to members through the local sections and by publication in the Bulletin as well as through the daily press.

A decree permitting importation of mining machinery into Mexico free of duty is forecast in an announcement issued by the Mexican News Bureau in Washington. The bureau also reports the 1917 production of petroleum in Mexico to have been 55,292,770 barrels.

Editorials

The New Tax Law

A GREAT deal more money must be raised by taxation. Everybody recognizes that, and everybody will face the new burden with courage and cheerfulness if it be distributed equitably. The prospect that the present monstrosity of a tax law will be discarded in favor of a new and scientific law affords even some grounds for optimism. The present law is based neither on a system of taxing war profits nor a system of taxing incomes. It combines the worst features of both systems and is simply impracticable, inequitable and destructive. Its fundamental idea was to punish the wealthy. No such punitive law can be wise.

The new law will properly be based largely on the idea of taxing war profits. The mere thought that anybody should make money out of this dreadful war is abhorrent. Such money is blood-money, and no decent-minded person wants that kind of money. Therefore the state should take it, and everybody will cheerfully turn over to the state all that bears such a stigma. But in considering war profits let our legislators be careful to discriminate between what are such and what are not. Even in peaceful times there is a big difference between reported net earnings year by year and what is distributed as dividends. The difference is usually what goes back into the property and to a large extent replaces older property that is worn out. In war times the absorption of current profits in the bricks and mortar and machines of new construction, all at inflated prices, representing value that sooner or later will be extinguished, is much greater than in peaceful times. If private parties be deprived of the wherewithal for such necessary construction, the Government must supply it. Consequently any excessive taxation that does not recognize this means that what is taken by one hand must be given by the other. It is desirable to avoid the impediments ensuing from such a method.

But after all, out of the annual income of the American people, estimated roughly at about 50 billion dollars, the major part is pocketed by the 40 million workers. They are the ones, all of them, who have got to pay the major part of the taxes, for the money can only be drawn from where it is, not from any conjectural sources. There must be a taxing system that will fall upon everybody if we are minded to keep prosperous as a nation. Then let war profits, the true war profits, be captured. No honest concern will dread the exposure of the profiteers that the President and Secretary McAdoo talk about.

The taxation of mining companies presents some peculiar problems. We have discussed these so many times that we need not dwell upon them now. We suggest, however, that persons who are acquainted with special conditions that ought to receive consideration take the trouble to state them to the Secretary of the American Mining Congress, who will bring them to the attention of the Congressional committees.

Fixing the Price for Manganese Ore

THE War Industries Board last week fixed a schedule of prices for manganese ore. This was fixed at about the prevailing market rates. However, that there should be any price-fixing at all in this case reflects only what may be considered as price-fixing mania.

The country is desperately in need of manganese ore. Rising prices have been the stimulus to a greatly increased production, but the country's domestic supply is still far short of its needs. The one sure way of augmenting this supply is to let prices rise high enough to develop it. But the War Industries Board steps in and says, No.

The War Trade Board wants to increase the domestic production of manganese ore or to save the shipping that is necessary to bring ore from Brazil and elsewhere. The War Minerals Committee wants to stimulate the production of manganese ore, even by going so far as to guarantee a minimum price for it.

There seems to be some pixy in Washington that mixes things up; or is it that the several departments feel a sort of glee in working at cross-purposes with each other and forgetting that there is on hand any such job as winning the war? But the fixing of a maximum price for manganese ore in such juncture as the present, no matter what the inspiration, is nothing short of madness

The Increase in Railway Rates

FOR many years the railways appealed to the Interstate Commerce Commission for permission to increase freight rates, and that obstructive body denied their requests and told them that if they would only economize in operating expenses they would be all right. The Government, having taken over the railways, obtained such an opportunity to coordinate and economize as the railways never had. This was one of the prospective benefits that we were talking about six months ago. However, the Government apparently has not been able to practice what it preached, for it is whispered that the results of Governmental railway operation have been rather disappointing. Anyway, the Government, having raised wages, needed more money, and therefore in a rather slap-dash way it proceeded to figure on getting a lot more than the wage increase required, and therefore freight rates and passenger rates were both raised enormously.

Nobody will criticize the Government for getting what it needs, but we cannot avoid seeing something that is both humorous and painful in the Government promptly doing in an exaggerated way just what for years it refused to let the railways do in a moderate way. Thus, the Government recognizes the justice of the contention of the railways and stultifies itself by its past refusal to admit it. What a colossal loss this imposed upon the country last winter!

The sweeping increase in the freight rates and passenger rates is going to be a very serious matter. The rate on copper bullion from Montana and Arizona to the Atlantic seaboard is increased by about 65%. The rate on lead bullion from Pueblo is increased out of all proportion to the rates from some other quarters. These things, together with the general increase in the rates on ore traffic, are going to increase cost of production still more and are going to contribute to contraction of the output of both copper and lead, both of which metals are already showing some alarming signs.

Feats of Labor

THE newspapers are interesting reading these days, and particularly so to an engineer, for they bring to his attention prospective plans, the working out of large organizations, and the accomplishment of construction work in unprecedented time. The building of ships, a structural engineering job, commands first attention. On Apr. 21 there was published the record of the Skinner & Eddy Corporation, of Seattle. That firm built an 8800-ton steel ship in 55 working days from the date of the keel laying. On the same date, at the Bethlehem Shipbuilding Corporation, the erection of the steel framework of five destroyers was reported as having been accomplished in 50 minutes after the laying of the keels. The freighter "Tuckahoe" was launched in 27 days from the time the keel was laid. The events in the progress of this rapid construction were given by the *New York Tribune* as follows:

Keel laid Apr. 8.

Four days later double bottom was completed.

Six days later frames and bulkheads were erected and portion of shell plating finished.

On seventh day stern frame was in place.

On 14th day boilers were put on board.

On 21st day stern post was bored and stern tube put in place.

On 22d day masts were stepped and engine installation was begun.

On 24th day funnel was put in place.

On 26th day machinery was all in and engines completely installed.

From the 26th day to launch, the time was occupied in putting on finishing touches.

On the 43rd day the "Tuckahoe" arrived at an Atlantic port with a cargo of coal.

We are reminded by these feats of labor of some of the accounts given by Eliot Lord in his fascinating history of "Comstock Mining and Miners." We take some of the stories from his account as worthy of the attention of our readers:

Oct. 26, 1875, a coal-oil lamp was upset in a little lodging house in Virginia City, and flames filled the house in a moment. Fanned by the wind, the flames leaped from roof to roof, until the whole quarter was on fire and the imminent peril of the city was seen. Bells rang out the alarm, with their sharp, startling clangor, and steam whistles blew ear-piercing blasts, sounding above the crackling of the flames, the shouts of the firemen, the cries of escaping women and children, and the rattling of engines and cart-wheels.

Thus the great fire of Virginia City started, entailing a loss of \$10,000,000 and 2000 buildings and many mining plants.

On the morning after the fire, the smoking timbers and debris were cooled by buckets of water and streams from the hydrants in hundreds of places, and the lumber which came in by rail was placed on the reeking ground. The work of building went on continuously all day long and far into the night, in the midst of storms as well as in fair weather. A tornado blew down a large part of the newly erected houses during the week after the fire, but the wrecks were cleared away as soon as the storm ceased, and building was resumed. Sixty days after the fire, the principal streets running through the burned districts were lined with business houses, the majority of which were better built than those destroyed, and habitable dwellings covered the intervening blocks.

From the official report of S. T. Curtis, superintendent of the Ophir Mining Company:

On the day after the fire, competent men were dispatched to the lumber yards at Corson and Dutch Flat, Calif., to procure and ship timbers; machinery was telegraphed for; the new double-reel hoisting-engine and cables just completed for the combination shaft of the Chollar-Potosi, Hale and Norcross, and Savage were secured; and, through the heaviest storms which Virginia had seen for years, the old engine foundations were torn out and new ones to suit the combination engine were constructed; work was prosecuted without cessation; supplies were hauled a considerable distance, on account of the destruction of the railroad tunnel and bridges; the works were rebuilt and work through the shaft was resumed on Nov. 25, being inside of 30 days from time of destruction. While the reconstruction was going on, a donkey engine, furnished through the kindness of the Phil. Sheridan Mining Co., was put in place, with which we were enabled to retimber the shaft where it had been burned to a depth of 400 ft. from the surface, besides hoisting considerable water entering on the 700-ft. level of the mine. The buildings rebuilt have been made much larger and more complete and more convenient than formerly.

In 50 days the hoisting works of the Con. Virginia Mining Co. were reconstructed and ore was raised at the rate of 600 tons daily from the shaft.

In the early days of the Comstock, there was a breed of men who could accomplish things on a large scale when the demand was critical. In our day we are finding out that the same spirit is alive and with us. Great emergencies develop men. The present day feats of labor are only the beginning of a period of effort and accomplishment that will go down in history as the vindication of the American will to do well the task that the war has brought to us.

Calculations of a German Professor

PROFESSOR BALLOD, a well-known German statistician, has lately estimated Germany's national private wealth in 1914 as \$67,500,000,000; to which \$32,500,000,000 has since been added through government obligations issued and enhancement of agricultural land values, offset by \$10,000,000,000 loss through consumption of stocks and loss of property abroad; making the present net result \$90,000,000,000.

One of our contemporaries comments that, according to this method of computation, the more a government borrows from its citizens and spends for war, the richer the nation grows. We are not sure that the German professor was quite as innocent. M. Chéredame, the distinguished French publicist, has previously estimated that so far Germany has made money out of the war through its loot of Belgium, Northern France and Poland. Professor Ballod may estimate that the ad-

dition to the national debt is simply a capitalization of the stolen property.

But even so, we cannot become very enthusiastic over the enrichment of Germany, or believe that it is so good and real as it may look to optimistic Germans. We hope and believe that it will prove as ephemeral as that in the bag of the burglar who is trying to escape from a house that is surrounded by policemen.

BY THE WAY

As showing the violence of the recent German attack on one of the sectors held by French troops, writes the *Boston News Bureau*, an officer who lived through it said: "There were 10 big shells a second, and that lasted, with only two short pauses, for six days, all through the battle, and other shells were uncountable." A correspondent remarks that this assertion gives a new conception of the colossal scale on which this war is now conducted. It means not only that something like 5,000,000 heavy shells were expended by the Germans in a small part of the long front, but it also brings to mind the immense labors performed by the thousands and thousands of men whose task it was to keep those gunners supplied with ammunition.

To the Immortals in the Hall of Fame of Mining, including the patient burro, who discovered the silver in the *Cœur d'Alenes*, and the veteran mule, responsible for the location of the Silver King mine, in Arizona, together with the busy little hen with nuggets in her crop, and the grey goose with its gullet full of gold sand, must be added another representative of the animal kingdom. In an interesting old book, by John Mawe, an English mineralogist, recounting travel observations in Brazil, made in 1810, is recorded the discovery of gold in one of the then important districts in the State of Minas Geraes, in which the busy little ants played important parts. He says: "Some negroes employed in clearing the lands broke up an ant hill of considerable size, when, upon laying it open to the air, for the purpose of destroying or dispersing the insects, large grains of gold were found." Future historians of mining will please take note of the above, and distribute the credit and glory of the discovery of the world's precious minerals so that the insect kingdom shall have its dues.

Lorraine Ore Excites German Greed

It is alleged that a silent but fierce fight for millions is going on between Germany's most powerful industrial interests over a share in the spoils of the French-owned mines and smelting works in German Lorraine, according to a press dispatch from Amsterdam. The iron ore in this region is estimated at 650,000,000 tons. The chief owner is said to be Baron de Wendel, reputedly the richest man in Europe, who owns ore fields and iron foundries in four countries, France, Belgium, Luxembourg and Lorraine. His fortune has been estimated at \$100,000,000.

Baron de Wendel's possessions in German Lorraine have long excited the cupidity of the German overlord,

and a compulsory "liquidation" of this property is a matter of course. The value of his estate in this region is estimated at \$62,500,000, but the interests concerned are so involved and interlocked that this liquidation has been a difficult business proposition, and a hint has been given the German press to publish as little as possible about the negotiations.

The De Wendel concern was a member of the Düsseldorf steel trust, and the first idea was simply to divide the property among the members of the trust. Now a group of South German industrialists has taken a hand and has submitted a bid of \$50,000,000 cash to the Düsseldorf trust. This offer was refused, and after much squabbling the South German group split in twain into the Rhenish-Westphalian and the Thyssen combines. The latter has independently outbid the parent group, offering \$55,000,000.

Recently powerful voices have arisen, demanding why selfish big corporations should be permitted ruthlessly to dispose of property for purely monopolistic profiteering purposes, whereas the benefits should accrue to the empire at large and relieve the overburdened taxpayers.

To Confer on Antimony, Quicksilver and Tungsten

The U. S. Tariff Commission will hold a conference on antimony, quicksilver, tungsten ores and products at San Francisco in the assembly room of the Chamber of Commerce during the week of June 24 to which all producers, importers and consumers interested will be invited. The conference is for the purpose of securing information in regard to disturbances and changes in these American industries. The topics to be discussed fall under three heads: (1) The condition of the American industry before the war, in relation to foreign competition; (2) the effect of the war on the industry; and (3) competition with foreign producers after the war.

A separate hearing on tungsten will be held in Denver, Colo., on June 17, at 10 a. m., in the U. S. District Court room at the new post-office building. At San Francisco, the hearing on antimony is to be called at 10 a. m. on June 24, on quicksilver June 26, and on tungsten June 28.

The Japanese Zinc Industry

The Productive Industry Department of the Japanese government is studying how to maintain a supply of ore to keep the zinc smelters going. The output of ore in Japan is 50,000 tons, while the consumption of the smelters is 300,000 tons per year. During the last few years zinc ore and zinc concentrates have been imported into Japan from Austria, China, Burma, Indo-China, and Vladivostok. The Osaka Co. has made great efforts to increase the production of zinc ore in Korea, but all the mines together cannot produce more than about 15,000 tons per annum. The demand for zinc in Japan is estimated at about 29,000 tons yearly, against which Japanese smelters have a present productive capacity of about 45,000 tons per annum. In the near future, when all the schemes for new undertakings and extensions are completed, Japanese smelters will have a productive capacity of about 100,000 tons.

Personals

Have You Contributed to the Association of the 27th Engineers?

H. H. Nicholson is examining cobalt and chrome deposits in eastern Oregon.

Sir Edmund Osler, of Toronto, has been elected a director of the Imperial Oil Company.

D. C. Jackling visited Salt Lake City recently en route from San Francisco to Washington.

Paul F. Chamberlain has been appointed mutuality chairman of the Oliver Iron Mining Company.

R. T. Walker has been appointed superintendent of the Virginia-Louise Mining Co., at Pioche, Nevada.

T. A. Rickard addressed the Utah section of the American Institute of Mining Engineers on May 29 on the subject of "Americanization."

A. G. Mackenzie, secretary of the Utah Chapter of the American Mining Congress, attended the copper-price fixing meeting recently held in Washington.

Forest Rutherford, consulting metallurgist of New York, has been appointed a member of the advisory committee in non-ferrous metals to the U. S. Tariff Commission.

R. T. Regnall, formerly manager of the Dome Lake Mining and Milling Co. at Porcupine, Ont., is now on the staff of the Hollinger Consolidated Gold Mines, Ltd., at Porcupine.

John Russell, assistant superintendent of the Monclova unit of the American Smelting and Refining Co., in Coahuila, Mex., is spending a vacation at Rock Island, Ill., during which period he is being relieved by S. F. Shaw.

F. M. Watkins, for 14 years in the service of the Associated Oil Co. in California, has been transferred from the Kern River division to become superintendent of the McKittrick division. C. M. Small, superintendent at McKittrick, has taken charge of the Pioneer-Midway division. E. J. Schneider, has been transferred from the Pioneer-Midway to the Casmalia field in the Santa Maria region.

E. P. Mathewson has been appointed consulting metallurgist of the American Smelting and Refining Co. and its subsidiaries, taking effect June 1. Mr. Mathewson's headquarters will be at the company's office in New York, but his duties will require frequent and occasionally prolonged visits to the various plants of the company in working out problems that may arise. Mr. Mathewson was formerly with the American Smelting and Refining Co., then with the Anaconda Copper Co. and recently with the British American Nickel Corporation.

A. E. Wiggins, superintendent of concentration at the Washoe reduction works of the Anaconda Copper Mining Co., has been made general superintendent of the Boston & Montana reduction department at Great Falls, succeeding J. H. Klepinger resigned. Mr. Wiggins' position at the Washoe works will be filled by B. S. Morrow. S. S. Rodgers is made assistant superintendent in charge of the lower mill, to succeed Mr. Morrow. C. W. Morse will be assistant in charge of the upper mill; E. W. Handley will be superintendent of the zinc concentrator to succeed Mr. Morse, and H. S. Gieser is made concentration engineer to take Mr. Handley's place.

Obituary

Gerald B. Maerse, manager of the Anaconda Copper Mining Co.'s brick department, died on May 7 at Great Falls, Montana.

Dr. Frederick Remsen Hutton, formerly president of the American Society of Mechanical Engineers and its secretary for 23 years, died recently in New York, aged 65 years. In 1876, he was graduated from the School of Mines, Columbia University, where he later became head of the mechanical department, remaining until July 1, 1907, when he resigned and was elected emeritus professor. He was active in planning the present Engineering Societies Building, in New York, and was well known as the author of "The Mechanical Engineering of Power Plants," "Heat and Heat Engines," "The Gas Engine" and various other works.

Societies

Engineers' Society of Western Pennsylvania met in Pittsburgh on June 4. A paper entitled "The Promotion of Industrial Research" was presented by John Johnston, secretary of the National Research Council.

Canadian Mining Institute.—The Northern Alberta branch was organized on May 14 at the University of Alberta at Edmonton, with a membership of 55. The following officers were elected: President, Prof. John A. Allan; vice president, Norman C. Pitcher; secretary-treasurer, John T. Stirling.

Industrial News

L. G. E. Bignell has taken charge of the sales department of Sutton, Steele & Steele, Inc., of Dallas, Texas, where he will make his headquarters.

Colorado Iron Works Co., of Denver, Colo., mill and smeltery equipment engineers since 1860, has removed its eastern office to 30 Church St., New York.

General Engineering Co., of Salt Lake City, has opened a branch office at Room 2817, 120 Broadway, New York, in charge of E. B. Thornhill, who also retains the management of Canadian office in Ottawa.

Myers Whaley Co., Knoxville, Tenn., maker of shoveling machines for underground and surface work, has appointed J. P. Cotter as its representative for Nova Scotia and Newfoundland. Mr. Cotter's address will be Box 584, Sydney, Nova Scotia.

W. J. Roberts has been elected president of the Traylor Engineering and Manufacturing Co., of Allentown, Penn., succeeding S. W. Traylor resigned. H. L. Miller has been elected a director and appointed general manager.

Brown Hoisting Machinery Co., Cleveland, Ohio, has appointed H. D. Wright as its Pacific Coast representative, succeeding the Colby Engineering Co. in Northwest Territory. Mr. Wright has been in charge of the company's San Francisco office.

S. H. Brady, receiver for the Silver Mines Corporation of Nevada, has removed his main office to Tonopah, Nev. This change applies also to S. H. Brady & Co., Southwestern Mines Co., Great Western Mining and Milling Co., and the Garfield Copper Company.

Denver Engineering Works Co., Denver Colo., announces the appointment of William A. Torrence as general manager, in place of Lewis Searing, resigned. Mr. Torrence was formerly associated with the General Electric Co. The company will continue the manufacture of mining and milling machinery, electric hoists, etc.

Industrial Electric Furnace Co., of Chicago, makers of the Synder furnace, has shipped a 1250-lb.-capacity electric steel furnace, together with the auxiliary electrical equipment, to Burn & Co., Calcutta, India. The purchase was made by A. Anderson, representative in America for Burn & Co., through the Northwest Trading Co., of Seattle, Washington.

Asbestos Protected Metal Co., of Pittsburgh, Penn., recently announced a change of its corporate name to Aspromet Company, effective as of May 1, 1918. When the company was established, in 1905, its sole product was asbestos protected metal. This meeting with favor, other building materials were added that were used by consumers of asbestos protected metal, many of which contain neither asbestos nor metal. Thus, the descriptive name, Asbestos Protected Metal Co., became restrictive to the point of being misleading, hence the change. The New York office of the Aspromet Company has been removed to 170 Broadway.

Ohio Electric and Controller Co., 5900 Maurice Ave., Cleveland, has been incorporated with a capital stock of \$200,000 for the purpose of manufacturing lifting magnets and electrical controlling devices. The former will be built at once and controlling devices later. The officers of the new company include F. W. Jessop, president; W. B. Greene, vice president; and A. D. Walter, secretary-treasurer. Mr. Jessop was formerly works manager of the Electric Controller and Manufacturing Co., Cleveland, and has had an extensive experience in the manufacture of lifting magnets and electrical apparatus for the control of motors.

Trade Catalogs

A-C Generators, Coupled and Belt-Type. Crocker-Wheeler Co., Ampere, N. J. Bulletin No. 185, superseding Bulletin No. 150. Pp. 4; 8½x11; illustrated. Describes two and three-phase generators, 50 kva. and up.

"Rimco" Rubber Insulated Pliers, Electric Service Supplies Co., New York, Philadelphia, Chicago. Leaflet. 3½x6½. Pliers have been tested and passed for 10,000 volts by the Electrical Testing Laboratories of New York.

"The Milburn Light." Alexander Milburn Co., 1420-26 W. Baltimore St., Baltimore, Md. Book. Pp. 48; 6x9; illustrated. A catalog of portable acetylene lights, oxy-acetylene plants, welding torches, and similar articles.

"Continuous Filtration with the Portland Filter." Colorado Iron Works Co., Denver, Colo. Catalog No. 28-C. Pp. 32; 6x9; illustrated. Detailed description of filter construction and operation, with tables of pulp and sludge density relations.

Levin Oxygen and Hydrogen Generator. Electrolytic Oxy-hydrogen Laboratories, Inc., 15 William St., New York. Bulletin G. Leaflet. Pp. 4; 8½ x 11 in. Illustrated. Description of apparatus for generating oxygen and hydrogen by the electrolysis of water.

H. P. M. Hydraulic Valves and Fittings. Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Catalog No. 43. Pp. 59; 8½ x 10½. Illustrated. Operating, check, knock-out and safety hydraulic valves are clearly illustrated and described. Every standard type of hydraulic fitting is listed, also accumulator controls, pressure gages, etc. Some of the devices are of improved design and are published for the first time.

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.

Aluminum—Method of Obtaining Alkalis and Alumina from Silicates Containing Them. Franz A. Rody, Johnston City, Tenn., assignor to Metallurgical Co. of America, New York, N. Y. (U. S. No. 1,263,705; Apr. 23, 1918.)

Blasting Cartridge—John H. Blumenstein, La Grande, Ore. (U. S. No. 1,263,366; Apr. 23, 1918.)

Blasting—Miners' Crimping and Cutting Combination Tool. William W. Weber, Fort Myers, Fla. (U. S. No. 1,263,720; Apr. 23, 1918.)

Concentrator—Frank O. Sterrett, Colorado Springs, Colo. (U. S. No. 1,263,956; Apr. 23, 1918.)

Concentrator, Ore. Washington Baker Vanderlip, San Diego, Calif., assignor of thirty-five one-hundredths to Ernest Scherinkow, New York, N. Y. (U. S. No. 1,263,968; Apr. 23, 1918.)

Electric Furnaces, Improvements in. J. L. Dixon, Detroit, Mich. (Brit. No. 111,104.)

Flotation—Process of Recovering Metals from Ores. Henry E. Wood, Denver, Colo. (U. S. No. 1,263,503; Apr. 23, 1918.)

Gold Alloys—Improvements in Gold Alloys and the Preparation Thereof. K. Shiga, Nishiusaki, Prov. of Miyazaki, Japan. (Brit. No. 114,447.)

Hardness of Metals, Improvements in Apparatus for Testing the. Reid Bros., Ltd., London, and G. Brown, So. Norwood, Surrey, England. (Brit. No. 114,593.)

Furnaces—Improvement in Furnaces for Heating Ingots. G. J. Davis, Loughor, Glam., England. (Brit. No. 114,570.)

Leaching—Process for Extracting Copper from its Ores. Evald Anderson, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,263,727; Apr. 23, 1918.)

Slime Tables—Improvements in Concentrating Slime Tables. M. H. Baker, Bendigo, Victoria, Australia. (Brit. No. 114,594.)

Steel—Improvements in Casting Steel Ingots. A. Reynolds, Hove, Sussex, England. (Brit. No. 114,466.)

Steel—Improvements in Gas Valves for Steel Smelting Furnaces. Z. Davies, Llanelly, S. Wales. (Brit. No. 114,589.)

Editorial Correspondence

SAN FRANCISCO—June 2

Amended Safety Rules for gold dredges will have final consideration on June 20 at the offices of the Industrial Accident Commission in San Francisco. At the meeting on May 7 the discussion centered mainly about First Aid training and electrical safeguards, in so far as they were more easily complied with by the larger companies operating a number of boats than by companies operating one or two boats in remote parts of the state.

California Oil Production in April totaled 8,404,763 bbl. according to the Independent Agency figures. Shipments for the month were 9,169,484. These figures show a decrease in production from March of 14,308 bbl. and a decrease in stocks of 764,721 bbl. In April, 45 new wells produced a total daily average of 14,740 bbl. Midway-Sunset field led in production for the month, showing a total of 2,973,644 bbl.; Whittier-Fullerton produced a total of 1,784,775; Coalinga, 1,374,249 bbl. In April, 361 new wells were started. Producing wells totaled 7992; new rigs totaled 43 and 17 wells were abandoned.

Austrians in the Magnesite Mines at Porterville who failed to buy Liberty bonds during the last drive were invited by Italian miners to make themselves hard to catch. And the Austrians either invested or left. E. N. Belgrano, an Italian banker of San Francisco, visited the mines and addressed the Italian workmen and explained to those who did not fully comprehend the bond situation and their relation to the United States in the war, that it is the duty of all men in America who do not declare themselves alien enemies and allied with the Germans to help win the war by the purchase of Liberty bonds. The Italian miners immediately made it plain to their Austrian associates that they must either stand by America or get out.

Evidence of the Possibilities of renewed life of the Comstock mines is shown in recent developments on 2300 level of the Mexican mine. Drilling preparatory to sinking a winze developed a vein three feet wide, from which ore of good grade was obtained. Development in the Sierra Nevada mine on the 2500 level also confirmed the prospect. The Northend mines are showing a good production. Consolidated Virginia has taken its place among leading producers, and Sierra Nevada and Mexican are coming into place. Jacket-Crown Point-Belcher will increase production as soon as the mill and the Jacket shaft adjustment and repairs are completed. With the Gold Hill and the Northend districts thus advancing, the reopening of the Middle mines will not be long delayed.

The State Mining Bureau has been particularly active since the creation of the California State Council of Defence by Governor Stephens in assisting the council in its investigation of the petroleum industry, which has been thorough and later led to the appointment of D. M. Folsom as fuel administrator for the Pacific States. For four years State Mineralogist Hamilton has been especially active in directing the bureau work along the lines of petroleum conservation. The mining bureau, about three years ago, sponsored the present law providing for the protection of oil fields against damage by water. The administration of the law has met widespread approval by operators, and as the work of R. P. Laughlin, state oil and gas supervisor, involves the collection of facts relative to every oil well in the state, the Mining Bureau now has in its files probably the most complete data existing on this subject.

The Soda Products Co. is announced as a new concern to undertake extraction of materials from Owens Lake, Inyo County. There are now three plants operating, or two if the absorption of the Inyo Development Co. by the California Alkali Co. is consummated. The Inyo Development Co. was the pioneer enterprise on Owens Lake, and for several years operated at small profit, if any. The war has created a demand for soda products which guarantees a margin on investment. The second company to undertake the extraction of the brine from the water of the lake and experiment with the manufacture of profit-

able materials is the Natural Soda Products Co., which was for some time in almost disastrous financial straits, but was reorganized and placed on a paying basis about the time of the increased demand for the products. The new company is said to have been organized by San Francisco men, among whom are John D. Spreckels, Jr., and R. J. Tobin. The site selected for installation of plant is at the south side of the lake, near Olanche. The California Alkali Co. is also at the south side of the lake, at Cartago. The other plants are on the east side of the lake at Keeler.

DENVER—May 27

Mine Signal Code in use last year has been supplemented with a release signal, one bell, and four caution signals. The Commissioner of the Colorado State Bureau of Mines has ruled that in order not to make worthless the old codes, which a great many of the mines have gone to considerable expense in having made up on enameled steel, all emergency or caution signals may be placed on a separate enameled plate, to be placed near and preferably just below the regular code as now posted. The rules concerning the use of the code are now being revised and will be sent to the various mining companies.

Tungsten Producers of Boulder County claim that if the Government will establish and fix an adequate and stable price, the Colorado output now about one-third the entire output of the United States, can be increased from 50 to 100%. The producers have organized and have held several meetings to consider the proposed Minerals Control bill, now pending in Congress. Colorado tungsten miners claim that there should be a protective tariff on tungsten in order to make possible a heavier production. It has been announced that a tariff commission will come to Denver on June 17 to give a hearing to the tungsten miners and producers of other rare metals thought to be in need of protection. Advices from Washington indicate that the Minerals Control bill will probably be enacted within a month. As soon as the proposed law is enacted, a committee of tungsten producers will go to Washington to confer with those in authority with the view of bringing about a substantial increase in Colorado's production of tungsten ores.

Manganese Producers of Colorado are much interested in the movement to encourage the use of lower-grade manganese ores and products. As a result of a recent meeting between Government officials and the alloy committee of the Iron and Steel Institute, a meeting of steel manufacturers was called to arrange, if possible, for a modification of the practice of steel-making, whereby a much lower grade of manganese and a larger supply of spiegeleisen could be used in the manufacture of steel. On behalf of the steel men, the Iron and Steel Institute agreed to accept as standard 70% ferromanganese and 16% spiegeleisen as against former figures of 80 and 25, respectively. This is in line with the policy of the Government to encourage to the fullest possible extent the use of lower grades of domestic manganese ores, in order to relieve shipping. The use of lower-grade manganese ore will enable Colorado producers largely to increase their output. Recent investigations by the Government indicate that the possible manganese production of Colorado is greater than any other known source in the West.

Colorado Gold Producers view with alarm the existing conditions affecting production, which are likely to become more and more adverse so long as the war lasts. Unfortunately, little help can be directly extended to the gold miner. Since it is conceded that no advance in the price of gold is possible, it is difficult to formulate measures that would bring relief. The elimination of all excess-profit taxes on gold mining would obviously increase output, and as larger dividends would mean greater revenues from individuals, the loss to the Government from this act would apparently be largely offset. It is probable that a strong effort to exclude gold mining from the provisions of the Federal revenue laws in order to encourage production will be made when these laws are revised. Much thought and

consideration are being given to this question by financiers as well as gold producers. National and state organizations of mining men are inviting suggestions from their members for concrete plans of relief, with the hope that through united action a definite plan may be adopted which will in a measure improve the distressing conditions now confronting the mining industry. In this connection it is of interest to note that the world's gold production is rapidly declining under war conditions, and, with increased cost of production and no corresponding increase in the price of the product, the shortage may soon reach alarming proportions. Colorado's production in 1917 was \$16,020,000, as against \$19,154,000 in 1916. Under present conditions it is probable that gold costs more now in prospecting, discovery, development, production, and replacement of equipment than it is worth to the Colorado producer. In certain favorable instances this may not be true. It is obvious that unless relief appears soon, a more rapid decline in production must follow. The total gold production of the world decreased about \$30,000,000 last year, and it is estimated that the falling off will exceed that amount this year. Considering the fact that the total output in 1917 was about \$414,000,000 and that, so long as the war lasts, conditions affecting production are likely to become more adverse, there appears to be good reason for alarm.

SALT LAKE CITY—May 31

Utah Copper's New Leaching Plant at Garfield is reported to be treating upward of 1500 tons of carbonate ores daily, and producing precipitates carrying from 65 to 70% copper. The leaching plant has 12 tanks of a capacity of 4000 tons each, and when operations are fully under way, it is expected to produce about 20 tons of precipitates daily. The amount of material handled daily will be about 4000 tons. The copper precipitates are being shipped to the Garfield smeltery of the A. S. & R. Co. Preliminary estimates of production by the Utah Copper Co. in April place this at 1,000,000 lb. in excess of the March output, which amounted to 16,179,831 lb. copper.

Production of Potash from alunite in Piute County during 1917 is reviewed in a bulletin published by the U. S. Geological Survey. Potassium sulphate was produced by the original plant of the Mineral Products Co. at the rate of about 25 tons daily, up to the time of its destruction by fire in the autumn. In addition to the high-grade potassium sulphate produced, a quantity of calcined alunite carrying 16% available potash was marketed for use with fertilizer. Raw alunite was shipped to eastern reduction works to be treated for the recovery of potash. Since the issue of the bulletin, the Mineral Products mill has been rebuilt, and is now producing 20 to 25 tons of potassium sulphate daily.

The Daly West Mine at Park City, under the new management, is to be energetically developed. With a view to obtaining funds necessary for this purpose, the capitalization is being increased by 70,000 shares, which are to be sold at not less than \$2 a share. Total capitalization will then amount to 250,000 shares. The new management states that large expenditures must be made to place the property in condition for efficient operation, and before large returns can be expected. The surface equipment and plant have been allowed to run down, and the mill, if used, would have to be completely remodeled. During the time of rehabilitation, the property is to use the Judge concentrator for the treatment of its ores. The new board consists of H. Otto Hanke, president; George G. Brooks, vice president; G. W. Lambowne, treasurer and general manager; A. H. Peabody, secretary; and O. N. Friendly, general superintendent. The mine shipped 338,900 lb. of ore during the week ended May 18.

The Question of a Semi-Monthly Pay Day has caused dissension at the Loose and Knight properties in the Tintic district. This system was recently inaugurated by other companies in the district, following a similar move at Bingham. At the Loose properties—the Mammoth, Gold Chain, and Grand Central at Mammoth—following a

vote taken among themselves in favor of the new system and failure of agreement on the part of the management, the miners in some cases walked out. At the Iron Blossom, one of the Knight mines, the men also walked out, and there has been a partial suspension of operations at the Dragon Consolidated and Colorado, which are controlled by the Knight interests. It is understood that the latter have instituted semi-monthly payments at the Spring Canyon coal mines and a weekly system at the Knight woolen mills; and it is thought that either the latter system or the semi-monthly system in operation at other Tintic properties in the district may be tried out. It has been stated by a Knight official that a vote will be taken among the men in regard to the question, which will be met by the companies, as far as possible.

BUTTE, MONT.—May 30

Montana State School of Mines this year will have only four graduates. Last year the attendance was 85, and this year the class has been cut down to 35. Many of the young men joined the Engineers and not a few enlisted in the mining and sapping department of the Marines, through inducements held out by the recruiting officers.

WALLACE, IDAHO—May 31

A Lost Tungsten Vein on Pony Gulch, in the Coeur d'Alene gold belt, has been rediscovered by Colonel Chester T. Kennan, who has had men employed in the search for a year or more. This vein was discovered many years ago by placer miners, but received no attention, as its value, if it had any at that time, was not realized. The outcrop extended across the gulch, and in time was deeply buried with tailings. The discovery of more or less scheelite in the gold belt soon after the abnormal demand created by the war attracted Colonel Kennan to the district. In the course of his investigations he heard from old-timers the story of the outcrop that had been uncovered by early placer miners on Pony Gulch, the distinguishing feature of which was a yellowish vitreous substance along with the quartz and of greater specific gravity. This information, together with the fact that he found considerable scheelite with the gravel in the gulch, convinced Colonel Kennan that the mysterious substance in the lost outcrop was scheelite, and he set out to find it. The outcrop was found last week crossing the old channel under a deep bed of tailings. It is over 40 feet wide and has been followed along its course about 25 ft. About eight feet next to the foot wall is made up of scheelite and quartz intermingled. Samples of the scheelite have the appearance of being high grade, and the size of the deposit indicates that it will prove an important tungsten discovery.

HOUGHTON, MICH.—June 2

Construction Has Been Resumed on two additional stamp heads for the Point Mills plant of the Lake Milling, Smelting and Refining Co., a Calumet & Hecla subsidiary that came to the company when the Fay management turned over the Allouez-Centennial mines and plants. Steel for the two heads was set up last autumn, but work was discontinued during the winter. One of the additional heads is for Isle Royale, the other for Hancock. The boilers are being installed and the entire plant will be electrified to utilize exhaust steam. A mixed flow pressure turbine will operate a 2000 kw. electric generator. A 30,000,000 gal. motor-driven centrifugal pump is also to be installed. Intake is to be placed on the west limits of the property so as not to interfere with sand tailings. A pumping plant, to shoot tailings out into Torch Lake, is being erected jointly by the Osceola, the Lake and the Calumet & Hecla.

JOPLIN, MO.—May 27

Unsatisfactory Ore Prices have resulted in a slowing up of drilling operations in the district, but many new concentrators are being planned upon leases proved up before the slump developed. Among the important are mills for the Anna Beaver and Huttig companies. Bulkeley Wells, of Denver, is managing director of the former company, and its plant one mile west of Picher was completed last summer, being the only one equipped with skips in the Oklahoma section. The new mill will be erected a short distance to the northwest of the first mill and will be almost a duplicate. The shaft has been put down in lime and now is being driven to the orebody. The Huttig company already has three mills, and will build a new one to the south of the others, immediately east of St. Louis, Okla. Its mill formerly known as the Merrill has been changed in name to Mars, and its other mills in this field will be known as the Jupiter, Saturn, and Inspiration. The new mill will be of 350 tons' capacity.

SPOKANE, WASH.—May 29

Tin deposits recently discovered on Moran prairie, south of Spokane, are attracting much attention, and a company has been organized to develop the property. The installation of a concentrator and a small smeltery is said to be considered. The property is expected to receive the immediate attention of the Government if the Mineral Control bill is passed by Congress.

The Home Builder Nitrate Properties near Coeur d'Alene, Idaho, are being investigated by Jay P. Graves, capitalist and builder of the Granby smeltery. The property consists of 43 claims, six of them patented, lying 18 miles east of Coeur d'Alene, Idaho, and a few miles northeast of the Fourth of July Canyon road. It contains a dike having an estimated width of 600 ft., in which work has been carried on.

Independent Mine Owners and Producers' association of the Kootenais expect to hold a meeting about June 1, in Nelson, B. C. Members of both the provincial and dominion parliament are to attend. The Canadian Pacific Railroad company is in sympathy with the owners and will probably be represented, making the meeting one of great interest and importance. Smeltery rates and general subjects that mine owners must handle are to be considered.

TORONTO—May 31

Oil in the Peace River District of Alberta promises to be active in development during the summer. Many locations have been made, and extensive preparations for drilling are reported. A big drilling plant owned by H. L. Williams and associates has been shipped to the field and will sink a well at Three Creeks. The Far Island Oil & Gas Co. has also a plant on the way, and many other companies and individuals are planning to enter the field.

Hon. G. Howard Ferguson, Ontario Minister of Mines, has made a personal investigation of mining conditions in Northern Ontario, and decided that prospectors will not be compelled to perform their postponed assessment work. In addition to this year's work, in one season. There will not be a general extension of time similar to that granted last year, but all claim-holders will be required to perform one installment of work, and in cases where two assessments are due, the second will be extended for one year. This decision has been received with much satisfaction in the mining camps.

Representatives of the Canadian Iron and Steel Industries conferred with the Canadian government and the Imperial Munitions Board at Ottawa recently regarding the supply of steel for war purposes. The government strongly urged the necessity of using every effort to increase the present output. The matter of granting subsidies to pig-iron manufacturers was considered, but after being fully discussed the proposal was dropped. The government decided to purchase the output for three years of all pig iron produced in any new blast furnaces established during the next two years. The price to be paid is to be governed by the market conditions prevailing at the time of purchase. This arrangement is expected to give a considerable stimulus to the industry.

The Recent Ruling of the Ontario Department of Lands, Forests and Mines, to the effect that assessment work on mining claims extended from last year to this year shall accrue and become due together with this year's work, is meeting with strong opposition in the mining centers of Northern Ontario. It is urged that one year's assessment work is a heavy enough burden without its being doubled. The Haileybury Board of Trade has passed a resolution declaring the action of the government inexpedient and inadvisable and likely to cause hardship and loss to many bona-fide prospectors and miners. It asks an amendment of the regulation so that only the last year's work will be required this season and this year's work held over until next year. The Boards of Trade in Cobalt, Timmins and South Porcupine are also remonstrating.

VICTORIA, B. C.—May 29

To Induce Locating and Developing of the rarer minerals among prospectors of British Columbia, Hon. William Sloan, Minister of Mines, has authorized the display of complete exhibits of the rarer metals at centers of the six mineral-survey districts into which British Columbia has been divided. It is the Minister's opinion that one of the reasons that comparatively little is known of the resources of Western Canada in respect of the rare minerals, the usefulness and value of which have been emphasized by the demands of the

war, is that the prospectors are not fully conversant with their characteristics.

A Canadian Survey Branch Station is to be permanently established in British Columbia, with Charles Camsell, one of the department's ablest geologists, in charge. With such a centre in the West, provided with a complete library of reports and maps, covering all the information which the geological department has compiled in its work in this province during the last seven or eight years, it will be possible for those interested to obtain data at short notice.

Infusorial and Diatomaceous Earth resources of the province are receiving inquiries from Great Britain, especially in regards to the manufacture of asbestos. In Manchester, England, the supply of which before the war was imported from Russia and France, British Columbia has considerable quantities of infusorial earth, probably the best known deposits being situated about 20 miles north of Savona, B. C., a Canadian Pacific Ry. station, where there are beds up to 30 ft. in thickness. In view of the demand, it is thought likely that active development will be undertaken in the course of a few months.

The Ward-Hopp Case, which has been engaging the attention of the Legislature and the courts of British Columbia for years and which is familiar to all mining men of Canada, has assumed a new phase. In a recent judgment the Court of Appeal of the province found in favor of the plaintiff, R. T. Ward and his associates, thus reversing the decision of Justice A. Macdonald, in the lower court, whose verdict was that the placer-mining leases in dispute were properly the property of the defendant, John Hopp et al. It is expected that the case will be appealed by the latter, possibly going to the Supreme Court of Canada, and thence to the Privy Council of the Empire. The British Columbia Court of Appeal upheld Ward's position that he and his associates were in possession under a prior lease and that their prior lease, validated by statute, was not subject to the provisions of the Placer Mining Act, under which it was alleged their rights had lapsed.

MELBOURNE, AUSTRALIA—Apr. 28

Great Fingall Consolidated, Ltd., at Day Dawn, three miles from Cue, Western Australia, is being closed down after operating since 1892. The output of ore aggregated about 2,000,000 tons for a return of £4,919,466, of which £1,250,000 has been paid in dividends. The company was formed in May, 1899, to acquire the holdings of the Great Fingall Reefs, Ltd., and the Consolidated Murchison Gold Mines, Ltd., and held in all 392 acres. The treatment plant consisted of 100 stamp mills, slime plant, etc. The capital of the company was £125,000 in 10s. shares, duly paid. Operations recently have been conducted at a loss.

Water Trouble at Westonla Mines (Edna May group). Since the last breakage of one of the Edna May pumps has prevented the unwatering of the bottom level, the high grade ore from the bottom levels is not available for treatment, and the payable ore from the higher levels is becoming exhausted. Until the Edna May Co. is capable of dealing efficiently with the heavy inflow of water, the position is precarious. In the event of the water getting beyond control, there is little doubt that some of the other companies will be affected. The future of the Westonla as a mining field now practically depends on a scheme being carried out which will ensure the mines being kept unwatered. Mr. Montgomery, state mining engineer, recommends the erection of a central power station and the use of electrically driven pumps.

Block 10, Misima Gold Mines, of Papua (New Guinea) was formed in January, 1917, by the amalgamation of the Broken Hill Block 10 Co.'s interests with the Misima Co. The present company has a nominal capital of £200,000, in shares of £1 each, of which 150,000 have been issued. The Broken Hill Block 10 Co. subscribed the entire working capital of £30,000, and, in addition, spent £12,000 in development. The present milling plant is capable of treating 1400 tons of ore per month, but a larger plant is necessary, and it is proposed to increase the amount payable on each share. A net profit of £1146 was made for the half year ended Dec. 31, 1917, during which 7045 tons of ore was crushed, assaying 30s. 10d. per ton, from which 5605 tons of sands were cyanidated for £6921, equal to 24s. 8d. per ton of sand treated. Gold recovered from sands treated shows an extraction of 88.7%. Total working costs, including management, amounted to 19s. per ton. Transport difficulties delayed plant erection; consequently 1186 tons of slimes, assaying 43s. per ton, have been stacked for treatment. Operations generally were hampered and costs raised owing to war conditions.

The Mining News

ALASKA

MOTHER LODGE (Kennecott)—Officially announced that control of this company has been acquired by Kennecott Copper Corporation, the latter interests holding 51% of the stock.

ALABAMA

Talladega County

CENTRAL ALABAMA C. & I. Co. (Jenifer)—To rehabilitate the Jenifer iron furnace plant and to erect hot-blast stove, machine shop, and install complete electrical equipment. An additional washery to be built at brown-ore mines near furnace. Fifty coke ovens will be added to present battery of 100 at coal mine. Reported that the Thomas Furnace Co. will operate the plant when completed.

ARIZONA

Cochise County

HILL TOP EXTENSION (San Simon)—Syndicate is being formed to take over property. Expect to ship one carload per week soon.

Mohave County

COPPER AGE GROUP (Kingman)—Arizona Ore Reduction Co. employing 50 men at property. A 250-ton concentrating plant built and a million-gallon reservoir under construction.

GEORGE WASHINGTON (Kingman)—Reported sold to W. C. Page, of San Francisco.

HACKBERRY CON. MNG. CO. (Kingman)—Has opened up new orebody which was first discovered 30 years ago, and abandoned on account of water.

WALNUT CREEK M. & M. CO. (Kingman)—Working on 1500-ft. tunnel to strike vein 500 ft. below the 400 level.

BANNER GOLD M. & M. CO. (Oatman)—Reported that the oreshoot which was objective of operations for three years was reached on the 400 level, about 300 ft. west of shaft.

Pima County

DAYLIGHT MINING (Tucson)—Tunnel at Rosemont claim now driven 300 feet.

NEW CORNELIA (Ajo)—To sink main shaft 60 ft. more before drifting. Three shovels now working to full capacity.

Pinal County

RAY HERCULES (Ray)—First 500-ton mill unit expects to begin partial operation July 1.

Yavapai County

HACKBERRY MINES (Dewey)—Have purchased machinery and will install 250-ton mill.

BLUE MONSTER COPPER (Jerome)—Superintendent Sutcliff reports peacock copper at a depth of 100 feet.

JEROME SUPERIOR (Jerome)—Shaft sinking suspended during erection of 60-ft. headframe. Formation at bottom of 400-ft. shaft is quartz-porphry. George E. Mitchell, Sr., is general manager.

UNITED VERDE CO. (Jerome)—Work on smeltery progressing rapidly. Blast furnace to be blown in by June. Stack, to be 425 ft., now 325 ft.

FORD GOLD & SILVER (Prescott)—Recently purchased Promoter group, now actively operating.

HOME OIL CO. (Prescott)—Contract has been let for water well, and a depth of 200 ft. reached.

UNITED CHINO O. & R. CO. (Prescott)—Report states that drill at well is down 620 feet.

Yuma County

SWANSEA MINE (Swansea)—Flotation plant being completed.

ARGUS COPPER (Yuma)—Reports good orebody at 120 ft. in new shaft.

YUMA CHIEF G. & C. CO. (Yuma)—To install drill to explore orebodies showing at surface and opened by shafts and tunnels. Samuel Klous, of Boston, is general manager.

CALIFORNIA

Calaveras County

PIONEER (Angels Camp)—Unwatering shaft preparatory to deepening. Electric power to be installed and have taken over power line transformers and other equipment of Brown-Smith-Ryland Co.

Inyo County

TUNGSTEN SHIPMENTS from Bishop for week ended May 11 amounted to 30 tons of concentrates.

Los Angeles County

WESTERN CHEMICAL PRODUCTS CO. (Los Angeles)—Purpose manufacture of potassium permanganate and strontium nitrate. Plant to be situated at Vernon.

Mariposa County

ADAMS CHROME CO. (San Francisco)—Mines situated on Merced River, seven miles from Coulterville, leased to A. G. McAllister and William Nelson, of Sonora. Development and extraction to begin soon.

Nevada County

REPUBLIC (Graniteville)—Modern machinery installed last season preparatory to extensive development and extraction during the open months of this year. Other properties near Graniteville being reopened. Heavy snowfalls render mining difficult in the winter.

KENOSHA (Grass Valley)—Mine near Deadman Flat to be unwatered. Edward E. Drake, of San Francisco, is president. Equipment includes 5-stamp mill and electric power.

ST. LOUIS (Nevada City)—Vein reported to carry ore at 800 ft. Mine was first worked in 1884 and closed down in 1890. Now being developed by Peter McAuslan and associates.

Placer County

CHROME MINING and development in the Forest Hill and Iowa Hill districts are active, with indications of large production. Dodds ranch, about 15 miles northeast of Auburn, containing 135 acres, and 160 acres of Government land have been taken over by R. H. Farmer under options and lease. The chrome deposits are reported to be large. Concentrating mill will be installed. Other operators on Forest Hill divide are hauling chrome to Colfax, about 15 miles, by motor trucks. Two deposits of chrome have recently been disclosed in the Iowa Hill district, north of Forest Hill district, by E. A. Rosa and Philip McCoy and by W. H. Russell. These deposits are near the Colfax wagon road and about 15 miles east of Colfax.

Plumas County

WALKER COPPER (Portola)—Fourth level started at 150-ft. point in the same winze below the 210-ft. level. Operating 100-ton flotation plant and employing 135 men.

Santa Barbara County

BROOKS OIL CO. (Santa Maria)—Drilling in Cat Canyon field.

Santa Clara County

CHROME DEPOSITS on the G. A. Frost ranch, 27 miles from Livermore, to be developed and ore hauled to Livermore for rail shipment.

San Joaquin County

PACIFIC ELECTRIC METALS CO. (Stockton)—Plant for electric smelting of manganese ores installed at Bay Point to have capacity of 40 tons ferromanganese per day. C. D. Clarke is president. J. M. Kroyer is superintendent. Ores will come chiefly from Mother Lode district.

San Luis Obispo County

BENTON RANCH (Cambria)—M. Rickels driving tunnel to develop chrome deposit. Two tons of ore extracted in development. Ore hauled by motor trucks to San Luis Obispo for rail shipment.

GOOD WILL (San Luis Obispo)—Company has optioned part of Canada de Los Osos ranch and will mine manganese ore in connection with its copper mining on the

Gibson and Filliponi ranches, in Los Osos Valley.

Shasta County

AFTERTHOUGHT (Ingot)—One 150-ton unit of flotation plant in operation. Five motor trucks hauling concentrate to the railroad.

GARDELLA NO. 2 DREDGE (Redding)—Placed in commission May 18. On Clear Creek at McCormick ranch. Lawrence Gardella, of Oroville, owner.

Trinity County

COPPER KING (Redding)—Developed three years ago as a copper mine and produced high-grade copper. Now producing chrome of high grade.

HEADLIGHT (Trinity Center)—The 40-stamp mill and 225-ton cyanide plant being dismantled and machinery to be shipped to Redding. Property closed down since 1915. Plant was electrically driven. Electric power plant sold to the California-Oregon Power Co.

COLORADO

Boulder County

LITTLE CORKSCREW (Lakewood)—To be developed under lease by James Pittman. Streak of tungsten ore has been cut.

Clear Creek County

ROYAL GEM (Caribou)—To be reopened and developed by New Orleans capitalists. Shaft and levels are being cleaned out.

STRANAHAN (Dry Lake)—Taken over by Tungsten Products Mining Co. To be developed and operated under leasing.

RAKE OFF (Lakewood)—Dumps have been leased by Primos Chemical Co. to Coates & Bates, who are installing equipment for operation during the summer.

McKENZIE (Nederland)—Mining machinery installed and contract let to drive 500-ft. crosscut tunnel to cut Long Chance and Tungsten Mountain veins.

Ouray County

INDIANA (Ironton)—A. M. Barnes lease taken over by A. E. Eiseaman. Force to be increased. Good-grade oreshoot 5 ft. wide opened.

Park County

HOCK HOCKING (Alma)—Winter ore, 12 or 15 cars, ready for shipment.

MOFFAT (Alma)—Tunnel stopped 1200 ft. from portal; winze being sunk.

SOUTH LONDON (Alma)—Lessee Oscar Bloomquist shipping ore.

Saguache County

RAWLEY (Bonanza)—Company to build seven mile tramway and 300-ton mill. Mill and part of tram not yet purchased. Chas. E. Beckwith is superintendent.

San Juan County

SUMMIT COPPER MINING CO. (Silverton)—Operating San Antonio and Koehler tunnel properties, will raise 500 ft. from tunnel to Carbon Lake shaft.

ZUNI (Silverton)—Workings retimbered, and main tunnel to be driven to cut Zuni or main vein. Operated by lessees. Is one of few places in world where mineral zunyite is found.

San Miguel County

CARBONERO (Ophir)—Making shipments of good-grade ore.

LEWIS (Telluride)—Good progress made in drifting toward Little Dorrit claim. Air drills used.

MOUNTAIN FLOWER (Telluride)—Developing with satisfactory results. Delta crosscut through vein system, opened some good-grade ore. To start drifting.

PRIMOS CHEMICAL CO. (Vanadium)—Operating at full capacity. About nine cars per month shipped.

Summit County

DUNCAN (Breckenridge)—Excessive water, due to melting snow, caused temporary cessation of work. Several cars gold ore ready to ship.

OHIO (Breckenridge)—Shoot high-grade silver ore opened recently in tunnel.

WELLINGTON (Breckenridge)—On east 4th level, shoot of milling-grade zinc ore 6 to 8 ft. wide opened, and now being stoped.

MINNIE (Kokomo)—To be reopened by Swastika Mining Co. Property a lead-silver producer, but closed several years on account litigation.

LIBERTY MINING & REDUCTION CO. (Montezuma)—Developing Pennsylvania group. Controlled by Dorr Co., of Denver. Owen Johnson is in charge.

Teller County

FOREST QUEEN (Cripple Creek)—Development in ore on 750 level progressing steadily. Shaft to be sunk. Large tonnage old caved material of milling grade being shipped. Lease runs for four years more, and hope to develop large producer in that time.

INDEX (Cripple Creek)—Oreshoot 120 ft. long and up to 10 ft. in width assaying well in gold opened in south drift from 150-ft. winze below 900 level. Shipments being made.

UNITED GOLD MINES CO. (Cripple Creek)—One car per day being shipped from Wild Horse mine to Golden Cycle mill. Ore averages about 1 oz. gold. New oreshoot, opened below third level of main shaft, is 3 ft. wide.

KANSAS

Joplin District

BIG SHOT (Baxter Springs)—To build mill on lease southwest of town. Company incorporated for \$200,000. Tract drilled and shows ore on two levels. J. A. Frates, of Miami, is president.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Not to be delayed by recent decision as to Minerals Separation patents in installing flotation plant. To put new barrel drum on one of the Nordberg hoisting engines at No. 5 Tamarack. Production at reclamation plant uniform and uninterrupted.

NEW BALTIC (Houghton)—Has cut wide copper vein.

NORTH LAKE (Houghton)—Discontinued drifting on new lode in southeast crosscut. To continue crosscut northwest for Butler lode.

SOUTH LAKE (Houghton)—Butler lode opened by drifts on 6 level showing mass and stamp grades.

AHMEEK (Kearsarge)—Drifts running 350 ft. north and south on the conglomerate to be continued when the labor conditions permit.

LA SALLE (Laurium)—No. 2 shaft cutting plat at 23 level. Drifting on all but two levels.

COPPER RANGE (Painesdale)—Closed Baltic shaft No. 5 to mine rock in West vein from No. 4 shaft.

WINONA (Winona)—Arrangements to be made with Minerals Separation Co. to install experimental plant.

NEVADA

Esmeralda County

ATLANTA MINES CO. (Goldfield)—Raise from east crosscut on 1900 level being extended on incline to east to reach 1750 level for ventilation purposes and as a center for lateral drifting on the vein between these levels.

GOLDFIELD CONSOLIDATED (Goldfield)—Treating some oxidized ores by cyanidation and to treat milling grade ore mined by Red Hill Florence.

GRANDMA CONSOLIDATED (Goldfield)—Sinking continues in main shaft and flow of water moderate.

RED HILL FLORENCE (Goldfield)—Settlement of dispute with Florence-Goldfield company in regard to future apex rights has been reached in a manner satisfactory to all concerned, and a five-year loan on all valuable ground adjoining on the east has been secured.

SILVER PICK CONS. (Goldfield)—Appearance of formation improving in shaft sinking below the 1100 level.

Humboldt County

EDMUNDS-BUCHANAN GROUP (Winemucca)—Tungsten property 25 miles southwest shipping to Toulon, near Lovelock, for concentration. The ore is scheelite. James Edmunds and John Buchanan are operators.

Nye County

TONAPAH DISTRICT ore production for the week ended May 18 totaled 10,621 tons, of an estimated gross milling value of \$180,557. Producers were: Tonopah Bel-

mont, 2199 tons; Tonopah Mining, 3800; Tonopah Extension, 2375; Jim Butler, 586; West End, 1061; MacNamara, 331; Montana, 140; North Star, 53; Halifax, 48; Midway, 4; and miscellaneous, 24 tons.

BULLFROG DISTRICT indicates early expansion in scope of operations, with principal activities centered at Pioneer and Rhyolite.

WHITE CAPS (Manhattan)—Prospecting area between shaft and west orebodies. Next mill clean-up to be completed June 2.

PIONEER CONSOLIDATED (Pioneer)—Planning reorganization and development at depth. J. K. Turner is engineer in charge.

CONSOLIDATED MAYFLOWER (Pioneer)—Exploration on main vein to north and south of shaft reported to have opened up ore of milling grade on the 200, 300 and 400 levels.

SUNSET M. & D. CO. (Rhyolite)—Cross-cutting below 700-ft. depth in shaft to open up two principal veins in which ore was found on higher levels.

White Pine County

WARD MINE (Ely)—Shipping 40 to 45 tons daily of lead-silver ores. Manganese shipments light and little in sight.

GRAND PRIZE (Hamilton)—Discovery has been made of a high-grade lead-silver ore.

CONSOLIDATED COPPERMINES (Kimberly)—Both mill units operating. Near old Alpha shaft (caved) at 400 ft. depth, drilled through 48 ft. of carbonate ores. Hoisting from 11th and 12th levels of Giroux shaft in continuation of high-grade pocket ore discovered on 7th and 10th levels.

OKLAHOMA

Joplin District

LUCKY JENNY (Hockerville)—To build 300-ton mill. Shaft completed.

JEFFERSON (Miami)—Began sinking shaft on lease southwest of St. Louis. To build mill. A. S. Clark, St. Louis, Mo., is president.

PRODUCERS (Picher)—Operating new mill northwest of town. Ore from air drift between shafts now milled. T. R. H. Smith, of Oklahoma City, is secretary-treasurer.

ROYAL (Picher)—Mill in operation. Mining 60 tons zinc ore weekly.

BETHLEHEM (Quapaw)—Purchased Tom C. mill, south of Webb City, for \$25,000 and to move same to lease east of Quapaw.

LINCOLNVILLE L. & Z. (Quapaw)—Has begun shaft. T. H. Newborn, of Miami, is president.

OREGON

Jackson County

NELLIE WRIGHT (Gold Hill)—Resumed operations. Equipped with a Beers mill, plates and Johnson concentrator operated by electric power. R. M. Wilson is lessee.

SYLVANITE (Gold Hill)—Under lease to J. G. Davies, of Sacramento, Calif. Erecting 10-stamp mill, rock crusher, amalgamating plates, and concentrating tables.

MANGANESE MINING (Lake Creek)—Made initial shipment of 90 tons of manganese concentrates.

M. S. JOHNSON (Rogue River)—To ship manganese ore. Reduction plant to be erected to treat the non-shipping ore.

UTAH

Beaver County

RED WARRIOR (Milford)—Shipment made from strike between 500 and 600 levels.

Box Elder County

SUSANNAH (Golden)—Ore of milling grade being mined and treated in Lane mill. T. C. Morrow, of Salt Lake, operating under lease.

VIPONT (Kelton)—Recently examined by prospective purchasers.

Grand County

NEEDLES MINING (Green River)—Mining manganese ore by opencut. Expects to increase output. A. J. Bruneau, of Salt Lake City, is president.

Juab County

CHIEF CONSOLIDATED (Eureka)—Lessees Huish and Beane shipped car of manganese ore from Homanville section of property. Other shipments pending.

GEMINI (Eureka)—Enquist lease continues shipment of rich ore.

GODIVA (Eureka)—Developing on 1200 level. Combes lease on the 700 level is mining high silver ore.

VICTORIA (Eureka)—Mining high silver ore 1050 level. Property controlled by Birmingham Mines Co.

Plute County

FLORENCE M. & M. (Marysville)—Work on new mill delayed by heavy snowfall. Material for plant assembled and good progress expected.

Salt Lake County

COLUMBUS REXALL (Alta)—Mine expects to ship 50 tons daily for indefinite period.

CARDEFT (Salt Lake)—New ore opened in extension of main tunnel level at this Big Cottonwood property. Awaiting better hauling conditions before shipping.

Summit County

PARK CITY SHIPMENTS for week ended May 18 amounted to 4,257,550 lb., five properties shipping.

GLENCO (Park City)—Property under lease and bond to James B. Allen. Four cars of ore ready for shipment.

IOWA COPPER (Park City)—Ore being mined and working forces increased.

ONTARIO (Park City)—Ore on 1700 level increasing in extent. Preparations being made to sink below 1700 on ore, from a point 700 ft. from old shaft, which is badly caved below 1700 level. Expect new ore to connect with this part of mine, formerly productive. N. A. Dunyar is superintendent.

SILVER KING CONSOLIDATED (Park City)—New drainage and transportation tunnel being driven under Thaynes Canyon section.

Tooele County

WESTERN UTAH EXTENSION (Goodwin)—Tunnel opened copper vein 15 to 18 ft. between walls. B. T. Heywood, of Salt Lake, is superintendent.

Uinta County

CRANE OIL SHALE (Watson)—Company controls oil-shale lands near Watson. Plans erection of distillation plant. Crane process to be used.

CANADA

British Columbia

BLUEBELL (Ainsworth)—Producing about 1500 tons of silver-lead ore per month.

GRANBY CONSOLIDATED (Anyox)—Added two converters to plant. To handle matte instead of shipping to Grand Forks plant.

Ontario

WALSH CLAIMS (Gowganda)—Decided to continue development by Crown Reserve, which holds option.

PORCUPINE-VIPOND (Schumacher)—Mine is to be closed own, keeping underground workings drained.

GOLD RIDGE (Porcupine)—Work discontinued. Machinery sent to the Cisco claims, Hurricanian district.

McINTYRE (Porcupine)—Drifting east from 1000 level of Jupiter property started for purpose of exploring Plenaurum property at depth.

VIPOND (Porcupine)—Amalgamation with Porcupine Crown officially denied. Development to be carried from 600 to 1100 level.

WHELPDALE (Porcupine)—Third vein cut at 150 level.

OPHIR (Cobalt)—Sinking on shoot to contact 150 ft. below in ore said to assay 1600 oz. per ton.

PETERSON LAKE (Cobalt)—To treat tailings by flotation. Plant nearly complete for treatment of Seneca Superior tailings.

PITTSBURG-LORRAIN (South Lorrain)—Ball mill shipped to property.

KIRKLAND LAKE (Kirkland Lake)—Erection of 150-ton mill begun.

LAKE SHORE (Kirkland Lake)—During March and April mill treated 2570 tons of ore, producing bullion valued at \$66,696.

WRIGHT HARGREAVES (Kirkland Lake)—Mine developed to the 400 level. Seven faces of workings in high-grade ore.

MEXICO

Baja California

COMPAGNIE DU BOLEO (Santa Rosalia)—Copper production during April was 1,818,880 lb. Copper ore averaged 3.525% copper.

The Market Report

SILVER AND STERLING EXCHANGE

May June	Silver			June	Silver		
	Sterling Ex- change	New York, Cents	Lon- don, Pence		Sterling Ex- change	New York, Cents	Lon- don, Pence
30		48 $\frac{1}{2}$		3	4.7550	99 $\frac{1}{2}$	48 $\frac{1}{2}$
31	4.7550	99 $\frac{1}{2}$	48 $\frac{1}{2}$	4	4.7550	99 $\frac{1}{2}$	48 $\frac{1}{2}$
1	4.7550	99 $\frac{1}{2}$	48 $\frac{1}{2}$	5	4.7550	99 $\frac{1}{2}$	48 $\frac{1}{2}$

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.
Mexican dollars at New York: May 31, 77; June 1, 77; June 3, 77; June 4, 77; June 5, 77.

DAILY PRICES OF METALS IN NEW YORK

May June	Copper		Tin		Lead		Zinc
	Electro- lytic	Spot.	N. Y.	St. L.	N. Y.	St. L.	St. L.
30			7.00	6.92 $\frac{1}{2}$			7.20
31	*23 $\frac{1}{2}$	↑	@7.05	@6.97 $\frac{1}{2}$			@7.25
1	*23 $\frac{1}{2}$	↑	7.05	6.97 $\frac{1}{2}$			7.22 $\frac{1}{2}$
3	*23 $\frac{1}{2}$	↑	@7.10	@7.02 $\frac{1}{2}$			@7.27 $\frac{1}{2}$
4	*23 $\frac{1}{2}$	↑	7.05	6.97 $\frac{1}{2}$			7.22 $\frac{1}{2}$
5	*23 $\frac{1}{2}$	↑	@7 $\frac{1}{2}$	@7.15			@7.30
			7.25	7.17 $\frac{1}{2}$			@7.35

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

†No market.
The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) 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.
We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.
Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 20c. per 100 lb. above St. Louis.

LONDON

May June	Copper		Tin		Lead		Zinc
	Standard	Electro- lytic	Spot	3 Mos.	Spot	3 Mos.	Spot
	Spot	3 Mos.	Spot	3 Mos.	Spot	3 Mos.	Spot
30	110	110	125	353	353	29 $\frac{1}{2}$	54
31	110	110	125	350	350	29 $\frac{1}{2}$	54
1							
3	110	110	125	348	348	29 $\frac{1}{2}$	54
4	110	110	125	345 $\frac{1}{2}$	345 $\frac{1}{2}$	29 $\frac{1}{2}$	54
5	110	110	125	331	331	29 $\frac{1}{2}$	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 \$4.7515. £29 $\frac{1}{2}$ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—June 5, 1918

The most interesting feature of the markets this week was the sharp advance in lead. The other metals were uninteresting.
Copper—Producers received this week official notification from the War Industries Board of the continuation of the 23 $\frac{1}{2}$ c. price until Aug. 15. Another meeting of producers is called for Aug. 7.

Consumers have been clamoring for copper. Some agencies have been booking orders until Aug. 15 at 23 $\frac{1}{2}$ c. Others have been accepting orders only subject to revision of price. There seems to be an undercurrent of thought that in spite of the official fixing to Aug. 15 there may be some revision before then.

Copper Sheets are quoted at 31 $\frac{1}{2}$ c. per lb. for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26 $\frac{1}{2}$ c. f.o.b. mill, carload lots.

Tin—In the early part of the week, Chinese No. 1 sold at 85c. in San Francisco, but at the close, 86c. was bid for it there. In this market Chinese No. 1 on the spot was quoted at 91@92c. at the close, while a small lot of Straits tin was held at \$1.08@1.10.

Lead—The price advanced from day to day on moderate business, but there was broad inquiry. During the afternoon of June 4, the A. S. & E. Co. advanced its price to 7.25c., and today there was large and widespread inquiry and negotiation, especially for future deliveries. The Government has been taking a good deal of lead, and there now seems to be a general disposition among consumers to stock up. The statistical position is undoubtedly strong, and under normal conditions everything might be considered as pointing to a further advance, but nobody knows what interference the War Industries Board may interpose, or what will be the result if there be interference. The rise in the market this week occurred on relatively small business, outside of Government orders. Canada bought a considerable tonnage of Mexican lead. Japan inquired for some round lots.

At the request of Mr. B. M. Baruch, the Lead Producers' Committee for War Service has been organized with Clinton H. Crane as chairman and Edward Brush, F. Y. Robertson, Harry L. Day, T. Wolfson, L. Vogelstein, Julius Loeb, A. W. Dodd as the other members.

Zinc—The market was a little stronger, but business was very light. The Government has been asking for further lots of Grade C spelter. There is an angry feeling among producers over the treatment they are receiving at the hands of purchasing officers in the Ordnance Department. Unjust charges of conspiracy are lightly made by young lieutenants, and threats are made if producers do not accede to every demand, reasonable or unreasonable. Producers are gravely concerned respecting the welfare of their industry.

Smelters at Bartlesville, Okla., struck on June 1, demanding 75c. per day advance in wages, which the operators refused to give. The men returned to work June 4, temporarily, pending investigation of increased cost of living, etc.

The American Zinc Products Co. has put into operation its sheet-zinc rolling mill at Greencastle, Indiana.

Zinc Sheets—Unchanged at \$15 per 100 lb., less usual trade discounts and extras as per list of Feb. 4.

Other Metals

Aluminum—A maximum base price of 33c. per lb. in lots of 50 tons or more of ingot, 98 to 99% grade, was fixed by President Wilson under an agreement between producers and the War Industries Board. The new price is effective June 1 and will continue to Sept. 1; differentials for sheet, rod and wire increased by about 12 $\frac{1}{2}$ %; differentials for quantity and grade for alloys will remain as approved by the board on Mar. 3 last.

Antimony—The Government was in the market for 250 tons for July. We quote spot at 12 $\frac{1}{2}$ @12 $\frac{3}{4}$ c. We quote futures at 11 $\frac{1}{2}$ c., c.i.f., in bond.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at \$3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted at \$1.50 per lb., unchanged.

Nickel—Market quotation is 40@45c. per pound.

Quicksilver—Quiet at \$115@120 for California virgin. San Francisco reports, by telegraph, \$113, steady.

Gold, Silver and Platinum

Silver—No new features are apparent in the silver market. Shipments abroad for the past week to England and France are reported at 1,200,000 ounces.

Platinum, Palladium and Iridium—Prices fixed at \$105, \$135 and \$175, respectively.

Ore Markets

Joplin, Mo., June 1—Blende, per ton, high, \$77.10; basis 60% Zn, premium, \$75; class B, \$55; prime Western, \$45@43; calamine, per ton, basis 40% Zn, \$35@30. Average selling prices: Blende, \$58.20; calamine, \$23.83; all zinc ores, \$57.12 per ton.

Lead, high, \$89.90; basis 80% Pb, \$86@84; average selling price, all grades of lead, \$83.98 per ton.

Shipments the week: Blende, 8620; calamine, 399; lead, 1522 tons. Value, all ores the week, \$643,980.

Producers have taken action to prevent the further increase of production of premium grades of ore, and the allotment was advanced the last week to 47%, against 45% the two previous weeks. The heavy buying of last week was followed this week by a return to usual purchases, but in lowering the price \$2, several buyers went short on orders.

Platteville, Wis., June 1—Blende, basis 60% Zn, highest price reported paid for premium grade under new schedule was \$70.25 per ton; high lead-zinc product sold down to \$45 per ton base. Lead ore, basis 80% Pb, \$80 per ton. Shipments reported for the week were 2819 tons of blende and 1044 tons sulphur ore. No galena. For the year to date the totals are: 55,280 tons blende, 2879 tons galena and 23,866 tons sulphur ore. During the week 2726 tons of blende was shipped to separating plants.

Chrome Ore—Important producers have established a schedule on the basis of \$1.30 per unit for 40% ore, with variations of 2 $\frac{1}{2}$ c. up or down. However, business is reported to have been done at \$1.50 per unit, with variations of 5c. up and down. These quotations are f.o.b., shipping points in California and Oregon.

Manganese Ore—The price has been fixed by agreement between the War Industries Board and the American Iron and Steel Institute, as reported elsewhere in this paper.

Molybdenum Ore—Quoted nominally at \$1.25 per lb. of molybdenum sulphide in ore of 90% grade, but it seems to be very difficult for anybody to sell this ore.

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. Domestic pyrite is selling at prices ranging from 25 to 30c. per unit, f.o.b. mine.

Tungsten Ore—Unchanged at \$24 for scheelite, and \$19@24 for wolframite.

Iron Trade Review

PITTSBURGH—June 4

There is no change in the principles upon which pig iron and steel are distributed. All furnaces and mills are provided with information as to the sequence in which material should be shipped, the more important war material first. In nearly all cases the supplies available are insufficient to carry the distribution to the end of the list, but beyond the present list lie many items of commercial consumption that involve helping the war indirectly, though clearly. There is little visible prospect that any of the less essential commercial industries will obtain material for a long time. The system of distribution is the same that has been in force for some time and is in harmony with the pledges given by the manufacturers five or six weeks ago, that they would be 100% efficient in supplying material to help win the war.

Some producers are taking no new orders except those placed or recommended by the Government. Others are booking tonnages from their regular customers in regular

course, but with the distinct understanding that there is absolutely no delivery promise involved, however distant.

The joint committee of the War Industries Board and the industry appointed May 17 to study the actual requirements, month by month, of the war activities and the prospective supplies, has furnished no information as to the progress of its work. Its report will be made to the board, and it was the original expectation that this report would furnish a basis on which the board might determine whether it would formally take over the distribution of commercial steel—i. e., the steel it does not now distribute—but there is practically no such steel now.

The freight rate advances that become effective June 25 will add about \$1.25 per ton to the cost of making pig iron and close to \$2 a net ton to the cost of making the average finished-steel product. The advance affects producers only on their raw and intermediate products, as on material sold the buyer pays the freight. This increase in cost, together with that caused by the 15% wage advance in April, will be urged as an offset to the War Industry Board's desire for reduced prices after June 30. At the last settlement of prices serious discussion of reductions was postponed because of the exceptionally high costs the furnaces and mills had had in the first two months of the year by reason of curtailment in output due to traffic conditions. Now the large companies at least are making remarkable profits.

Pig Iron—There remain a few idle furnaces, but those in operation are well supplied with coke in nearly every instance and are making maximum tonnage, the country's output being at the rate of fully 42,000,000 tons a year. The moderate increase in coke supplies of the last three months have been accompanied by a much greater increase in pig-iron production, because the quality of coke is better and the furnaces work much more efficiently when operating steadily. The market remains quotable at the set maxima: Bessemer, \$35.20; basic, \$32; No. 2 foundry, \$33; malleable, \$33.50; forge, \$32, all f.o.b. furnace. Freight from the Valleys to Pittsburgh advanced from 95c. to \$1.10 May 22. The new rate, June 25, will probably be \$1.40, and there is a question whether the detached furnaces, which have hitherto had a lower rate to Pittsburgh than the Valleys had, will be allowed any lower rate. Messrs. W. P. Snyder & Co. announce the average prices ruling on sales in May of Valley iron at \$35.20 for Bessemer and \$32 for basic, these being the set prices. The change in freight rates makes an average of \$1 for the month, for ascertaining prices of Valley iron delivered Pittsburgh. The average quotation on Valley foundry iron in May was \$33.

Steel—Occasional odd lots of steel rejected under Government specifications, chiefly forging steel, are coming into the market, but there is nothing in ordinary soft steel, except as allocated by the Government. The set prices remain: Billets, \$47.50; small billets, \$51; sheet bars, \$51; slabs, \$50; rods, \$57.

Ferroalloys

Ferromanganese—Inquiry is light. Sellers are firm at \$250, delivered, for 70%, but it is not certain that the \$4 unit price for higher manganese content is always observed strictly. Spiegeleisen is \$70, furnace, for 16 to 18%, and can hardly be had, even for July shipment.

Coke

Connellsville—Production in the region continues to run at about 240,000 tons a week, with car supplies usually adequate, but with some difficulty as to labor, the men not putting in full time. Slightly more coke is appearing in the open market, but only as foundry grade, as the operators always have 72-hour coke, drawn Monday or Tuesday, and can get \$1 a ton more for it from foundries than from furnaces. There are few foundry coke contracts running, so there is a good demand for all the spot lots offered. Coke screened from old dumps is moving at the rate of many carloads a day, and is bringing as high as \$6.50. The market remains quotable at the set prices: Furnace, \$6; foundry, 72-hour selected, \$7; crushed, over 1-in., \$7.30, per net ton at ovens. Coke freights, per ton, 2000 lbs., advance 15c. June 25 if the existing rate is under 50c.; 25c. on 50c. to 99c., 40c. on \$1 to \$1.99, 60c. on \$2 to \$2.99 and 75c. on \$3 and higher. This will make rates from the Connellsville region as follows: Pittsburgh, \$1.15; Wheeling and Valleys, \$1.75; Cleveland, \$2.15; Erie, \$2.20; Toledo and Buffalo, \$2.60; Chicago, \$3.25.

STOCK QUOTATIONS

N. Y. EXCH.†	June 4	BOSTON EXCH.*	June 4
Alaska Gold M.	11	Adventure	7 1/2
Alaska Juneau	1	Ahmeek	75
Am. Sm. & Ref. com.	75 1/4	Algomah	30
Am. Sm. & Ref. pf.	104	Aloues	49
Am. Sm. Sec. pt., A	88	Aris. Com. cfs.	13 1/2
Am. Zinc	16 1/2	Arnold	20
Am. Zinc, pf.	46	Bonanza	15
Anaconda	63 1/2	Butte-Balaskiva	25
Batopilas Min.	1	Calumet & Aris.	70
Bethlehem Steel	84	Calumet & Hecla	44 1/2
Bethlehem Steel, pf.	88 1/2	Centennial	12 1/2
Butte & Superior	21	Copper Range	44 1/2
Butte Cop. & Zinc	9	Daly West	1
Cerro de Pasco	32	Davis-Daly	5 1/2
Chile Cop.	15	East Butte	9 1/2
Chino	42	Franklin	4 1/2
Colo. Fuel & Iron	48	Granby	74
Crucible Steel	64	Hancock	7 1/2
Crucible Steel, pf.	91 1/2	Hedley	12 1/2
Dome Mines	7	Helvetia	20
Federal M. & S.	31	Indiana	1
Federal M. & S. pf.	31	Ile Royale	23 1/2
Great Nor. ore cfs.	32	Keweenaw	1 1/2
Greene Cananea	40 1/2	Lake	6
Gulf States Steel	86	La Salle	2 1/2
Homestake	65	Mason Valley	4
Inspiration Con.	50	Mass	5
International Nickel	52	Maxflow	2
Kennecott	32	Michigan	1
Lackawanna Steel	85	Mohawk	63
Mexican Petrol.	93 1/2	New Arcadian	1 1/2
Miami Copper	27 1/2	New Idria	14 1/2
Nat'l Lead, com.	57	North Butte	15 1/2
National Lead, pf.	85 1/2	North Lake	60
Nev. Consol.	20	Old Dominion	40
Ontario Min.	11 1/2	Osceola	51
Ray Con.	25	Quincy	73
Republic & S. com.	86	Santa Fe	49
Republic & S. pf.	99 1/2	Seneca	9 1/2
Sloss-Sheffield	67 1/2	Shannon	4
Tennessee C. & C.	18 1/2	Shattuck-Aris.	16
U. S. Steel, com.	100	So. Lake	1 1/2
U. S. Steel, pf.	1 1/2	So. Utah	12 1/2
Utah Copper	79 1/2	Superior	4 1/2
Va. Iron C. & C.	72	Superior & Bos.	2
		Trinity	3
		Tuolumne	96
		U. S. Smelting	41
		U. S. Smelt'g. pf.	43 1/2
		Utah Con.	10
		Utah Metal	1
		Victoria	2
		Winona	1
		Wolverine	27
		Wyandot	50

N. Y. CURB†

June 4	
Big Ledge	1 1/2
Butte & N. Y.	1
Butte Detroit	1
Caledonia	39 1/2
Calumet & Jerome	39
Can. Cop. Corp.	1 1/2
Carlisle	12
Cashboy	07
Con. Ariz. Sm.	1 1/2
Con. Coppermines	6
Con. Nev.-Utah	1 1/2
Emma Con.	21 1/2
First Nat. Cop.	1 1/2
Goldfield Con.	25
Goldfield Merger	02 1/2
Greenmaster	4
Hecla Min.	14
Howe Sound	14 1/2
Jerome Verde	1 1/2
Kerr Lake	5 7/8
Louisiana	30
Magma	25
Marsh	04
McKinley-Dar-Sa.	40
Milford	11
Mohican	06
Mother Lode	47
N. Y. Bond	112 1/2
Nipissing Mines	18 50
Nixon Nevada	61
Ohio Cop.	4
Rawley	42 1/2
Ray Hercules	1 1/2
Richmond	45
Rochester Mines	15
St. Joseph Lead	15
Standard S. L.	20
Stewart	20 1/2
Success	09
Tonopah	21
Tonopah Ex.	1 1/2
Tribulation	25
Troy Arizona	16
United Cop.	1 1/2
United Verde Ext.	38 1/2
United Zinc	1 1/2
Utica Mines	08

SAN FRAN.*

June 4	
Alta	02
Andes	06
Best & Belcher	01
Caledonia	05
Challenge Con.	03
Confidence	04
Con. Virginia	33
Gould & Curry	02
Hale & Norcross	02
Jacket-Cr. Pt.	06
Mexican	45
Occidental	60
Ophir	06
Overman	01
Savage	03
Sierra Nevada	14
Union Con.	68
Utah Con.	3
Belmont	00
Jim Butler	69
MacNamara	18
Midway	06
Mont.-Tonopah	12
North Star	11
Rescue Eula	07
La Rose	81
Atlanta	05
Booth	03
Oomb. Frac.	102
Florence	10
Jumbo Extension	09
Keweenaw	16
Nevada Hills	03
Nevada Packard	24
Round Mountain	25
Silver Pick	04
White Caps	37
Big Jim	75
United Eastern	350

STOCK QUOTATIONS—Continued

COLO. SPRINGS June 4	LONDON	Apr. 15	
Cresson Con.	4.56 1/2	Burma Corp.	£4 0s 0d
Doctor Jack Pot.	03 1/2	Cam & Motor.	0 11 0
Elkton Con.	04	Camp Bird	0 7 9
El Paso	12	El Oro	0 8 6
Gold Sovereign	1.02	Eperanza	0 8 6
Golden Cycle	1.68 1/2	Mexican Mines	5 5 0
Granite	20	Min. Corp. Can.	0 16 3
Isabella	04 1/2	Nechl. pf.	0 10 6
Mary McKinney	05	Oroville	0 17 9
Portland	86	St. John del Rey	0 16 0
United Gold M.	14	Santa Gert'd Id.	0 12 9
Vindicator	31	Tomboy	0 17 3

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

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	88.082	27.597	36.410	43.620
Apr.	64.415	73.875	85.346	30.662	36.963	44.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	81.060	39.065	41.110	48.875
July	62.940	79.010	81.060	40.110	41.110	48.875
Aug.	66.083	85.407	81.060	41.110	41.110	48.875
Sept.	68.515	100.740	81.060	42.324	44.324	48.875
Oct.	67.855	87.332	81.060	42.324	44.324	48.875
Nov.	71.604	85.891	81.060	43.584	45.584	48.875
Dec.	75.765	85.960	81.060	43.584	45.584	48.875
Year	65.661	81.417	81.060	31.315	40.851	48.875

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

Copper	New York		London	
	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000
Feb.	31.750	23.500	137.895	110.000
Mar.	31.481	23.500	136.750	110.000
Apr.	27.935	23.500	133.842	110.000
May	28.788	23.500	130.000	110.000
June	29.962	23.500	130.000	110.000
July	26.620	23.500	128.409	110.000
Aug.	25.380	23.500	122.391	110.000
Sept.	25.073	23.500	117.500	110.000
Oct.	23.500	23.500	110.000	110.000
Nov.	23.500	23.500	110.000	110.000
Dec.	23.500	23.500	110.000	110.000
Year	27.180	23.500	124.892	110.000

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293.227
February	51.420	92.000	198.974	311.525
March	62.940	94.388	207.443	318.875
April	65.910	95.910	220.171	329.905
May	63.175	94.388	215.146	364.217
June	62.053	94.388	242.083	364.217
July	62.570	94.388	242.181	364.217
August	62.681	94.388	243.978	364.217
September	61.542	94.388	244.038	364.217
October	61.851	94.388	247.467	364.217
November	74.740	94.388	298.556	364.217
December	87.120	94.388	298.556	364.217
Av. year	61.802	94.388	237.563	364.217

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	6.772	9.158	6.701	30.500	29.50
May	10.207	6.818	10.202	6.704	30.500	29.50
June	11.171	6.818	11.123	6.704	30.500	29.50
July	10.710	6.818	10.644	6.704	30.500	29.50
August	10.598	6.818	10.518	6.704	30.500	29.50
September	8.680	6.818	8.611	6.704	30.500	29.50
October	6.710	6.818	6.650	6.704	30.500	29.50
November	6.249	6.818	6.187	6.704	30.500	29.50
December	6.375	6.818	6.312	6.704	30.500	29.50
Year	8.787	6.818	8.721	6.704	30.500	29.50

Sptelcr	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.800	9.289	6.711	54.632	54.000
May	9.362	7.314	9.192	7.114	54.000	54.000
June	9.371	7.314	9.201	7.114	54.000	54.000
July	8.643	7.314	8.473	7.114	54.000	54.000
August	8.360	7.314	8.190	7.114	54.000	54.000
September	8.136	7.314	7.966	7.114	54.000	54.000
October	7.983	7.314	7.813	7.114	54.000	54.000
November	7.847	7.314	7.672	7.114	54.000	54.000
December	7.685	7.314	7.510	7.114	54.000	54.000
Year	8.901	7.314	8.813	7.114	52.413	54.000

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

Pig Iron, Pgh.	Bessemer†		Basic†		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	\$35.95	\$37.25	\$30.95	\$33.95	\$30.95	\$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	33.49	33.95	35.91	33.95
April	42.23	36.15	38.04	32.95	40.06	33.95
May						

Current Prices—Materials and Supplies

IRON AND STEEL.

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

	Large Mill Lots Pittsburgh	St. Louis	Chi-cago	San Fran-cisco	(New York) Cur-rent	(New York) One Yr. Ago
Blue Annealed						
No. 10	4.25	5.52	5.45	6.25	5.45	6.80
No. 12	5.35	6.97	6.80	7.70	6.80	8.50
No. 14	4.35	5.62	5.55	6.35	5.50	6.90
Black						
Nos. 18 and 20	4.80	6.32	6.25	7.15	6.25	7.30
Nos. 22 and 24	4.85	6.37	6.30	7.20	6.30	7.35
No. 26	4.90	6.42	6.35	7.25	6.44	7.40
No. 28	5.00	6.52	6.45	7.35	6.45	7.50
Galvanized						
No. 10	5.25	6.97	6.80	7.70	6.70	8.45
No. 12	5.35	6.97	6.80	7.70	6.80	8.50
No. 14	5.35	6.97	6.80	7.70	6.80	8.55
Nos. 18 and 20	5.65	7.17	7.10	8.00	7.10	8.85
Nos. 22 and 24	5.80	7.32	7.25	8.15	7.25	9.05
No. 26	5.95	7.40	7.40	8.30	7.40	9.20
No. 28	6.25	7.77	7.70	8.60	7.70	9.50

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh		Chicago	
	Cur-rent	One Year Ago	Cur-rent	One Year Ago
Standard bessemer rails.	63	38.00	63	38.00
Standard openhearth rails	65	40.00	65	40.00
Light rails, 8 to 10 lb.	*3.135 (100 lb.)	58.00	*3.135 (100 lb.)	53.00
Light rails, 12 to 14 lb.	*3.09 (100 lb.)	57.00	*3.09 (100 lb.)	54.00
Light rails, 25 to 45 lb.	*3.00 (100 lb.)	53.00	*3.00 (100 lb.)	52.00

*Government price per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh		Chicago		San Fran-cisco
	Current	One Year Ago	Chicago	St. Louis	
Standard railroad spikes, ½ in. and larger	\$3.90	\$3.85	\$4.50	\$5.30	\$6.45
Track bolts	4.90	5.00	5.50	Premium	7.75
Standard section angle bars	3.25	3.50	4.50	Premium	4.90

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill Pitts-burgh	(New York) Cur-rent	(New York) One Yr. Ago	St. Louis	Chi-cago	San Fran-cisco	Dallas
Beams, 3 to 15 in.	\$3.00	\$4.195	\$3.95	\$4.27	\$4.20	\$4.90	\$5.50
Channels, 3 to 15 in.	3.00	4.195	3.95	4.27	4.75	4.90	5.50
Angles, 3 to 6 in. ¼ in. thick	3.00	4.195	3.95	4.27	4.75	4.90	5.50
Tees, 3 in. and larger	3.00	4.195	3.95	4.27	4.75	4.90	5.50
Plates	3.25	4.445	4.75-5	4.52	5.00	5.25	6.00

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

	Current	One Month Ago	One Year Ago
	\$4.5	\$3.10	\$3.10

RIVETS—The following quotations are per 100 lb.:

	STRUCTURAL		Warehouse			
	Mill Pitts-burgh	(New York) Cur-rent	Chi-cago	St. Louis	San Fran-cisco	Dallas
¾ in. and larger.	\$4.65	\$6.09 ½	\$6.50	\$5.55	\$6.90	\$8.00
CONE HEAD BOILER						
¾ in. and larger.	4.75	6.19 ½	6.50	5.60	7.00	8.00
¾ and 1 ¼	4.90	6.34 ½	6.75	5.75	7.15	8.15
½ and 1 ¼	5.25	6.69 ½	7.10	6.05	7.50	8.50

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

Galvanized iron rigging	New York and St. Louis List + 20%
Galvanized cast steel rigging	Net List
Bright plow steel	30%
Bright cast steel	17 ½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pitts-burgh	Cin-cinnati	Chicago	St. Louis	Denver	Birm-ingham
Straight	\$5.25	\$6.50	\$6.50	\$6.25	\$7.50	\$6.25
Assorted	5.40	6.50	7.00	6.40	7.75	6.50

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:
Iron bars 3.5c. Steel bars 2.9c.

COAL BIT STEEL—Warehouse price per pound is as follows:

	New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
	\$0.12	\$0.16 ½	\$0.18	\$0.18	\$0.17	\$0.12

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham
Solid	15c.	14c.	15c.
Hollow	24c.	25c.	...

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

		STEEL		IRON	
Inches		Black	Galvanized	Inches	Black Galvanized
¾, 1 and 1 ½		44%	17%	¾ to 1 ½	33%
1 ½		48%	33 ½%		17%
2 to 3		51%	37 ½%		
LAP WELD					
2		44%	31 ½%	2	26%
2 ½ to 6		47%	34 ½%	2 ½ to 4	28%
				4 ½ to 6	15%
BUTT WELD. EXTRA STRONG PLAIN ENDS					
¾, 1 and 1 ½		40%	22 ½%	¾ to 1 ½	33%
1 ½		45%	32 ½%		18%
2 to 3		49%	36 ½%		
LAP WELD. EXTRA STRONG PLAIN ENDS					
2		42%	30 ½%	2	27%
2 ½ to 4		45%	33 ½%	2 ½ to 4	29%
4 ½ to 6		44%	32 ½%	4 ½ to 6	28%

Note—National Tube Co. quotes on basing card dated Apr. 1.

From warehouses at the places named the following discounts hold for steel pipe:

	New York	Chicago	St. Louis
¾ to 3 in. butt welded	38%	41.9%	40.1%
3 ½ to 6 in. lap welded	18%	37.7%	36.1%
Galvanized			
¾ to 3 in. butt welded	22%	26.9%	25.1%
3 ½ to 6 in. lap welded	List	23.9%	22.1%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 15 and 5%.

MISCELLANEOUS

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Chicago	Denver
			In Bbl. In Car-Lots load Lots
Pure steam-distilled pine oil	\$0.51 ½	\$0.50	\$0.30 \$0.27
Pure destructively distilled pine oil	.48	.48	.30
Pine tar oil	.36	.42	.24 ½ .19
Crude turpentine	.38	.50	.44 .38
Hardwood creosote	.19 ½ *	.....	.34 ½ .31

*F.o.b. Cadillac, Mich.

SODIUM CYANIDE—New York price is 37c. per lb.; Denver, 44c.; in Chicago, 45c.; in St. Louis, 40c.

SODIUM SULPHIDE—In New York the price per pound is 4c. to 4 ¼ c. for concentrated, 2 ¼ c. to 2 ½ c. for crystals. The Denver price for crystals is quoted at 9c.; the St. Louis price, 5c. for concentrated; the Chicago price is 4 ½ c. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—New York price is 18c. per lb. in 1600-lb. barrel; Chicago, 18c.; in Denver, 13c. f.o.b. Pueblo; in St. Louis, 20c.

ALUMINUM DUST—Chicago price is \$1 per lb.

CALCIUM CARBIDE—Price f.o.b. cars at warehouse points east of Mississippi River (except in Alabama, Georgia and Florida) is \$97.50 for Cameo, \$102.50 for Union miners' carbide. In territory between Mississippi River and the Rockies and in Alabama, Georgia and Florida, add \$5; west of Rockies, add \$10 to \$15.

LINOLEUM—No orders being taken, owing to shortage of manufacturing materials.

HOSE—

	Fire	50-Ft. Lengths
Underwriters' 2 ½-in.	75c. per ft.
Common, 2 ½-in.	33 ¾%

	First Grade	Second Grade	Third Grade
¾ in. per ft.	\$0.60	\$0.35	\$0.30

Steam—Discounts from list
First grade.... 25% Second grade.... 30% Third grade.... 40%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:
Competition 40% Best grade 15%
Standard 30%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	40%	35%
St. Louis	45%	40%
Chicago	30-10%	40-5%
Birmingham	35%	40%
Denver	35%	30%

RAWHIDE LACING—40%.

MANILA ROPE—For rope smaller than 5-in. the price is 1/2 to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: 5-in., 8 ft.; 3-in., 6; 2-in., 4 1/2; 1-in., 3 1/2; for 5-in. and larger, in 1200-ft. coils: 1 1/2-in., 2 ft. 10 in.; 1 1/4-in., 2 ft. 4 in. Following is price per pound

Boston	\$0.34 1/2	Denver	\$0.35 1/2
New York	.35	Kansas City	.34
Cincinnati	.33 1/2	San Francisco	.32
Chicago	.33	Seattle	.33 1/2
St. Paul	.34		

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	\$0.90
Asbestos for high-pressure steam	1.60
Duck and rubber for piston packing	1.00
Flax, regular	.90
Flax, waterproofed	1.10
Compressed asbestos sheet	1.00
Wire insertion asbestos sheet	1.20
Rubber sheet	.60
Rubber sheet, wire insertion	.90
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.25
Asbestos packing, twisted or braided, and graphited, for valve stems and stuffing boxes	1.10
Asbestos wick, 1/2- and 1-lb. balls	.70

REFRACTORIES—Following prices are f.o.b. works, Pittsburgh:

Chrome brick	net ton	\$175.00
Chrome cement	net ton	75.00
Clay brick, 1st quality fireclay	per 1000	50.00—55.00
Clay brick, 2nd quality	per 1000	35.00—40.00
Magnesite, raw	ton	30.00—35.00
Magnesite, calcined	ton	32.00—35.00
Magnesite, dead burned	ton	32.00—35.00
Magnesite brick, 9 x 4 1/2 x 2 1/2 in.	net ton	110.00—125.00
Silica brick	per 1000	50.00—60.00

Standard size fire brick, 9 x 4 1/2 x 2 1/2 in. The second quality is \$4 to \$5 cheaper per 1000.
St. Louis—High grade, \$55; St. Louis grade, \$40.
Birmingham—Fire clay, \$55-60; silica, \$55-60.
Chicago—Second quality, \$25 per ton.
Denver—Silica, \$35 per 1000.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 in. by 8 Ft. 6 in.	6 In. x 8 In. by 8 Ft.
St. Louis	No. 1 White Oak	\$0.95	\$0.71
Chicago	Plain	1.30	1.15
Chicago	Crescoted	1.65	1.45
San Francisco	Douglas Fir—Green	1.35	.96

GREASES—Prices are as follows in the following cities in cents per pound for barrel lots:

	Cincinnati	Chicago	St. Louis	Birmingham	Denver
Cup	7	5 1/4	6.9	7 1/2	10 1/2
Fiber or sponge	8	6	7.4	7 1/2	15
Transmission	7	6	7.4	7 1/2	13
Axle	4 1/2	4	3.6	3	5
Gear	4 1/2	4 1/2	7.0	7 1/2	6
Car journal	22 (gal.)	3 1/2	4.5	3	6

COTTON WASTE—The following prices are in cents per pound:

	New York	Cleveland	Chicago
	Current	One Year Ago	Current
White	11.00 to 13.00	12.00	16.50
Colored mixed	8.50 to 12.00	10.00	13.50
			12.00 to 16.50
			11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	Cleveland	Chicago
	13 1/4 x 13 1/4	13 1/4 x 20 1/2
Cleveland	\$52.00	\$58.00
Chicago	48.00	50.00

LINSEED OIL—These prices are per gallon:

	New York	Cleveland	Chicago
	Current	Current	Current
Raw per barrel	\$1.58	\$1.31	\$1.65
5-gal. cans	1.68	1.41	1.80
	One Year Ago	One Year Ago	One Year Ago

*Nominal.

WHITE AND RED LEAD in 500-lb. lots sell as follows in cents per pound:

	Red	White
	Current	Current
	1 Year Ago	1 Yr. Ago
	Dry	Dry
	In Oil	In Oil
25 and 50-lb. kegs	11.70	12.15
12 1/2-lb. keg	11.92	12.37
100-lb. keg	11.47 1/2	11.92
5-lb. cans	13.27	13.25
1-lb. cans	14.17	13.25

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
	Current	Current	Current
	One Year Ago	One Year Ago	One Year Ago
Hot pressed square	\$1.05	\$0.50	\$1.05
Hot pressed hexagon	.85	.50	.85
Cold punched square	1.00	.50	1.00
Cold punched hexagon	1.00	.50	1.00

Semifinished nuts sell at the following discounts from list price:

	New York	Chicago
	Current	Current
	One Year Ago	One Year Ago
New York	40%	50%
Chicago	50%	45%
Cleveland	60%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
% by 4 in. and smaller	30—5%	40—10%	40%
Larger and longer up to 1 in. by 30 in.	30%	35—5	30—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York \$3.00 Cleveland \$3.00 Chicago \$3.00

For cast-iron washers the base price per 100 lb. is as follows:
New York \$3.50 Cleveland \$4.00 Chicago \$3.50

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing	40%	Gelatin	80%	Black Powder*
	20%		60%		
New York	.....	\$0.27 1/2	\$0.34 1/2	.41 1/2	\$2.40
Boston	\$0.24 1/4	.27 1/4	.34 1/4	.41 1/4	.....
Kansas City	.20	.26 1/2	.33 1/2	.43 1/2	2.45
Seattle	.17 1/2	.23 1/2	.31 1/2	.41 1/2	.....
Chicago	.18 1/2	.22 1/2	.33	.43	.....
St. Paul	.19	.23	.28	.43 1/2	2.45
St. Louis	.20	.24	.29	.43 1/2	2.45
Denver	.18	.25 1/2	.32 1/2	.42 1/2	.....
Dallas	.23	.30 1/2	.37 1/2	.47 1/2	.....
Los Angeles	.21	.28	.36	.....	.....
San Francisco	.17 1/4 †	.23 1/4 †	.30 1/4 †	.40 1/4 †	.....
Atlanta	.18 1/2	.22 1/2	.28 1/2	.....	2.35

*Per keg. †In carload lots.

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f.o.b. New York or Chicago:

	Carload Lots	Less Than Carload Lots
Tar felt (14 lb. per square of 100 sq. ft.)	64	65
Tar pitch (in 400-lb. bbl.)	20	21
Asphalt pitch (in barrels)	35	40
Asphalt felt	72.50	77.20

PREPARED ROOFINGS—Standard grade rubbered surface complete with nails and cement costs per square as follows in New York and Chicago:

	1-Ply	2-Ply	3-Ply
	c.l.	l.c.l.	c.l.
No. 1 grade	\$1.30	\$1.55	\$1.90
No. 2 grade	1.15	1.30	1.75

Asbestos asphalt-saturated felt (14 lb. per square) costs \$5.35 per 100 sq. ft.

Slate-surfaced roofing (red and green) in rolls of 108 sq. ft. costs \$1.95 per roll in carload lots and \$2.20 for smaller quantities.
Shingles, red and green slate finish, cost \$5.25 per square in carloads, \$5.50 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4x12x12	8x12x12	12x12x12
St. Paul	.056	.11	.162
Kansas City	.075	.14	.20
Denver	.11	.20	.30
Seattle	.07	.11	.16
Atlanta	.13	.19	.....
Los Angeles	.0633	.1071	.1966

LUMBER—Price per M in carload lots:

	8 x 8-in. x 20 Ft. and Under	12 x 12-in. 20 Ft. and Under
	Y.P.	Y.P.
	Fir	Fir
	Hemlock	Hemlock
	Spruce	Spruce
Boston	.....	.....
Cincinnati	\$39.00	\$43.00
Kansas City	34.50	39.50
Seattle	24.50	24.50
St. Paul	51.50	44.00
Denver	35.00	32.00
Atlanta	25.00	30.00

1-In. Rough, 10 In. x 16 Ft. and Under

	Y.P.	Fir	Hemlock
Boston	.....	.....	.....
Cincinnati	\$45.00	.....	\$41.00
Kansas City	47.25	53.00	\$43.00
Seattle	24.50	24.50	24.50
St. Paul	57.00	39.00	38.50
Denver	35.00	32.00	32.00
Atlanta	36.00	.....	25.00

NAILS—The following quotations are per keg from warehouse:

	Mill	St. Louis	Dallas	Chicago	San Francisco
	Pittsburgh	.....	.....	.....	.....
Wire	\$3.50	\$4.30	\$4.75	\$4.25	\$4.80
Cut	4.00	5.25	.....	4.40	6.40

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Current	One Month Ago	One Year Ago
New York	\$2.59	\$2.59	\$2.40
Jersey City	2.50	2.50	2.16
Boston	2.81	2.81	2.20
Chicago	2.36	2.36	2.16
Pittsburgh	2.46	2.46	2.16
Cleveland	2.59	2.59	2.29
Denver	3.39	3.40	2.89

LIME—Warehouse prices:

	Hydrated per Ton	Lump per 300-Lb. Barrel
	Finished	Common
New York	\$16.50	\$13.50
Kansas City	21.20	19.20
Chicago	18.00	17.50
St. Louis	14.00	.....
Boston	20.00	17.00
Dallas	16.50	.....
San Francisco	17.50	.....
St. Paul	17.00	14.00
Atlanta	.....	19.00
Cincinnati	12.43	12.18

*Per 180-lb. barrel. †200 lb. barrels.
Note—Refund of 10c. per bag, amounting to \$2 per ton.