VOL. X JANUARY, 1920 No. 1

# COLORADO SCHOOL OF MINES MAGAZINE

THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, PUBLISHERS, GOLDEN, COLO.

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## INDEX

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C. ERB WUENSCH, '14, EDITOR.

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## CONTENTS

# MANGANESE

## Its Ores, Metallurgy, Uses and Production Statistics

By C. Erb Wuensch, '14.

### Status of Manganese Mining in United States.

Previous to the war, manganese mining never was a very important industry in the United States. Because of the small size of our high-grade deposits and their remoteness from markets, and because of the difficulty in concentrating our large deposits of low-grade ores, there was no incentive to attempt to compete with the high-grade ores from foreign countries, which occur in large deposits and can be imported cheaply. However, during the war, because of the cessation of imports to the United States from India and Russia, the inadequate shipping facilities to supply us with sufficient Brazilian and Cuban ores and the increased demand for these ores for making ferro-manganese, great impetus was given to the development of our own resources. The higher grade ores brought three to five times their pre-war price, and low-grade ores, which previously could not have been marketed at any price, were accepted. The result was that the mining of manganese became one of the first importance.

From a production of only 2,635 tons of high-grade* ore, and 198,463 tons of low-grade† ore, in 1914, we increased our production in leaps and bounds until in 1918 we produced 304,366 tons of the former, and 1,503,552 tons of the latter; an amount sufficient to have satisfied all our war demands, even had importation of foreign ores ceased.

With the cessation of hostilities in Europe, the abnormal demand for manganese ores ceased. Almost instantly there was no more market for domestic ores. Many contracts were broken and the industry became demoralized. There were about 230,000 tons of high-grade ores in the stock piles at the various furnaces. This was more than ten months' supply. Although several companies are still operating on long-time contracts, it is interesting to note how, with the expiration of the contracts, their number is gradually decreasing.

The outlook is that before long the industry will return to about its pre-war status.

* More than 40% Mn.
† Less than 40% Mn.

### Most Important Manganese Ore-Minerals.

Pyrolusite ($MnO_2$) containing 63.2% Mn and Psilomelane ($MnO_2$, $H_2O + K_2O$ and BaO in varying amounts) containing from 45 to 60% Mn are the two principal manganese ore-minerals found in the United States. Other oxides are mined, but in insignificant quantities.

Rhodocrosite ($MnCO_3$) 47.5% Mn is also occasionally used, but it is seldom found in large quantities, except in Butte and Philipsburg, Montana, where, as a result of war-time demands, large supplies have been developed.

Franklinite (Fe Mn Zn) O $(Fe\ Mn)_2O_3$ containing from 10 to 20%. This is mined only at Franklin Furnace, New Jersey. It is used as a residuum from the zinc oxide plants to make spiegeleisen.

Manganese Wad, an impure mixture of manganese oxides in porous earthy material, and containing from 15% to 40% Mn is occasionally used for making paints.

### Classification of Manganese Ores.

The ores are classified as follows:

Class I Manganese Ores.
Class II Manganiferous-Iron Ores.
Class III Manganiferous-Silver Ores.
Class IV Manganiferous - Zinc Residium.

**Class I**—To this class belong the high-grade manganese and manganese dioxide ores. Those containing considerable quantities of iron are used for making Ferro-Manganese alloys. Those **free from iron** and containing from 80 to 90% $MnO_2$ are in great demand for Leclanche Storage Battery Cells and Dry Cells. If this class of ore should contain an excess of silica (more than 20%) so as to make it undesirable for the above purposes, it can be used for decolorizing glass.

The very pure dioxide ores, free from carbonates, sulphides, iron oxides and silicates are also in demand for the manufacture of Chlorine, Bleaching Lime and Bromine.

This class of ore is also used for manufacturing oxygen, disinfectants, potassium permanganate, coloring for glass, pottery and bricks, paints, as a dryer in plants, calico-printing, dyes and explosives. The lower oxides of manganese cannot be used for any of these purposes,

the "available oxygen" of the dioxide minerals is the valuable constituent.

Psilomelane containing large amounts of baryte is very desirable for making "Manganese Green" paint.

**Class II**—To this class belong the manganiferous ores consisting of iron and manganese oxides in various proportions. Ferro-Manganese and Spiegeleisen are made from those ores which contain high and medium (more than 40% and preferable 50% Mn) and medium (15 to 40% Mn) amounts of manganese, respectively. Those containing 5 to 15% manganese are not used for either purpose, but just as an iron ore.* The manganese in this case is considered an impurity. This ore is slightly more refractory than iron free from manganese.

**Class III**—This class which is known as the Manganiferous-Silver ores, is found abundantly in the oxidized portions of many silver deposits in the Western United States. In these ores the iron content frequently predominates over the manganese. The manganese content varies from 10 to 40%.

In the unoxidized portions (in the sulphide zone), silver, lead, zinc and iron sulphides are often found in a gangue of quartz or calcite, or occasionally rhodocrosite and rhodonite. Gold is frequently found, but usually in subordinate amounts compared to silver.

This class of ore is again sub-classified as follows:

### First Sub-Class.

Ores with a high percentage of silver and lead are used for these metals only. They draw a higher price (average premium about $2.00 per ton), if the manganese and iron oxides are present in sufficient amounts to make the ore desirable for fluxing purposes.

### Second Sub-Class.

Ores low in silver and lead, but containing large amounts of iron and manganese are used for manufacturing spiegeleisen and ferro-manganese. In this class occasionally the manganese content is so low that the ore is used only for its iron content.

### Third Sub-Class.

Ores too low in silver and lead to be used directly as a source of these metals, and too low in iron and manganese to be used for the manufacture of spiegeleisen and ferro-manganese, are sent to the smelters to be used on account of the fluxing qualities of the contained iron and manganese oxides. The silver and lead will be recovered during the smelting in conjunction with the other lead-silver ores of higher grade; the iron and manganese passing off into the slag.

**Class IV**—The manganiferous-zinc residium resulting from the distillation of zinc oxide in treating the franklinite ore from Franklin Furnace, N. J., in the zinc oxide furnaces is used for the manufacture of spiegeleisen. This residue has an average value of about $2.50 in normal times.

### Notes on the Metallurgical Uses of Manganese Alloys.

Every process of steel metallurgy, in the common practices of the present day uses some form of ferro-alloy to produce the properties peculiar to the steel manufactured by that process. But by reason of a comparison of the tonnages produced by the use of the various ferro-alloys ferro-manganese is by far the most important.

Spiegeleisen is an alloy of iron and manganese containing between 10 to 20% manganese, less than 5% carbon, less than 1% silicon and the remainder iron. Occasionally in commerce ferro-manganese alloys containing up to 35% Mn are called spiegeleisen, but texturally they are ferro-manganese when they contain more than 20% manganese.

Ferro-manganese includes alloys containing from 20 to 80% or sometimes 90% manganese. An alloy containing more than 90% Mn is unstable under weathering conditions. Ferro-manganese should contain less than 7% carbon and less than 1.6% silicon. The commercial standard of ferro-manganese is the 80% manganese alloy. In both of these alloys phosphorous and sulphur may be present but should not exceed 0.1% in 20% Mn alloys and 0.22% in 80% Mn alloys.

Spiegeleisen is used in steel metallurgy when only small quantities of manganese are required. When larger quantities are necessary the addition of spiegeleisen would introduce an injuriously high amount of carbon, hence the ferro-manganese alloys containing a higher percentage of manganese and a proportionately lower percentage of carbon are used.

### Effects of Ferro-Manganese in Steels.

**First**—During the final blasts the molten iron, in the Bessemer converter, absorbs small amounts of oxygen from the blast, forming iron oxide, the presence of which makes the steel hard to forge. The manganese in ferro-manganese robs the iron oxide of its oxygen; the manganese oxide formed is insoluble in the steel and hence goes into the slag as a protosilicate.

* Although during the war ores containing as low as 10% Mn were utilized if the silica content was not too high.



The manganese also unites with the iron silicate composing the small particles of slag that are disseminated in the steel, and forms a double silicate of iron and manganese. This latter causes the disseminated particles of slag to coalesce, and thence rise to the surface and join the slag.

Manganese also combines with the nitrogen that is absorbed by the steel from the blast, and forms manganese nitrides. These are also largely carried into the slag.

The manganese, however, does not remove the last traces of oxygen, silicon or nitrogen. Various aluminum and titanium alloys have been used after the ferro-manganese to remove the last traces of these elements, but only in special cases is this practice followed because these aluminum and titanium alloys introduce other objectionable impurities.

**Second**—On account of the extensive oxidation in the Bessemer converter, all, or nearly all of the carbon is oxidized, leaving the metal in the form of wrought iron instead of steel. The ferro-manganese is added during the final melting to restore the requisite amount of carbon. This is known as "Recarburization".

**Third**—The manganese also neutralizes the deleterious effects of sulphur and phosphorous, by forming a manganese sulphide (MnS) and a manganese phosphide ($Mn_3P_2$), most of which go into the slag. All good steels, however, do contain some sulphur and phosphorous in these forms. The manganese also prevents the carbon in the steel from separating out as graphite and tends to increase the power of carbon to combine with the iron.

**Fourth**—Ferro-manganese is used in large amounts to manufacture manganese steels. The nature and uses of these will be described in the following sections.

### Properties of Manganese Steels.

Manganese steel, in its most serviceable form, contains about 13 or 14% manganese. This alloy possesses a combination of extreme hardness, tenacity and ductility that makes it extremely valuable for many purposes. Its use is somewhat limited, however, because of its extreme hardness. This makes it almost impossible to work it with machine tools and necessitates its being cast into forms, as near to the shape in which it is to be used, as is possible.

Manganese steel is not so liable to "honeycomb" as ordinary steel. It is very fluid and can be cast into thin sections, but cools more rapidly than ordinary steel and has a greater co-efficient of contraction.

Steel containing from 2.5 to 6% Mn is very brittle; above 7% Mn and up to 15% a very hard and strong alloy is produced. Steel containing 10% Mn forms the softest manganese-steel. At 22% another hard stage is reached, but it is inferior to the 5% stage.

Manganese-steel, although it has a large iron content, is practically non-magnetic. It retains no residual magnetism even after it has been subjected to strong magnetic fields.

### Uses.

Manganese steel is used for dredger pins, bucket lip-plates, teeth for steam shovels and other parts of excavating machinery; for ore-crushing machinery, such as roll-shells, stamp-shoes and crusher plates; for ore-chutes and screens; for elevator links; for agricultural implements, as plow-points, cultivator points, shovels, rakes, etc.; for wheels, tires and axles on railroad cars and mining cars; for railroad and street car rails on curves; for safes and for making munitions and armaments.

One of its most important uses, because of its hardness and non-magnetic property, is for cover plates and coil-shields in large electro-magnets.

### Miscellaneous Alloys in Which Manganese is Used.

Manganese is used in the manufacture of many quarternary steel alloys, such as manganese-nickle steel; manganese-chrome steel; manganese-silicon steel, etc. A quarternary steel contains two elements besides carbon and iron; those containing only one element besides carbon and iron are called ternary steels, manganese-chromium, and manganese nickel steels possess great hardness and withstand severe shocks. Manganese-silicon steels, containing less than 1% of these elements, is used for high-class springs.

Manganese is used in the manufacture of cupro-manganese, an alloy of manganese and copper. This is used in the manufacture of manganese bronzes, manganese brass, and manganese German silver.

It is also used in the manufacture of manganese-aluminum alloys, which are very hard and non-magnetic, and also for Heusler alloys composed of copper, manganese and aluminum which possess very unusual magnetic properties.

### Notes on the Metallurgy of Manganese.

The reason why a high silica content is objectionable in manganese ores is that the manganese unites with the silica in an acid slag and is lost. A very basic slag is hence necessary to reduce this slag loss. This means that some barren basic

flux must be added, which reduces the capacity of the furnace.

Manganese increases the fuel consumption in smelting iron ores. It requires 4,500 to 5,000 pounds of coke for each ton of 40 to 50% ferro-manganese. A blast temperature of 1,200°C is required. A higher blast of from 1,400 to 1,500°C reduces the silica content of the ferro-manganese, but it corrodes the furnace lining.

In general, in manganese smelting a 40% ferro-manganese produces an 8% manganese slag, and an 80% ferro-manganese results in a 10% manganese slag loss.

Rhodochrosite, manganese carbonate, mixed with manganese and iron oxides, coke and limestone produces the best grade of ferro-manganese alloys, but the manganese slag loss is much higher (15%).

Ferro-mangenese or spiegeleisen is usually added in solid form at the end of the converting period in the Bessemer converters. Experiments have shown that in this practice 20 to 35% manganese is lost by volatilization. The practice now is tending toward the use of ferro-manganese in liquid form. The ferro-manganese is melted in specially designed electric-furnaces. The practice is also toward the use of the higher ferro-manganese alloys rather than spiegeleisen since the chemical reactions are much more rapid, and hence less heat is consumed and volatilization losses are also minimized by their use. During the war, however, ferro-manganese became very scarce, and numerous experiments were made, and plant practice accordingly modified in order to use the lower-grade alloy, spiegeleisen, whenever possible.

The ferro-manganese alloys, as well as the other ferro-alloys with molybdenum, vanadium, tungsten, chrome, silicon, etc., are manufactured either in the electric furnace or by the aluminum reduction process. The electric furnace practice is to mix the carbon fluxes and mineral oxides, and to smelt by starting with arc heating and completing the smelting by resistance heating. In the aluminum reduction process powdered aluminum and manganese dioxide mixed in equal parts (called manganese thermite) are ignited by a cartridge of barium peroxide. This is mixed with the proper fluxes, iron and the mineral oxide of the metal whose alloy is to be formed. The ferro-alloy is formed in the lower part of the crucible and the slag above it.

### Roasting Manganese Carbonate (Rhodochrosite)

Attempts have been made to convert the high-grade carbonate ores, by calcination, into high-grade manganese dioxide ores of chemical grade. These bring a high price because of their "available oxygen content."

If $MnCO_3$ is heated (calcined) to 260°C in the presence of air mangano-manganic oxide ($Mn_3O_4$), the brownish-red colored and most stable manganese oxide is formed, according to the following reaction:

$$3MnCO_3 + O + \text{heat} = Mn_3O_4 + 3CO_2$$

If this oxide ($Mn_3O_4$), is treated with hydrochloric acid (HCl) the mangano manganic oxide is oxidized to manganese dioxide, thus:

$$Mn_3O_4 + 2HCl + O_2 + \text{heat} = Mn_3O_4 + Cl_2 + H_2O + O = 3MnO_2 + 2HCl.$$

The process is reversible. There is no literature on the costs or methods of calcining manganese carbonate. These will have to be determined by some experiments. The calcining costs should be lower than those for calcining magnesite, magnesium carbonate, because the critical dissociation temperature of manganese carbonate is only 260°C, whereas that of magnesium carbonate is 650°C. The factor to be determined is the cost of the hydrochloric acid treatment of the residue.

### Concentration of Manganese Ores.

Before the war, the only class of manganese ores that were concentrated (and these were the only ones produced in any quantity) were those in which the manganese occurs in nodules disseminated in residual clays associated with cherts. The ore was crushed and the adhering clay removed in log-washers. The material was then screened and jigged. It is very evident that this is a very wasteful and inefficient method, but in view of the fact that they had to compete with the foreign ores that are so rich as to require no concentration, nothing else could be expected.

The following summary* of the methods applicable to the concentration of manganese ores is taken from Bulletin 9, U. S. Bureau of Mines War Minerals Investigation Series, by Edmund Newton. These are all preliminary to the greater and final concentration of the desirable elements in the blast furnace from which the ferro-alloy is produced:

Simple Methods of Concentration:

(a) Selective mining.
(b) Hand picking.
(c) Jigging.
(d) Screening.

* For a full discussion of the problems involved in the concentration, the reader is referred to the original publication, or to an abstract by the author in Bull. Am. Inst. Min. Eng., No. 146, p. 379, Feb., 1919.



(e) Log washing.
(f) Water classification.
(g) Roughing table treatment.
(h) Slime table or vanner treatment.
(i) Pneumatic separation.
(j) Combination of two or more of the above.

Complex Methods:

(a) Magnetic separation:
1. Without preliminary thermal treatment.
2. With preliminary thermal treatment.

(b) Electrostatic separation.

(c) Hydrometallurgical processes:
1. Leaching with various acids. Precipitation by chemical substances.
2. Leaching with various acids. Precipitation by electrolysis.
3. Leaching with various acids. Evaporation of solution and heat treatment in rotary kiln.

(d) Preliminary Thermal Processes:
1. Drying, to remove hygroscopic moisture.
2. Calcining, to remove carbon dioxide or combined water.
3. Agglomerating fine concentrates to make them desirable for blast-furnace use.
4. Volatilizing manganese at high temperature in the presence of certain constituents which form readily volatile compounds.
5. Direct reduction of oxides by carbon, under temperature control. (Jones' Step-Process.)

(e) Miscellaneous Processes:
1. Flotation.
2. Use of heavy solutions.

Of the simple methods of concentration, in general, it might be said, that they will effect a benefication, but because of the tendency of manganese minerals toward sliming, very low recoveries are possible. On the average probably only 50% of the manganese is saved.

Relative to the complex methods: Magnetic and electrostatic separation produce good results on coarse and medium sized material, but it is impossible to treat the "fines" by these methods. Hence, the metallurgical recovery is also low. However, magnetic concentration has been productive of good results in the treatment of Rhodocrosite ores.

The objection to all methods of concentration is that it is difficult to subsequently smelt the finely crushed concentrates. The only way in which they can be made marketable is to mix them with coarse "run of mine" ore.

The reason for this is that manganese ores are smelted in blast or electric furnaces. The presence of an excessive amount of fines would obstruct the blast and cause a serious dust loss in either blast or electric furnaces. However, technically, there is no reason why reverberatory smelting could not be practiced just as has been done in the smelting of other metals, when it became necessary to substitute this type of furnace for the blast-furnace.

The hydrometallurgical processes work beautifully in theory; these ores can be satisfactorily leached, but the electrolysis is difficult. Invariably the deposit contains more pulverulent manganese dioxide than compact metallic manganese.

Drying, calcining or agglomerating fine concentrates is warranted under certain circumstances. Volatilization processes effect a concentration, but the concentrates are in a finely divided state and in such a chemical combination as to be impossible of commercial utilization.

The Jones' Step-Process and other processes of differential reduction by proper control of temperature offer considerable promise. In these processes the iron oxide is reduced to metallic form at a low temperature. It may be drawn off when molten and cast into "pigs" and the resulting slag and manganese-sinter treated at a higher temperature to form silico-manganese.

Flotation has not, to my knowledge, given good results. Even though it had, it would be open to the same objection as other methods of mechanical concentration; the finely divided concentrate would be difficult of subsequent utilization.

The use of heavy solutions is impractical because of the tendency that manganese minerals have of sliming. These slimes would act as colloids in the heavy solutions and remain in suspension.

### Production Statistics.

The following statistics relative to manganese ores and their principal products, ferro-manganese and speigeleisen may be of interest:

UNITED STATES PRODUCTION AND IMPORTS.
(Long Tons.)

| | MANGANESE ORES | | | FERROMANGANESE | | | SPEIGELEISE | |
|---|---|---|---|---|---|---|---|---|
| Year | Imports (b) | Production (b) | Production(c) | Imports | Av. Value Per Ton(a) | Production | Imports | Production |
| 1909..... | 212,765 | 1,544 | 843,689 | 88,934 | $38.19 | 82,209 | 16,921 | 142,[illegible] |
| 1910..... | 242,348 | 2,258 | 619,735 | 114,228 | 37.99 | 71,376 | 25,383 | 153,[illegible] |
| 1911..... | 176,852 | 2,457 | 522,357 | 80,263 | 37.56 | 74,482 | 20,970 | 110,[illegible] |
| 1912..... | 300,661 | 1,664 | 868,501 | 99,137 | 39.41 | 125,378 | 1,015 | 96,[illegible] |
| 1913..... | 345,090 | 4,408 | 672,146 | 128,070 | 44.37 | 119,496 | 77 | 110,[illegible] |
| 1914..... | 283,294 | 2,635 | 445,827 | 82,997 | 41.33 | 106,083 | 2,870 | 79,[illegible] |
| 1915..... | 313,985 | 9,709 | 801,290 | 55,263 | 60.31 | 146,542 | 200 | 93,[illegible] |
| 1916..... | 576,321 | 26,966 | 548,803 | 90,928 | 101.62 | 221,532 | .... | 194,[illegible] |
| 1917..... | 629,972 | 114,216 | 1,103,503 | 45,381 | 134,58 | 257,842 | .... | 188,[illegible] |
| 1918..... | 491,303 | 304,366 | 1,356,756 | 27,168 | 156.75 | 345,306 | .... | 249,[illegible] |
| *1919..... | 225,985 | 44,539 | 103,029 | | | | | |

(a) At foreign port, no freight or duty. (b) High-grade manganese ore. (c) Manganiferous ore, not including manganiferous zinc ore.

The following table shows the receipts from the principal sources of supply long tons:

| | Cuba | Brazil | Russia | India | Cost Ric |
|---|---|---|---|---|---|
| 1905..... | ..... | 114,670 | 24,650 | 101,030 | ... |
| 1906..... | ..... | 30,260 | 13,805 | 154,180 | ... |
| 1907..... | ..... | 52,922 | 1,000 | 95,300 | ... |
| 1908..... | ..... | 17,150 | 250 | 143,813 | ... |
| 1909..... | ..... | 35,600 | 14,486 | 145,140 | ... |
| 1910..... | ..... | 53,750 | 33,120 | 140,965 | ... |
| 1911..... | ..... | 41,600 | 19,103 | 106,580 | ... |
| 1912..... | ..... | 81,580 | 83,334 | 128,645 | ... |
| 1913..... | ..... | 70,200 | 124,337 | 147,587 | ... |
| 1914..... | ..... | 113,924 | 52,681 | 103,583 | ... |
| 1915..... | 5,141 | 268,786 | ..... | 36,450 | ... |
| 1916..... | 30,563 | 471,837 | ..... | 51,960 | ... |
| 1917..... | 44,511 | 512,517 | ..... | 48,975 | ... |
| 1918..... | 82,974 | 345,877 | ..... | 29,275 | ... |
| *1919..... | 33,013 | 172,996 | ..... | ..... | 5,5[illegible] |

* Figures for 1919 cover only the first six months, January 1st to June 30th.

For 5 years preceding the European War, Russia produced an average of about 850,000 tons annually, India about 700,000 tons, and Brazil 200,000 tons. In 1916, with the curtailment of the Russian and Indian productions, the Brazilian production jumped to 650,000 tons; 471,000 tons of which were imported into the United States. Other imports of manganese ore came from Turkey, Cuba, Costa Rica and Chile.

### Prices.

The price of manganese ore varies according to the manganese, silica and phosphorous content. The base price is usually made on a 40% manganese content for ores containing less than 8% silica nor 0.2% phosphorous.

Bonuses are paid for the higher grade ores. Lower grade ores have a different base. Penalties or premiums are paid for each 1% silica above or below 8%. Likewise for each 0.2% variation in phosphorous content.

Before the war a 40% manganese ore of the above specifications brought 23 cents per unit of 22.4 pounds (long ton basis) during the war as high as $1.20, and present 50 to 60 cents. The market dull at present, and it is doubtful whether any ore could be marketed at this price. Prices are usually f.o.b. Pittsburgh, Chicago or at seaboard.

Ores of chemical grade find a ready market. Those containing less than 1[illegible] iron and 90% $MnO_2$ demand about $85.[illegible] per ton. If the iron content is more, and if other impurities are present they may only bring from $60.00 to $70.00 for 90[illegible] $MnO_2$.

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Significance of Manganese in American Steel Metallurgy. By F. H. Wilcox. Trans. A. I. M. E., Vol. LV.

Ferro-Manganese in the Iron and Steel Industry. By R. A. Anderson. Journal Franklin Institute, Vol. 183.

Economic Geology. By H. Ries.



# Recent Articles on Petroleum and Allied Substances*

Compiled by E. H. Burroughs.

**1. HISTORY AND GEOGRAPHIC OCCURRENCE.**

**Petroleum Times.** Oil prospecting in Barbadoes. Vol. 2, Sept. 20, 1919, p. 260. History of attempted development of this island.

**Petroleum Times.** Oil-shale possibilities in France. Vol. 2, Sept. 20, 1919, p. 272. Tells of the richness and proposed development of the deposits of the Mines de Boson, near Fréjus, in Var.

**Shannon, C. W.** The story of oil in Oklahoma. Oil News, vol. 7, Oct. 5, 1919, pp. 11-13. Historical.

**Witz, Aime.** Le pétrole d'Alsace. Rev. gén. de l'Ectricité, t. 6, Aug. 23, 1919, pp. 244-250. Gives history of the industry in Alsace, location of the deposits and their mode of occurrence, production methods used, quality of the oils and their treatment, and concludes with economic considerations.

**2. GEOLOGY AND ORIGIN.**

**Alderson, V. C.** The oil shale industry. Colorado School of Mines Quarterly, vol. 14, Oct., 1919, pp. 4-15. Nature and origin of oil shale, its world-wide distribution and present value, description of the Colorado shales and discussion of the present status of the industry and its future prospects. See also Salt Lake Min. Rev., vol. 21, Oct. 30, 1919, pp. 25-26.

**Bickley, F. T. D.** Geologist ranks Homer with the best. Oil and Gas Jour., vol. 18, Oct. 31, 1919, p. 50. Discusses possibilities of the Homer field, Louisiana, where high quality oil is produced from comparatively shallow sands.

**Brogan, W. F.** Mighty "gasser" raises hopes of White Point field. Petroleum, vol. 7, Oct., 1919, pp. 22, 25-26. Describes wild gas well in the vicinity of White Point, Texas, tells of other interesting gas wells in this field, gives account of attempted oil development there and a geological description of the field.

**Condit, D. D.** Oil shale in western Montana, south-eastern Idaho, and adjacent parts of Wyoming and Utah. U. S. Geological Survey Bull. 711-B, 1918. 26 pp. Gives geologic sections of these districts, describes mode of occurrence of the shale and samples tested, and concludes with practical considerations on the technology of shale oil.

**Dowling, D. B.** Preliminary study of the western gas fields of Canada. Trans. Roy. Soc. Canada, 3rd series, vol. 12, 1918 (published 1919), sec. IV, pp. 89-94. Gives history of Canadian natural gas, geology of the area and probable extent of the fields.

**Hager, Lee.** Red River uplift has another angle. Oil and Gas Jour., vol. 18, Oct. 17, 1919, pp. 64-65. Discussion of the geology of the Red River district of north Texas, including certain unusual geologic conditions brought to light by the development of the past two or three years and the application of the facts developed to the search for new oil fields.

**Rühe, W. F.** The oil fields of Egypt. A study of the geology. Petroleum Times, vol. 2, Sept. 20, 1919, pp. 269-270; Sept. 27, pp. 295-296; Oct. 4; pp. 327-328; Oct. 11, pp. 351-352; Oct. 18, pp. 375-376; (to be continued.).

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See also under: 1. Witz, Aimé. 3. Ferguson, R. N. 6. Jakowsky, J. J.

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### 4. TRANSPORTATION, STORAGE AND DISTRIBUTION.

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**Botkin, C. W.** The composition of shale and shale oil. Colorado School Mines Quarterly, vol. 14, Oct., 1919, pp. 1 17. Gives figures based on a large numb of analyses of Colorado, Utah, Wyomi and Nevada shales.

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**Petroleum.** What governs the selection of lubricants? Vol. 7, Oct., 1919, pp. 100, 102, 104, 106, 108, 110, 174. Discusses the selection of oils for various kinds of machinery and gives in tabular form properties of various lubricants, arranged by trade names of the oils and kinds of machines for which they are used.

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**Dubbs, L. A.** Process for treating hydrocarbon oils. United States patent 1319053, Oct. 31, 1919.

**Ellis, Carleton.** Motor spirit. United States patent 1318060, Oct. 7, 1919.

**Ellis, Carleton.** Process of making derivatives of petroleum hydrocarbons. United States patent 1317868, Oct. 7, 1919.

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**Gentile, Nicola.** Apparatus for recovering oil from ships' wells and for separating it from water and extraneous matter. United States patent 1317971, Oct. 7, 1919.

**Kennedy, F. W.** Lubricating oil purifying and reclaiming system. United States patent 1318086, Oct. 7, 1919. De Laval separator. Centrifugal.

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**7. UTILIZATION.**

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**Bates, L. W.** Coal and oil friends not enemies. Oil News, vol. 7, Sept. 20, 1919, pp. 14, 16, 18. Summary of the advantages and economic aspects of colloidal fuels and analysis of recent boiler tests with this type of fuel.

**Battle, J. R.** Change from coal to oil obviates building of new stack. Nat Petroleum News, vol. II, Oct. 15, 1919, pp. 38, 40. This point is brought out as an argument in favor of oil-burning plants.

**Battle, J. R.** Good fire brick necessary to success of oil-burning furnace. Nat. Petroleum News, vol. II, Oct. 29, 1919, pp. 44, 46, Emphasizes the necessity of ample combustion space and suitable refractory lining.

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**Gill, J. D.** Just how gasoline functions in an automobile engine. Nat. Petroleum News, vol. II, Oct. 15, 1919, pp. 43-44, 46, 51. Tells what gasoline is and how it functions in a motor car engine, discussing the question of future supply of motor fuel, including substitutes for gasoline, kerosene, etc.

**London Times Engineering Supplement.** Alcohol engines. Starting from cold. No. 540, 5th year, Oct., 1919, p. 320. Gives tests (made by the fuel committee of the Australian Council of Science and Industry) on starting internal combustion engines with cold alcohol.

**London Times Engineering Supplement.** Diesel engines for ship propulsion. Cause for their adoption. No. 539, Sept., 1919, p. 277. Discusses economy of upkeep and first cost.

**London Times Engineering Supplement.** Oil fuel for ships. Comparison with coal. No. 538, 15th year, Aug., 1919, p. 249.

**Murphy, C. E.** Asphaltic concrete pavements. Texaco Star, vol. 6, Oct., 1919, pp. 9-10. Tells how this type of pavement is made and discusses its advantages.

**Oil and Gas Journal.** Preliminary report by petroleum committee. Vol. 18, Oct. 31, 1919, p. 65. Gives report submitted to the general convention of the International Trade Conference by the Petroleum Committee, outlining briefly the petroleum requirements of Belgium, France, and Italy, more particularly their possible needs in fuel oil.

**Oil and Gas Journal.** Subject of motor fuel and lubricants. Vol. 18, Oct. 24, 1919, pp. 68, 70, 72-73. Discusses causes of and remedies for automobile engine troubles due to inferior grades of fuel or lubricants.

**Petroleum.** Analysis proves fuel oil cheaper than coal. Vol. 7 Aug. 1919, pp. 40-41, 174, 176, 178; Sept., pp. 176, 181; Oct pp. 182-183; to be continued. Discusses such questions as storage, handling costs etc.

**Petroleum.** Benzol as a motor fuel. Vol 7, Sept., 1919, pp. 40-41; Oct., p. 167; to be continued. Advantages and disadvantages.

**Ross, Joseph.** Waterproofing engineering for engineers, architects, builders, roofers and waterproofers. New York, John Wiley & Sons, Inc., 1919, 442 pp. Contains chapters on the selection, properties and tests of waterproofing materials, waterproofing specifications, a glossary of terms used in the waterproofing industry, and a bibliography on the subject.

**Somerville, G. N.** A discussion of the semi-Diesel engine. Pacific Marine Rev. vol. 16, Oct., 1919, pp. 59-61.

**Wyer, S. S.** Methods for more efficiently utilizing our fuel resources. Part XXX Natural gas. Gen. Elec. Rev., vol. 22, Aug. 1919, pp. 636-648; Oct., pp. 760-766. Abstracted from U. S. National Museum Bull. 102, part 7, 1918.

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**Little, C. C.** Carburetor. U. S. patent 1319158, Oct. 21, 1919.

**Martin, L. H.** Kerosene vaporizer for internal combustion engines. U. S. patent 1319718, Oct. 28, 1919.

**Newcomb, E. C.** Carburetor. U. S. patent 1319789, Oct. 28, 1919.

**Simmons, L. C.** Vaporizer for internal combustion engines. U. S. patent 1319628, Oct. 21, 1919.

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See also under: 4. Geiger, C. W.; National Petroleum News. 5. Good Roads; Trotter, H. R.

**8. LEGISLATION AND LEGAL REGULATIONS.**

**Beck, Elfred.** Government permission is necessary. Colombian decrees to regulate oil operations. Oil and Gas Jour., vol. 13, Oct. 17, 1919, pp. 52, 54. Gives translation of decree of June 20, 1919, which was revoked in August, 1919, pending further investigation by the Colombian Congress.

**Mendoza, Salvador.** El debate sobre los derechos adquiridos, con relacion al subsuelo petrolifero. Bol. del Petroleo, vol. 7, June 1919, pp. 587-592.

**Mining and Oil Bulletin.** Present status of the leasing bill. Vol. 5, Sept., 1919, pp. 581-582.. Gives complete text of the remedial provisions of the bill (S. 2775) as they now stand (Sept., 1919).

**Oil, Paint and Drug Reporter.** Petroleum in Mexico in the year ending July 31, 1919. Chief J. Vazquez Schiaffino, of Mexican Oil Bureau, details most important work accomplished in period beginning August 1, 1918. Record of denouncements, taxes, etc. and summaries of various tax decrees issued. Vol. 96, Oct. 6, 1919, pp. 18-20.

**Revue Generale de l'Electricite.** Loil portant modification du régime douanier des produits pétrolifères en France. T. 6, Aug. 23, 1919, p. 256. Gives text of law dated Aug. 5, 1919.

See also under: 2. Lunt, H. F. 4. National Petroleum News.

**9. BIBLIOGRAPHIES.**

**Bureau of Standards.** Bibliography of scientific literature relating to helium. Circular 81, Sept. 10, 1919, 21 pp. Related articles are grouped in chronological order, forming in effect a brief bibliography



See also under: 2. Lunt, H. F. 7. Ross, Joseph.

**10. MISCELLANEOUS.**

**Brooks, Sidney.** Great Britain, the Empire and petroleum. Petroleum, vol. 7, Sept., 1919, pp. 19-20, 100, 102, 104, 106; Oct., pp. 175, 180. Necessity for oil expansion and potential sources of oil.

**Felgar, J. H.** The education of a petroleum engineer. Mech. Eng., vol. 41, Oct., 1919, pp. 816-817. Suggests course of study.

**McQueen, A. M.** Petroleum in Canada. Bull. Canadian Min. Inst., Nov., 1919, pp. 1137-1140. Abstract of paper before the Natural Gas and Petroleum Association of Canada. Discusses the present status and future prospects of the industry in Canada.

**Mining and Oil Bulletin.** New wage scale for California oil workers. Vol. 5, Sept., 1919, pp. 583-586, 590-593. Reproduces complete memorandum of terms governing the relations of oil operators and workmen as finally agreed upon at the conferences called by the President's Mediation Commission, together with wage schedules for fields, pipe lines and refineries.

**South African Mining and Engineering Journal.** Bituminous shales in South Africa. Vol. 29, part 1, Sept. 20, 1919, p. 29. Tells of the formation of a company to exploit shales in the Transvaal Wakkerstroom district, and discusses prospects of developing the industry there.

**South African Mining and Engineering Journal.** Oil in southern Africa. Vol 28, part 2, June 14, 1919, pp. 437-438. Discusses the necessity for government action toward attempting to develop oil fields in the Union of South Africa.

# TECHNICAL REVIEW

## GENERAL.

**Present Problems of the Mining Industry. By Van H. Manning. (Mining & Scientific Press, December 6, 1919.)**

This article is an abstract of an address delivered by the Director of the U. S. Bureau of Mines before the American Mining Congress at St. Louis on November 7. The general problems facing the mining industry are discussed and in each case the author indicates that which in his judgment seems to be the most desirable way in which their solution should be attempted. Some of the problems are the coal strike, the international policies in the development of the mineral resources of the world, the utilization of fuel oil, and lastly the training of competent engineers and technologists to solve these problems.

The author believes in the policy of encouraging foreign companies to acquire holdings in the United States on a parity with our own people. He condemns severely the exclusion policy as practiced by many countries and believes "that the policy of national selfishness is short sighted and may lead to serious international complications."

W. S. LEVINGS.

**New Angles to the Apex Law. By John A. Shelton. (E. & M. J., November 1, 1919.)**

A discussion of the question of property rights in regard to existing mineral claims subject to the Apex law, which still continues to be a source of much litigation and dissatisfaction. The bad effect of the law as demonstrated in Butte is called to mind. Mr. Shelton holds that the outcome of such litigation is uncertain and that uncertainty as to titles injures the community and cites Mexico as a specific example.

W. S. L.

**Ore Contracts. By C. A. Grabill. Part I. (E. & M. J., November 22 and 29, 1919). Part II (E. & M. J., December 6, 1919).**

In these two articles the author completely analyzes ore contracts. Contracts are desirable and essential from both the viewpoint of the buyer and seller. Both must get together in a friendly spirit and realize that the best contract is the one that enables both parties to realize the maximum profit. He denounces the idea of "trying to slip one over" as bad for all concerned. The following points should be covered in every contract: date of contract and time element, source of ore, character and classification of ore, tonnage involved, place of delivery, shipping expenses and responsibilities, weights, sampling, moisture, assaying, comparison of assays and splitting limits, umpires, shipper's representative, schedule of payments and deductions, quotations, exchange, taxes, advances, liquidations and settlements, manner and place of payments, deleterious substances and their penalties in schedule, no payments to be made for things not provided for, forces majeure or acts of God, penalties, special claims, etc.

The author analyzes each of these points and shows their bearing on the contract.

Part II deals especially with ore schedules. It shows upon what data they are based. This article should be studied

by every engineer, whether he is experienced in buying or selling ores or not.

C. ERB WUENSCH.

**Editorial Discussions—In Retrospect and Prospect. By Louis C. Cates. (Arizona Mining Journal, December, 1919.)**

This is an editorial reviewing the conditions of the present and the outlook for the future. The article also includes the views of several noted men active in mining and getallurgy.

F. A. LICHTENHELD.

**Activities of Provincial Sanitary Engineers. By Fred A. Dallyn: (The Canadian Engineer, January 1, 1920.)**

The supervision of municipal sanitation is a matter well worth while. It paves the way for the mining engineer to assist in sanitation in and about mining camps.

The author deals with municipal sanitation and its improvements. There are several tables showing that this problem has a future and the results obtained are a reward for their work. F. A. L.

**The Bunker Hill Enterprise. I. By T. A. Rickard. (M. & S. Press, January 3, 1920.)**

This article is a historical retrospect on the early exploration and settlement of the Oregon territory. Some of the topics discussed are the following: The Louisiana Purchase; Louis and Clarke's Overland Expedition; Founding of Astoria in 1811. W. S. L.

**Alaskan Railroad Makes Rich Country Accessible. By F. Le Roi Thurmonel. (E. & M. J., November 8 and 15, 1919.)**

In this article it is shown that mineral occurrences along the government railway in the Broad Pass district give indications of great potential wealth, but that there exists a need for prospecting and development. Gold, silver, copper, lead and zinc have been found. W. S. L.

**Potash Deposits in Spain. By Hoyt S. Gale. (E. & M. J., November 8 and 15, 1919.)**

The prospective development of potash developments in the province of Barcelona in Catalonia, Spain, is of marked commercial interest. The article discusses and illustrates the geological features, the origin and its possibilities as a source of the mineral.

The Spanish government, as stated by Mr. Gale, has provided that the mines shall be grouped into a syndicate in which the government shall have a share an a voice.

Potash lands may be held for operatio by the government and all mining co cessions are under the supervisory co trol of the government.

The author enumerates the princip owners of concessions. They include Franco-Belgian syndicate, a Spanis chemical company with German affili tions, a Spanish-French chemical com pany, a German company and an Amer can company. W. S. L.

## MINING.

**Panel System of Stoping at the Herma Mine. By S. H. Brockhunier. (E. & M J., December 6, 1919.)**

The Herman gold mine in Placer Coun ty, California, presents unusual feature and in the mining of the vein offers diffi cult conditions. This article describe the vein and the manner in which an un profitable method of stoping was change a few years ago into a profitable one b changing from overhand stoping wit square sets to the panel system. Th values of the gold bearing quartz vei occurs in shorts. Little timbering wa necessary and a cost less than that re quired by shrinkage methods was ob tained. W. S. L.

**Rand Ore Reserves. By A. Cooper Key (E. & M. J., November 1, 1919.)**

This article is merely a review of the present status of the great gold produc ing mines of the Rand. W. S. L.

**Mine Accidents. By Albert H. Fay. (E. & M. J., November 1, 1919.)**

This article brings out in a clear and convincing manner the two following facts:

1. The chief causes of accidents are ignorance, poor living conditions, ill health, discontent and disregard of law and order.

2. Mine accidents may be reduced by Americanization of non-English speaking labor and constant effort to eliminate carelessness. W. S. L.

**Details and Costs of a Mine Model. By Volney Averill. (E. & M. J., Novem ber 22 and 29, 1919.)**

A glass mine model which was con structed at low cost for the Tonopah Ex tension Mining Co., is described and a bill of materials given. The model is of the plan type showing the geologic plans of twenty levels on sheets of glass, placed one above the other at the proper ver tical distances according to the scale of the drawing. It is viewed from above and illuminated from below.

W. S. L.



**Standard Chutes for Metal Mines. By Chas. A. Mitke. (E. & M. J., November 8 and 15, 1919.)**

A compilation of chute types suitable for use in metal mines. The requisites for a standard chute are stated, together with construction details and necessary provisions that must be made for the successful operation of various types.

W. S. L.

**A Calculator For Mine Valuation. By Ross B. Hoffman. (Mining & Scientific Press, December 27, 1919.)**

The author describes, with the aid of a few photographs, a "home-made" calculator for graphically solving mine evaluation problems involving the tonnage, net yield per ton, annual rate of interest on capital, capital expenditure, life of property and sinking fund factor. The device is made by the use of a carpenter's rule and celluloid triangle, both properly graduated. It can be made in a few hours, whereas hours of time may be saved by its use in graphically solving evaluation problems. C. E. W.

## MILLING.

**Approximate Quantitative Microscopy of Pulverized Ores. By Will H. Coghill and J. P. Bonardi. (Tech. Paper No. 211, U. S. Bureau of Mines.)**

A pamphlet well worth the study of every millman. Authors describe a simple microscopic method whereby it is possible to accurately determine the quantitative minerologic composition of ores, concentrates, tailings, etc. From this it is simple to estimate the analyses of the various products. This method is cheaper and more rapid than ordinary chemical laboratory methods and for most purposes in experimental metallurgical work more satisfactory.

C. E. W.

**Technical Operations on the Suan Concession, Korea—III. By A. R. Weigall and J. F. Mitchell-Roberts. (Mining & Scientific Press, December 6, 1919.)**

The third installment of this admirable series of articles is concerned in general, with the design and equipment of the Tul Mi Chung Mill. Detailed descriptions are given relative to the milling operations; crushing and sorting, grinding, flotation, tables and slime plant. Power consumption and cost of milling are also discussed briefly. There are two mills on the Concession; one at the Suan mine and the other at the Tul Mi Chung.

**Technical Operations.**

The gold extraction from the Tul Mi Chung mill ore is unsatisfactory, averaging only 60 per cent. The ore has an average grade in gold of $6.12, silver 0.5 oz. per ton and 0.98 per cent of copper. The main product of the mill is in form of a flotation concentrate containing gold $100 per ton, copper 26 per cent and 9 oz. of silver per ton.

The problem is that of obtaining a satisfactory gold extraction from an extremely refractory ore. The final decision after exhaustive investigation is to treat the accumulated mill tailings by simple leaching with cyanide by which it is expected to recover 70 per cent of the gold in the tailings. W. S. L.

**Technical Operations on the Suan Concession, Korea—IV. By A. R. Weigall and J. F. Mitchell-Roberts. (Mining & Scientific Press, December 13, 1919.)**

The subject of flotation on the concession forms the bulk of this article. Its history, the types of apparatus and reagents used are discussed in detail. Detail drawings of a Suan froth trap and flotation machine are given. The advantages and disadvantages of counter current decantations as opposed to thickening and filtration are treated at length. The power source, both steam and electric, is situated at Pyang Yang some 55 miles away from the concession.

W. S. L.

**Technical Operations on the Suan Concession, Korea—V. By A. R. Weigall and J. F. Mitchell-Roberts. (Mining & Scientific Press, December 27, 1919.)**

This article is the last of the series and deals with the equipment and flow sheet of the Suan mill. The treatment includes amalgamation, table concentration and flotation. The products are gold-silver bullion and two concentrates one of which contains approximately 3½ per cent bismuth. An interesting general description of location, living conditions, climate, etc., concludes the article.

W. S. L.

**The Use of Napthylamin and Xylidin in Flotation. By Edward H. Robie. (E. & M. J., November 1, 1919.)**

This paper deals with the manufacture and use of these reagents in place of oils in several western mills. The metallurg-

ical results are noted. The most promising of the flotation oils as determined by laboratory experimentation is known technically as Alpha-Naphthylamin and commonly known as "X-cake." This reagent apparently functions as both collector and frother, but the problem of solution requires the addition of crude Xylidin to the X-cake in the proportion of 40 to 60. In general X-cake froths are much more easily broken down than oil froths and the thickened concentrate is more easily filtered. Improved recovery is obtained on many ores particularly those containing colloidal matter. The cost of X-cake and xylidin mixture per ton of ore treated is in general greater than that for oil mixtures commonly employed. W. S. L.

**A Contribution to the Study of Flotation. I. By H. Livingstone Sulman. (M. & S. Press, January 3, 1920.)**

A paper from the Institute of Mining and Metallurgy on the physics of flotation. Float concentration processes are classified. The results of agitation are discussed at length. A review of the principles and processes involved are also given. Mr. Sulman, who is one of the patentees identified with the Minerals Separation Company, has become the object of much editorial criticism due to his failure to make the customary references to previous writers on the subject. W. S. L.

**Cottrell Electrical Precipitation Process in Japan. By Dr. Ritaro Hirota and Kyoshi Shigo. (E. & M. J., December 13 and 20, 1919.)**

The authors describe the Cottrell installations in the various smelteries and cement plants of Japan. The equipment was purchased in America and installed under the supervision of the Metallurgical Research Institute. C. E. W.

**Precipitate Smelting at Tonopah. By George J. Young. (E. & M. J., December 13 and 20, 1919.)**

Three mills used oil-fired double-chamber Monarch melting furnaces lined with carborundum and one a cylindrical tilting furnace of the crucible type. Author gives details of melting and slag treatment. C. E. W.

## OIL.

**Mapping Oil Wells. By S. S. Langley. (E. & M. J., December 13 and 20, 1919.)**

Author describes methods of accurately mapping the subsurface structure of oil fields by carefully recording and correlating the well-logs. Article contains numerous illustrations which show how the drilling of many unproductive holes can be avoided. By carefully studying the logs water troubles can be anticipated and the production from subsequent wells improved. C. E. W.

**Value of American Oil Shales. Discussion of Paper by Charles Baskerville. (Bull. A. I. M. E., December, 1919.)**

This is a written discussion of an article that originally appeared in the June, 1919, bulletin. Men vitally interested in the development of the American Oil Shale industry took part in the discussion. Most of the points emphasized were old. However, there were several new features brought to light. One of these, the vital importance of heat control during retorting, is of especial interest, because the quality of the crude shale oil produced is directly influenced by it. If properly controlled, the refinery loss will be low and the refined products of good grade. F. A. L.

## 1920 PROSPECTOR.

The Junior class will publish a Prospector this year. It has been two years since a "Prospector" has been published, but the Juniors are willing to brave the "h. c. of printing and engraving" in order to issue a book that will be a credit to the school and the class of 1921.

We all realize the necessity of getting out such a book in order to perpetuate the events and associations of our college days. Every student is urged to support those who are unselfishly giving their time and effort to make the publication possible.

It is estimated that the book will cost about $2,000.00. Therefore, each copy will cost about five dollars. The book is well worth twice that amount now, and like good wine "it increases in value with age." Ask any "old grad" what he thinks about his copy of the "Prospector" and you will realize how important it is that you should get a copy.

The Prospector board consists of: Editor, Bilisoly; Business Manager, I. M. Charles; Assistants: Prentiss, Surfluh, Edgeworth, Brinker, Fopeano and Bailey. F. A. L.

The smallest electrical motor can be carried in the vest pocket or worn as a watch charm.



# DISCUSSION

## ONE-MAN SURVEYS.

Editor

Sir:—In reference to the mild criticisms concerning my article, "One-man Surveys", which appeared in the October, 1919 number and was commented on by you in that number and by James Underhill in the December, 1919 number, I desire to reply as follows, to-wit:

**1st.** I assume that the criticisms are meant in a kindly way and as it has always been the custom from times immemorial for C. S. M. men to stick together, I wish to state that I acquired most of the ideas mentioned in my article from fellow students and from instructors while I was attending the School of Mines—so beware man that criticiseth!

**2nd.** I can heartily endorse a good deal of what M. Underhill says in his letter of discussion and I believe his quarrel is not so much with the method set forth in my article as it is with what he conceives to be the application of the method. The fault in this respect is mine for not being clearer in my explanations.

In practically applying the method in the field it is customary to pick out one or two very prominent objects to triangle onto—otherwise the surveyor would have to promenade ceaselessly between points as suggested in the criticisms. In one case I surveyed an area of four square miles from only one such triangulation objective (it was on a high hill) it took two hours to climb the hill and set the flag, but that two hours of climbing saved days in time later. For example, I desired the distance between the SW corner and the NE corner of the section. To get this I set up a base triangle near the section corner at the SW corner of section and sighted to the SW corner and to the flag on the hill as described in my article. This was repeated at the NE corner of the section. No mad scrambling about that and very much quicker than a traverse in that country. The same general observation is true as to working in a winze; the surveyor can go up and down the winze a number of times proportional to his assininity; I have never yet found a case where I had to go more than twice. I nearly always make it in one trip and pull the light up with a rope, when through with it. If it is desired to establish a meridian from the bottom of the shaft onto level, I usually use the compensation method of obtaining azimuth from compass—accurate to at least 5° without great care—accurate to one or two minutes with great effort on observer's part.

I note with commendation what Mr. Underhill says about the engineer cheapening himself to save chainmen; his remarks are certainly applicable to some conditions and might be particularly appropriate as to certain sections of Mexico where men cost about 5 cents or so per day, but I believe that for the average survey in civilized communities not only time and money will be saved by the one-man method but the work is dignified by elevation of ones results somewhat above the plane of dependence on methods of measurement which originated about the time the snake was operating in the Garden of Eden.

What Mr. Underhill says about the value of chainmen as witnesses and subjecting triangulation to blunted acumen of the average juror is well worth considering and I believe that point is really a good argument against the "One Man Survey."

However what is the way to really find out whether the method is any good or not? Try it. I leave it to any unbiased engineer to decide after using. Take any survey on which the circumstances will allow you to spend a little extra time. Run the survey both ways—by traverse, with tape, and by triangulation by the method of the "One Man Survey." I subjected the "One Man Survey' to several just such tests, timed myself with a watch on both surveys, and then wrote the article.

Go thou and do likewise and we will then see thee further.

Respectfully

G. O. MARRS.

Denver, Colo., Jan 10, 1920.

## LATIN-AMERICAN CLUB.

The Latin-American students have gotten together and formed an organization to promote good fellowship and understanding between themselves. They have been granted the use of the Athletic Board's room in the "gym".

The officers elected are Ernest Ornelus, President; J. E. Serrano, Vice-President; Santiago Urteaga, Secretary and Treasurer.

The Annual Freshman Ball was held at Guggenheim Hall on December 12th. The affair was unusually well attended.

# PERSONALS

'95.

Clyde M. Eye, who recently returned from the Philippine Islands, is spending the winter at 3021 Third St., Ocean Park, Calif. Any Mines men in that vicinity might be on the look-out for a visit from him. He is enjoying a well earned vacation and incidentally, a new Buick Six, which the Benguet Consolidated Co., of the Philippine Islands presented him in appreciation of his services.

'00.

Colonel Louis R. Ball is Professor of Military Science and Tactics, Junior Division, R. O. T. C., Los Angeles High School, Los Angeles, Calif.

Lloyd Robey is Mill Supt. for the Colorado Mining Co., Aroroy, Masbate, Philippine Islands.

'01.

J. L. Bruce has resigned from the general managership of Butte & Superior Mining Co., Butte, Mont. He is now general manager of the Davis-Daly Copper Co. in the same city.

'04.

Lee L. Fillius is manager of the Anna Beaver Mine at Tar River, Okla.

'08.

Hal G. Knight is General Manager of the Rubber City Sand & Gravel Co. at Akron, Ohio.

Chas. A. Reno left the Magma Copper Co. and has joined the staff of the Cerro-Gordo Mines Co. at Keeler, Calif.

'10.

Dana W. Leeke, who recently returned from the Tul Mi Chung Mine, Nantei, Korea, has accepted a position in the engineering department of the Benguet Mining Co. and expects to sail for Manila and the company's property the early part of March.

S. M. Soupcoff has just returned to his offices, 821 Newhouse Building, Salt Lake City, Utah, from a four months' examination trip to Venezuela, South America.

'11.

William C. Douglass is superintendent of the Kennecott Copper Corporation at Kennecott, Alaska.

'12.

Edmund M. Field and Miss Dorothy Browne, of Kansas City, Missouri, were married on January 20th. Mr. and Mrs. Field will make their home at 1218 West 51st, Kansas City. Mr. Field is practicing law and has offices in the Keith and Perry Building.

'13.

C. Arthur Swanson is here from Nevada. He is developing a process at the experimental plant to treat the ores from a property at Cherry Creek, Nevada.

Peter A. Young visited Golden December 26th. He is with the Nature Products Co. at Cotopaxi, Colo.

Charles N. Bronstein has left the Garfield Smelting Co. at Garfield, Utah. His present address is Apt. 8, 1364 Downing Street, Denver, Colo.

'14.

A. R. Brousseau has been discharged from the army and has located at Humboldt, Ariz.

E. R. Crutcher has returned from Queenstown, Tasmania, where he installed a electrolytic zinc leaching plant for the Mt. Reed and Rosebury Mining & Smelting Co.

Edward V. Graybeal has moved from Great Falls, Montana, and is located at 33 Richmond Avenue, Arrochar, Staten Island, New York.

Charles F. Oram is assistant chemist for the Amalgamated Sugar Company at Smithfield, Utah.

'15.

Samuel J. Burris and Miss Hazel Smith, of Salt Lake City, Utah, were married on December 24th.

Monroe O. Carlson is General Inspector for the Utah Fuel Co. He makes his headquarters at Somerset, Colo.

Breese Rosette's present address is Box A, Park City, Utah.

G. H. Van Dorp visited Golden recently.

'16.

R. H. Miller of Great Falls, Mont., visited in Golden during the holidays.

'17.

Max T. Hofius has returned to his home in Belize, British Honduras, C. A. He will have charge of an oil exploration party.

'18.

Mr. and Mrs. D. D. Riddle announce the arrival of a fine baby boy on December 14th at Saint Anthony's Hospital in Denver.

'19.

George R. Roll and Miss Nina Baekland were married at the bride's home in Yonkers, N. Y., on December 22nd. Mr. and Mrs. Roll will reside in Casper, Wyo., where Mr. Roll has a position in the operating department of the Midwest Oil Co.

Otto H. Metzger has returned to his home at Meeker, Colo., from Ely, Nev. After a short visit he will leave for Cuba, where he has accepted the position of mining engineer with the Minas de Matahambra, at Pinar del Rio.



W. A. Conley has left the Roxana Petroleum Co. and is now division engineer for the Moctezuma Copper Co. at Pilares de Nacozari, Sonora, Mexico.

'20.

Fitch Robertson and Miss Myra Kenworthy, of Pueblo, Colo., were married on December 24th at Pueblo. Mr. and Mrs. Robertson will make their home at Elko, Nev., where Mr. Robertson has accepted a position with the R. M. Catlin Shale Oil Co.

E. W. Robinson and Miss Agnes Marie Braidwood, of Denver, were married at St. Barnabas' Church on December 28th. Mr. and Mrs. Robinson will make their home at Mullan, Idaho, where Mr. Robinson has accepted a position as assayer with the Gold Hunter Mining & Smelting Co.

EX-MINES.

'14.

George Mellen was a Golden visitor recently. He is at present at 1616 Pearl Street, Denver, Colo.

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Dr. W. I. Robinson, Assistant Professor of Geology, has resigned to take a position with the Michigan Geological Survey. The vacancy left by Dr. Robinson will be filled by Harold F. Crooks, of the University of Illinois.

# ATHLETICS

By F. A. Litchenheld, '20.

Thus far basketball has attracted little attention, altho there has been keen rivalry among the candidates for the team.

Four practice games have been played with the high school teams of Denver. Mines has shown improvement in each succeeding game. By the time the season opens they should be in good form to tackle any Varsity team in the conference. The first game will be on January 3, at Golden, when Mines tackles Boulder. This game should prove a battle from start to finish. Both teams will know, after the final whistle has blown that they have been thru a real game; one that will be hard to forget.

Captain Dunn will lead the team. He will play forward. Altho small he has enough speed to make up for his size. He has one great "fault"—he is death on baskets. If he does not get ten or twelve baskets in a game Coach Glaze begins to worry. So far Glaze hasn't a gray hair.

Jordan, another fast man who is trying out for forward, will make a good running mate for Dunn. The pair should be hard for any guards to stop.

The guard position is being hotly contested by Galucci, Davis, E. Bunte and Rhodes. E. Bunte and Rhodes are letter men from last year and have shown up well. However, the others will give them a run for their money.

A. Bunte and Bryant are fighting it out for the center position. Bunte is a letter man from last year and capable of playing either guard, center or forward, therefore Glaze will probably use him where he needs him most. Bryant is a new man and it is indefinitely known whether or not he will stay in school.

There are several men besides these out for basketball, ready to battle the Varsity for positions.

Benjamin, one of these, hails from the last year Teachers' team. He is a forward, famous for his long shots. If he runs true to form he will be a valuable man to the Mines.

The Freshmen have a strong team. They will be eligible for this year's basketball team when the second semester starts.

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MINES BASKET BALL SCHEDULE FOR 1920 SEASON.

Jan. 31—University of Colorado at Golden.

Feb. 7—Colorado College at Golden.

Feb. 14—Aggies at Ft. Collins.

Feb. 21—Denver University at Denver.

March 6—University of Colorado at Boulder.

March 13—Colorado College at Colorado Springs.

March 20—Aggies at Golden.

March 27—Denver University at Golden.

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CONFERENCE ADOPTS BOXING.

Prof. Roger H. Motten, Rocky mountain delegate to the National Collegiate Association convention, made a report on his trip. Professor Motten told of the adoption of boxing and wrestling as major intercollegiate sports. He also declared that his plea against taking Western athletes to Eastern schools by flattering offers with pecuniary rewards had met with favorable indorsement. Immediately after hearing Professor Motten's

report, the conference adopted boxing and wrestling as major sports in our schools.

### BOXING.

Roper, who has had considerable experience in the art of boxing has a set of huskies training under him. Among them are Peet, a freshman, who is trying out in the 145-pound class; Cunningham, Beven, Levings and Adamson in the 125-pound class. Both Levings and Adamson are veterans from last year's boxing class. In the 135-pound class we have Harron, a new man at the game but a willing "mixer." Strock has had a year's experience and has given a good account of himself in previous years. He boxes in the 145-pound class. Clothier will h down the 158-pounders.

### WRESTLING.

Great interest is taken in the wre ling game. There are several candidat out under personal instruction of Seraf and Terry who have had experience a know the game well. Both have start in the D. A. C. tournaments. Among t likely men out for this branch of sp are Thompson, Terrazas, Savage, Par and the Crawford brothers.

Dual meets have been arranged wi the University of Colorado and Den University. Colorado College will pr ably have a team later to compete wi Mines.





# PROFESSIONAL CARDS

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# COLORADO SCHOOL OF MINES MAGAZINE

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